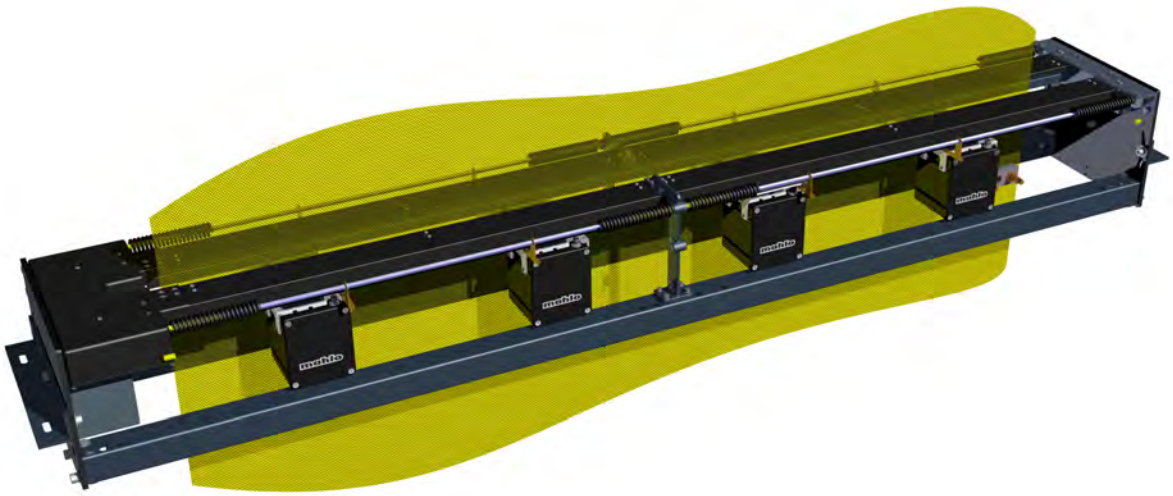
mahlo
trendsetting technology. worldwide.

mInfo Distortion Detection

Intelligent detection of skew and bow distortions

Compact! Precise! Simultaneous!



mahlo
think beyond!

Quality made
in Germany

TEXTILE
NONWOVEN
COATING & CONVERTING
PAPER
EXTRUSION

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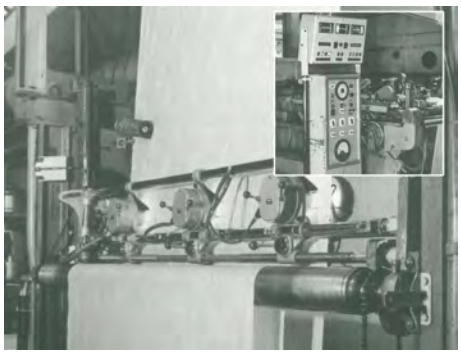
SPOT ON: THE MAHLO WEFT DETECTION



1958 - First Orthomat FMC at Erbatech

Since the invention of the first automatic weft straightener by Mahlo, our applied systems for distortion detection have been consistently further developed and adapted to the constantly increasing requirements of the textile industry. To date, no other system can detect distortions anywhere near as precisely as Mahlo scanning. Even the most complicated weaves, surface structures and patterns can be detected fully automatically.

This advantage in performance and reliability deserves special consideration. We fully explain this in more detail.

The reason for the superior performance of Mahlo scanning is the perfect interaction of the following factors:

- Sensor technology for distortion detection
- Scanning concept (number of scanning heads, width adjustable, traversing)
- Control (speed, accuracy, reaction times)
- Precision engineered mechanical parts to accommodate the sensors
- Operating concept (visualisation, ease of use, optics and haptics, software adapatable according to customer requirements)
- Service availability
- Data management, digitalisation, and Industry 4.0

In the following, all these points are examined and evaluated one after the other.

Sensor technology for distortion detection

Große Bandbreite an Sensortechnik

Spurred on by a dynamic innovation process, textiles have undergone major changes in recent decades: From simple structures for clothing to highly technical applications in the aerospace industry, textile surfaces today cover a wide range of different applications. This results in new standards during production with regard to speed, accuracy and the amount of data to be evaluated. Warp detection must be fully automatic at today's high fabric speeds, regardless of surface effects, pile, loops or hairs.

