MICRO-EPSILON

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Your Automation Partner

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Inspection Systems for the Tire Industry

MICRO-EPSILON SYSTEM DIVISION

MICRO-EPSILON

ME-INSPECTION SK
a MICRO-EPSILON company

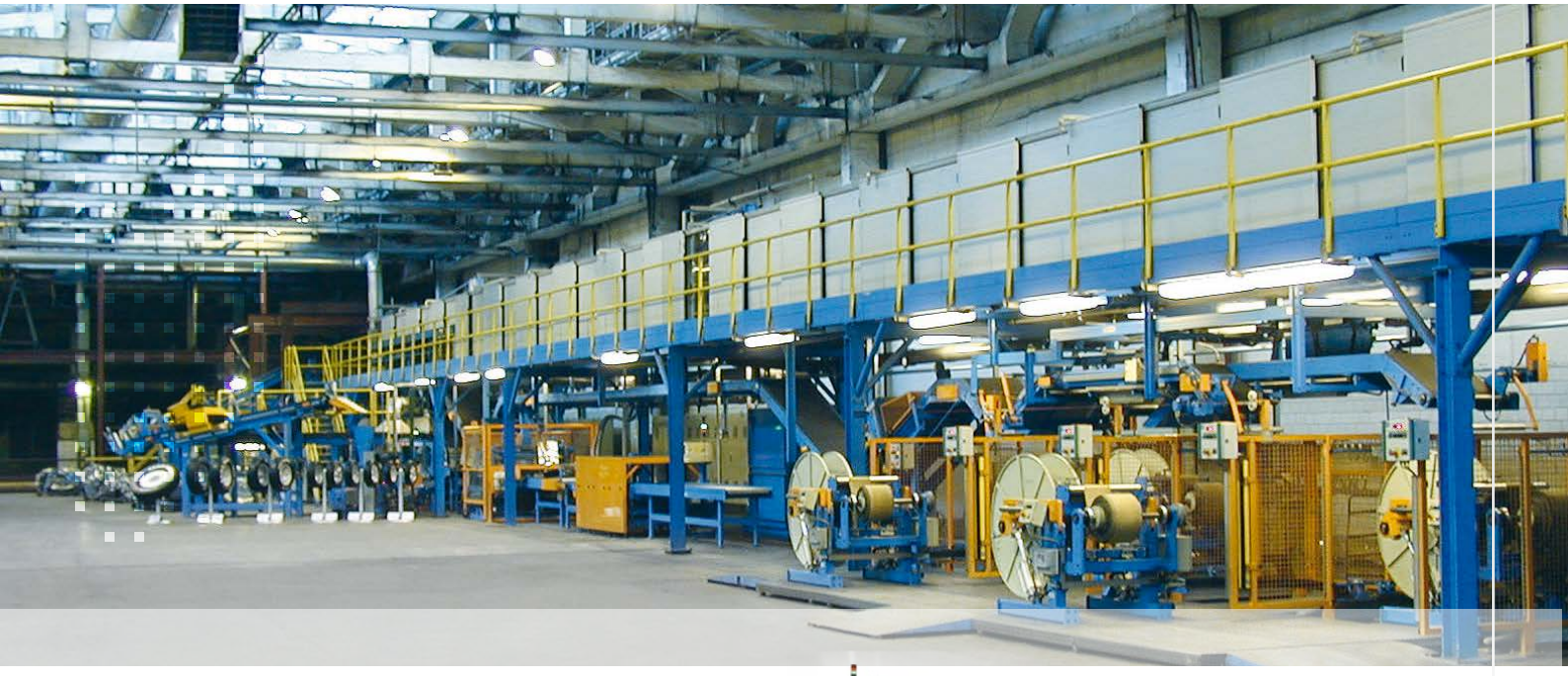
Best Efficiency, by Mastering Microns

Performance, quality as well as reliability of products and service developed and manufactured in close cooperation have made Micro-Epsilon Messtechnik GmbH & Co. KG and ME-Inspection SK to leading suppliers of inspection systems for tire industry. More than 150 installations in 16 countries all over the world placed in the preparation area, final finishing and wheel assembly speak for themselves. Generating all required core components like sensors, software and measurement specific mechanic construction within the company group provides unique innovative skills which are mirrored in the product portfolio of Micro Epsilon.

References (extract)

GOODYEAR
BRIDGESTONE
Firestone
RODOLFO COMERIO
Continental
SEMPERIT
PIRELLI
Krauss Maffei Berstorff
MRF TYRES
TROESTER
EXCELLENCE IN EXTRUSION.
EUROFIT
HARBURG FREUDENBERGER

Overview **Preparation Area**



Tire Component Profilometer

thicknessCONTROL TCP 7303.ET

Thickness measurement in

- Extrusion lines
- Innerliner calender
- Ply calender
- Textile or fabric cord calender

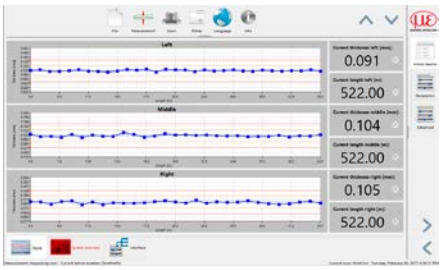
Realized as a gantry, thicknessCONTROL is a cost-effective and precise way to measure the thickness in a fixed position in form of a length profile inside tire component lines.

Flexibility in several variations

thicknessCONTROL TCP 7303.ET can be equipped with up to three sensor combinations. One of these combinations consists of a laser triangulation sensor and an eddy current sensor. The eddy current sensor features an opening, where the light spot and the reflection of the triangulation sensor pass through, forming a concentric measurement spot. These sensors are combined with a roller that guides the material. This roller is not necessarily a special measurement roller, it can also be a calender roller.

The eddy current sensor detects the surface of the roller and therefore the lower side of the tire component, whereas the laser triangulation sensor measures the upper side. The thickness of the target is the difference between the two displacement sensor signals. Due to the fact that the result is always based on the measured displacement between the gantry and the roller, effects on the frame caused by temperature gradients do not influence the gauge.

The sensors are mounted on a linear guiding and can be adjusted manually in X direction to the desired position.