Sensor technology for distortion detection

To ensure this, Mahlo has developed a rich portfolio of a wide variety of specialised sensors that take into account the varying complexity of the surface:

Optoelectronic scanning (TK-12)

The principle of optoelectronic scanning still sets the standards in the field of distortion detection. No other measuring principle can cover so many materials and applications fully automatically without special settings.

Imaging scanning (CK-15)

For exceptions that cannot be scanned with the optoelectronic sensor, Mahlo offers imaging methods with cameras as a supplement.

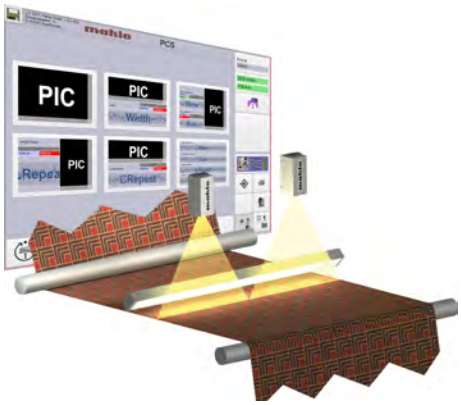
Hybrid scanning (Combi TK-12 & CK-15)

Hybrid scanning is a combination of TK-12 and CK-15. Two independent systems are combined to form a superior scanning system. Hybrid scanning combines the advantages of the two individual systems and eliminates/compensates for their respective limitations.

Imaging scanning specifically for carpets (CTK-15)

The CTK-15 probe is a sensor specially designed for carpet (woven or tufted) applications.

Sensor technology for distortion detection



Scanning for pattern recognition (PCS-20)

The PCS-20 camera-based scanning system automatically detects pattern distortions across the entire fabric width. It is therefore ideally suited for all fabrics where a straight pattern across the width is primarily required.

For more detailed information on the individual scanning systems, please refer to our "mKnowledge Scanning" and our corresponding presentations.

All other suppliers in the market only have one scanning method each and therefore always have to use the same sensor technology. For example, only one imaging process is available and must be used whether or not it is suitable for the weaves, surface structures, colours, fabric speeds or thread densities.

Conclusion

At Mahlo, after detailed consultation with our specialists, the user can choose the warpage detection system that is best suited to his product mix.

***Each customer can be offered a customised solution**, without always having to resort to the same scanning principle.*

Scanning concepts

The scanning concept refers to the arrangement of the sensors used for distortion detection.

There are two systems on the market:

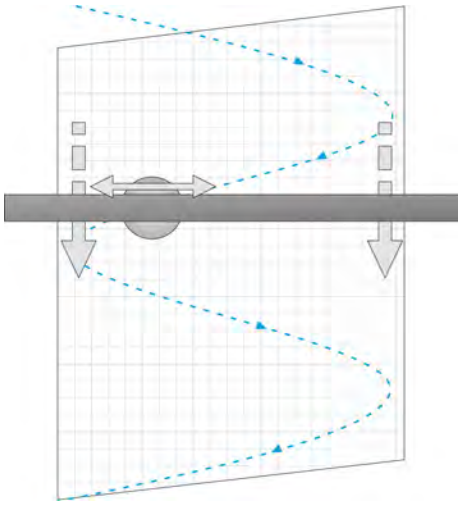
- Simultaneous scanning with several sensors
- Traversing scanning with one sensor

Mehrere Sensoren erfassen die gesamte Warenbreite simultan

Several sensors detect the entire fabric width simultaneously

A number of sensors, to be defined depending on the application, are installed across the width at the outlet of the straightening machine. A motorised width adjustment ensures that the sensing heads are always optimally distributed across the fabric width. Edge sensors detect changes in the fabric width and adjust the position of the sensors.

Microprocessors in all scanning heads simultaneously and continuously provide signals proportional to the weft angle. In fractions of a second, the total draft is calculated, the deviation from the norm (=straight weft thread) is determined and the necessary control impulses are derived. This way, changes in distortion can be detected and controlled practically in real time. Lowest residual distortion tolerances are guaranteed.



One sensor traverses the entire fabric width

Traversing scanning with one sensor

A camera is moved with a traversing device in cross direction to the fabric web. During traversing, the camera takes snapshots of the passing fabric at predefined points and evaluates the images obtained with an evaluation algorithm with regard to weft angle. After traversing, the total distortion is calculated from the individual calculated values and the deviation from the norm (=straight weft thread) is determined. This then results in the necessary control pulses for the actuators of a connected straightening mechanism with skew and bow rollers.

Mahlo has always relied on the superior simultaneous scanning with fixed sensors for distortion detection. There are many measuring tasks for which Mahlo also uses traversing sensors (see Qualiscan QMS-12, Colorscan CIS-12 etc.). However, for the fast and precise correction of distortions in textile webs, distortion detection with a traversing sensor is disadvantageous for the following reasons:

The max. speed at which a sensor can reasonably traverse across the width is approx. 1500 mm/s. In the edge areas, braking must take place before the reversal point. This means that with a width of 3200 mm a traversing will take 2 sec or more in any case. Only when all information of a traversing is available, the total distortion can be calculated. This means that it takes at least 2-3 seconds from one distortion calculation to the next. Assuming the usual fabric speeds of 70 m/min, approx. 2.5 - 3 m of fabric pass through the straightening machine unobserved during this time.

Knitted fabric that has been processed in tubular form in the preliminary processes normally has a high distortion dynamic, i.e., frequently changing distortions are to be expected. Especially then, a quick reaction is required, and a recalculation of the total distortion after 3 seconds is not sufficient.

If the usual values are used for light woven fabrics, which are often run at up to 100 m/min on the stenter frame, then the cycle time until the next calculation is extended to almost 4m of fabric. Even if woven goods have a lower warping dynamic, too much fabric passes the scanning without being able to react to it. A fast correction of distortions is therefore only possible to a limited extent. The following graphic illustrates this:

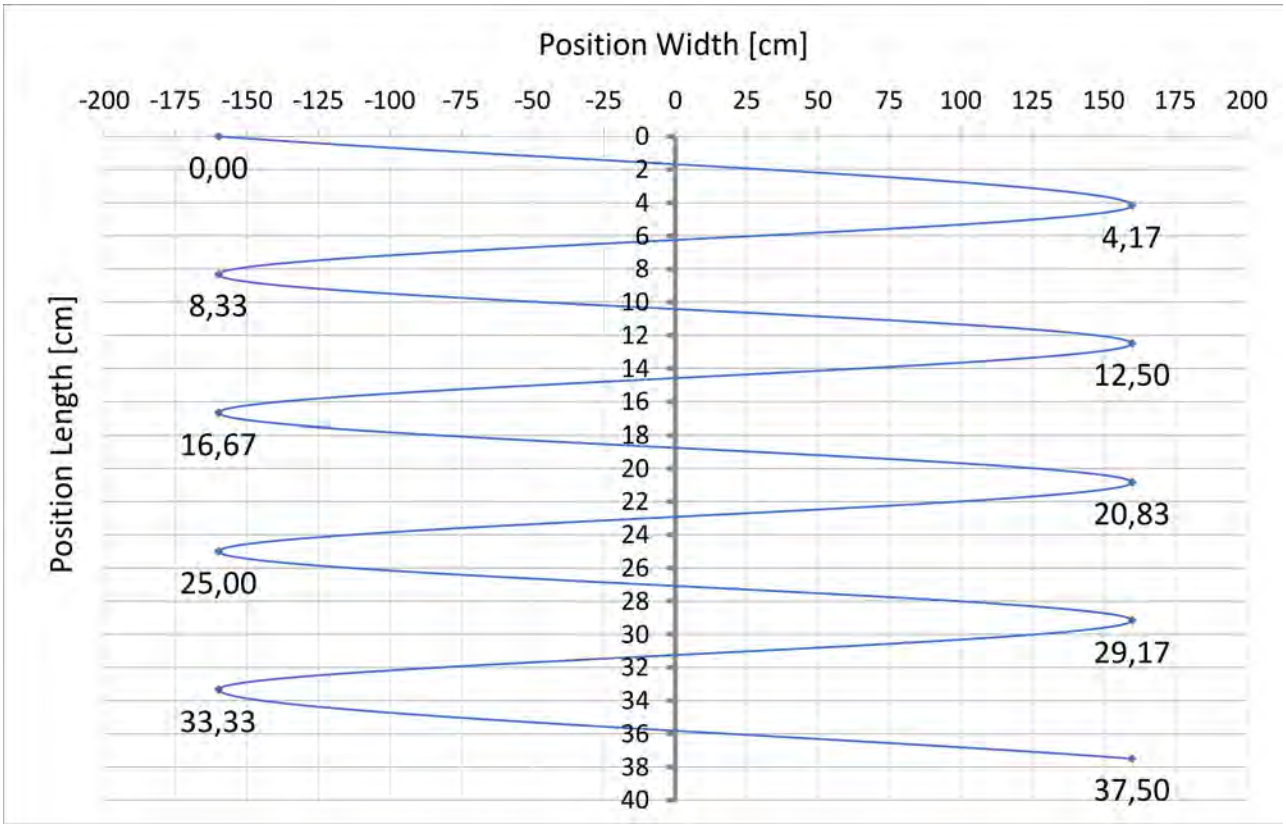
The following calculation and graph illustrate this:

Initial values:

- Fabric width: 320 cm
- Plant speed: 100 m/min
- Traversing speed: 150 cm/s
- Scan time: 2,5 s
- Scan length:: 4,17 m

Tab. 1: Scanning values traversing scanning

Scan	1	2	3	4	5	6	7	8	9	10
Position width [cm]	-160	160	-160	160	-160	160	-160	160	-160	160
Position Length [m]	0,00	4,17	8,33	12,50	16,67	20,83	25,00	29,17	33,33	37,50



Unobserved fabric during traversing

Conclusion

Simultaneous scanning with several sensors is clearly superior to traversing scanning with one sensor. The opportunity at Mahlo to directly compare experience with traversing and stationary systems clearly revealed the weaknesses of traversing.

In the time between the sensor's reversal points, too much fabric passes through the straightener unobserved. Especially goods with high distortion dynamics are negatively affected by this.

Control

Built in intelligence

Once the distortions in the fabric have been detected, it is important to derive the necessary control impulses as quickly as possible. Of course, the controller used plays a central role in this.

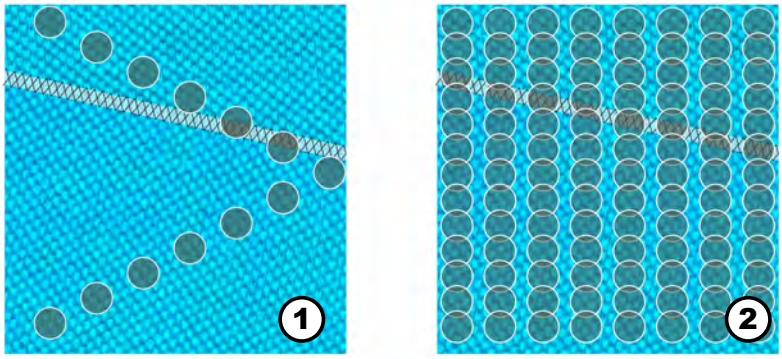
Together with the Deggendorf University of Applied Sciences, the Mahlo controller was further optimised. Thanks to the AI used, it can adapt automatically to changing influences and fabric parameters (speed, fabric tension, etc.). Complex algorithms enable it to anticipate the future distortions. This additionally increases the control speed. This is only possible because the necessary information about the total distortion can be calculated more or less in real time. Delays resulting from the traversing of a measuring head across the fabric width can thus be avoided.

Capture entire fabric width with one scan

As already mentioned, this factor plays an outstanding role especially when straightening knitted fabrics. With fabric qualities such as piqué or single jersey, it is almost impossible for the machine operator at the stenter frame to place a straight seam between two pieces, i.e., the distortion changes direction from one second to the next.

Only a scanning concept based on multiple scanners across the fabric width can detect this change immediately. A traversing system will detect this change after 2 scans at the earliest. Too much uncorrected fabric passes the straightener and leads to waste and / or an additional stenter frame passage.

Mechanics for mounting the sensor system



Comparison of the measuring points during the scanning of a seam

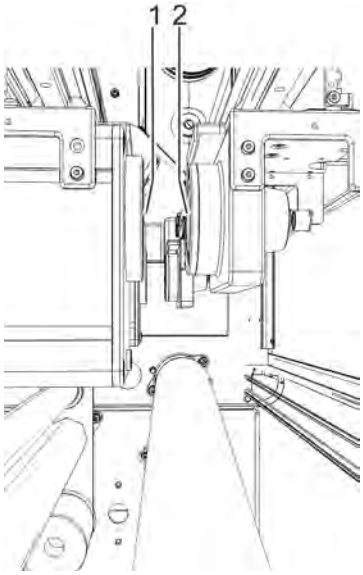
① Traversing system with one sensor
② Area-covering stationary system (multi-sensor)

Conclusion

Stationary scanning unfolds its full potential, especially in closed-loop control. The fact that the real data can be transferred directly to the computer means that there is ***no delay in correcting the fabric****.*

This advantage is particularly noticeable with knitted fabrics and seams.

Mechanics for mounting the sensor system



Probe (1) and spotlight (2) are easily accessible and easy to clean

Low maintenance - high redundancy

In times of ever-increasing competition, textile companies must focus their attention on smooth production. There is hardly any time left for machine cleaning. Therefore, Mahlo has consciously decided to adapt to the circumstances and optimised the accessibility for a quick cleaning of the sensors.

Mahlo scanners can accommodate up to 8 sensors across their width. The sensing heads are optimally adjusted across the width either by motor or manually. Under the conditions mentioned, it can happen that sensors fail even with Mahlo systems. In such a rare case, however, all other sensors of the straightening machine are still fully usable, and the **straightening machine can continue to be operated without interruption** until the repair has been carried out or the sensor has been replaced.

High maintenance effort and risk of failure

With a traversing sensor, the functionality of the entire system always depends on a motorised, mechanical traversing device. If this fails, the entire system comes to a standstill and can no longer be used.

If one considers the harsh environmental conditions that prevail at the infeed of stenter frames in many textile plants, then one quickly becomes aware of the risk associated with such drive systems. Especially in cotton processing plants, a lot of lint and fibre fly is to be expected. These fibres settle everywhere, penetrating through the smallest cracks. Even stainless-steel screens and enclosures cannot prevent them from making their way into the traversing areas. There they soak up moisture and chemicals. If they are not removed, this inevitably leads to the mechanics suffering and - as reported by some users - repeatedly blocking the traversing.

If this is detected too late, destroyed belts and drives are the result, which in turn leads to **time-consuming repairs with long down-times** and high costs (repair, spare parts, loss of production, possibly distorted goods). In any case, traversing scanning requires enormous care and maintenance.

Conclusion

A permanently installed bridge with sensors that are freely accessible and can therefore be continuously cleaned and maintained is a guarantee for continuous, safe production.

The environmental conditions in a textile finishing plant are the natural enemy of any mechanical traversing system. *A failure of this mechanics inevitably means the total failure of the entire system.*

Operating concept & Visualisation

Visualisation and operation via touchscreen

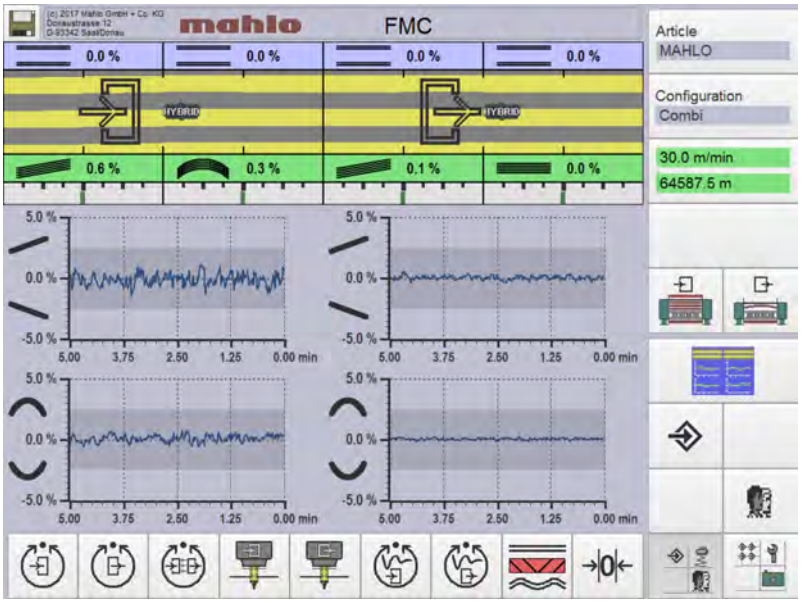
Visualisation, operating concept, ease of use, look and feel, software scalable according to customer requirements

The simple operation, the look and feel of the Mahlo visualisation are unsurpassed and serve as a benchmark for the industry. In addition, many customers already use Mahlo devices and are therefore very familiar with the operating concept.

25,000 Mahlo straighteners in use all over the world speak a clear language here.

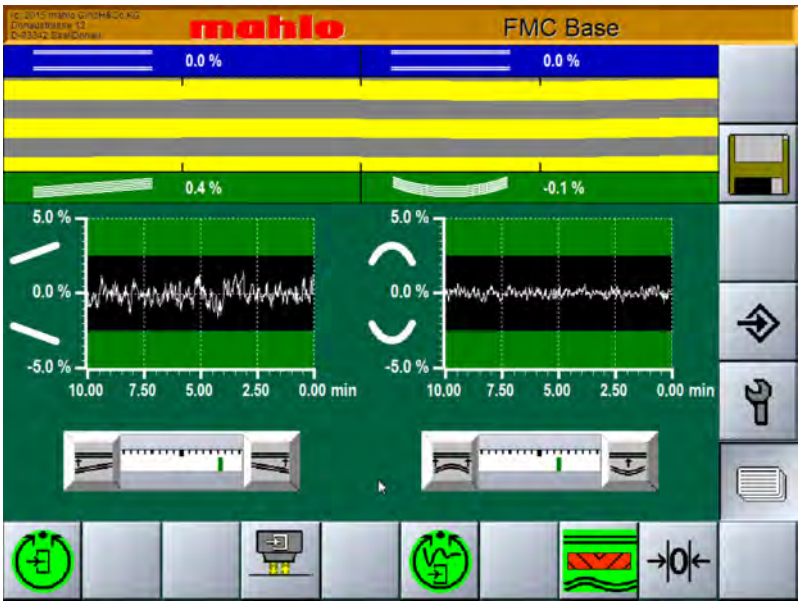
Operating concept & Visualisation

Full version FMC



Mahlo also offers customised solutions in this area. For more complicated structures and weaves, standard software ("FULL") is available. This version offers full functionality in the areas of diagnostics, signal filtering, recipe management. Ergonomics and ease of use also leave nothing to be desired.

Version FMC Base



For simple applications, the customer can use the basic software ("BASE"), which ensures intuitive and uncomplicated operation of the straightener.

Visualisation G-15

In addition, with the higher-level GEN15 software, Mahlo offers a tool with which the display can be easily configured by the customer himself so that it exactly meets the requirements of the respective application and operator.

This can be adapted on site at any time to new circumstances and new operators with a different view.

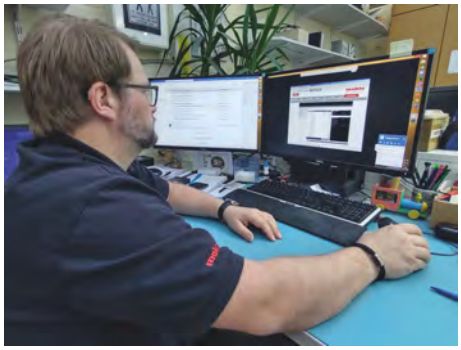
Conclusion

*Mahlo operation is intuitive, application-oriented and individually adjustable. This reduces **human errors to a minimum** and adapts working with Mahlo products to the needs of the machine operators.*

The result: Mahlo machines are more fun!

Service availability & Application technology

Straightening machines are machines that are very much characterised by sensor technology, electronics, and software. Therefore, customers need good support from the manufacturer. A globally active, broad, and quickly available service network is essential for this. Only very few straightening machine manufacturers can offer such a specialised service network. The consequence is that with suppliers with a less well-developed service network, one often must wait a long time for a problem to be solved. Sometimes even a very long time.



Remote service: time and cost-saving deployment at the customer's premises

Mahlo, on the other hand, has internalised the topic of service for decades and covers the globe with a dense service network in which our worldwide representatives play a prominent role. This service network is constantly being expanded. In reality, almost all important textile markets on all continents, Mahlo maintains local service stations, either independently or connected to the local subsidiaries or agencies. These service technicians are continuously trained and educated at the Mahlo headquarters in Germany in terms of technology and application knowledge. At the same time, the highly experienced service team from the headquarters is constantly present in the markets and supports the local service stations with advice and assistance. Remote service and application training are of course also offered.

This service availability from Mahlo is particularly appreciated by all machine builders and OEMs who use our machines in their plants. If a problem occurs on site, all it takes is an e-mail or a call to the service department and Mahlo takes care of it immediately, so that the machine builder can concentrate on his actual activities.

Especially with straightening machines and process control, a service technician must not only understand the Mahlo machine, but always see it in interaction with other machines (stenter frames, wet finishing machines, Sanfor systems, denim finishing systems, etc.) and recognise the corresponding requirements. For this, a sound application knowledge is a basic prerequisite. This is exactly where Mahlo can score over all other suppliers.

Conclusion

A textile machine is only as good as the service that goes with it. Mahlo continuously trains its globally available service technicians in terms of technique and current technologies.

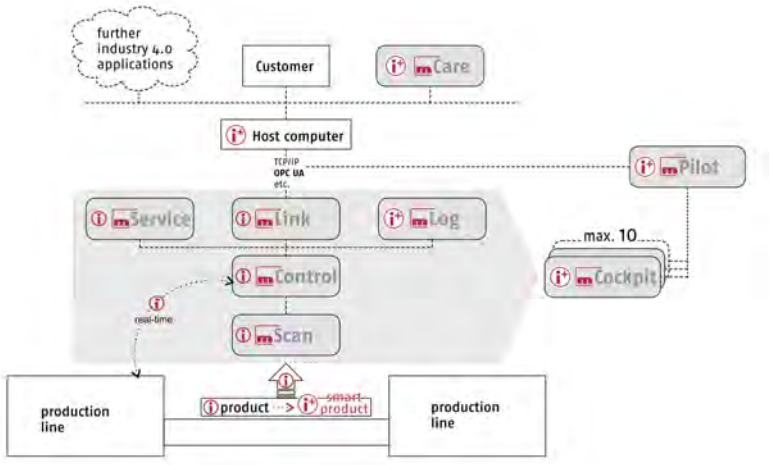
This means that every Mahlo customer has a competent contact person on site.

Data management, Digitalisation and Industry 4.0

Industry 4.0 concept mSmart

A straightening machine generates and collects a multitude of data on the condition of the goods passing through in order to derive the control impulses. On the one hand, this data about the condition of the goods is highly interesting for the producer himself: In many cases, a decision must be made on how to proceed with the goods after they have passed through a process.

Whether a product is coated or flame-laminated, for example, always depends on the residual distortion of the goods. Appropriate protocols and comparison possibilities with existing historical data are extremely helpful in avoiding costs and ruling out problems with the end customer. In many areas, it is a must to have the historical production data available in a suitable form in case of complaints (e.g., airbags, technical textiles, automotive textiles).



mSmart - the Mahlo platform for industrial digitalisation

On the other hand, such information is also important for the end customer. With the help of the information from Mahlo data management, it can be decided remotely whether certain batches are suitable for packaging and are released for dispatch.

mLog - Data analysis tool

Mahlo is aware of its responsibility in this area and has therefore completely overhauled its data management and, with the mLog and mLog enhanced, offers two tools that fit seamlessly into other I4.0 solutions such as mPilot and mCockpit. Data loss is completely excluded, as all data is continuously stored on an edge server with 2 hard drives in a RAID array.

mLog Search & Logs

For more information, see the brochure "*Datamanagement mLog*".

Conclusion

Transparency internally and externally sustainably improves internal processes and customer relations. This saves real money and makes cooperation much easier.

The result: Close customer relationships with a better return.

And the certainty that with a Mahlo system problems are avoided before they arise.

Further questions? Contact our experts!

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We hope that we have been able to help you as an interested Mahlo trade partner or service partner with our explanations. If you have any further questions on this topic, please contact our sales team or our application technology. We will answer all your questions in detail.

If you have any other ideas for such compilations, please let us know. We will keep you fully informed.

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Monitoring and control systems, automation

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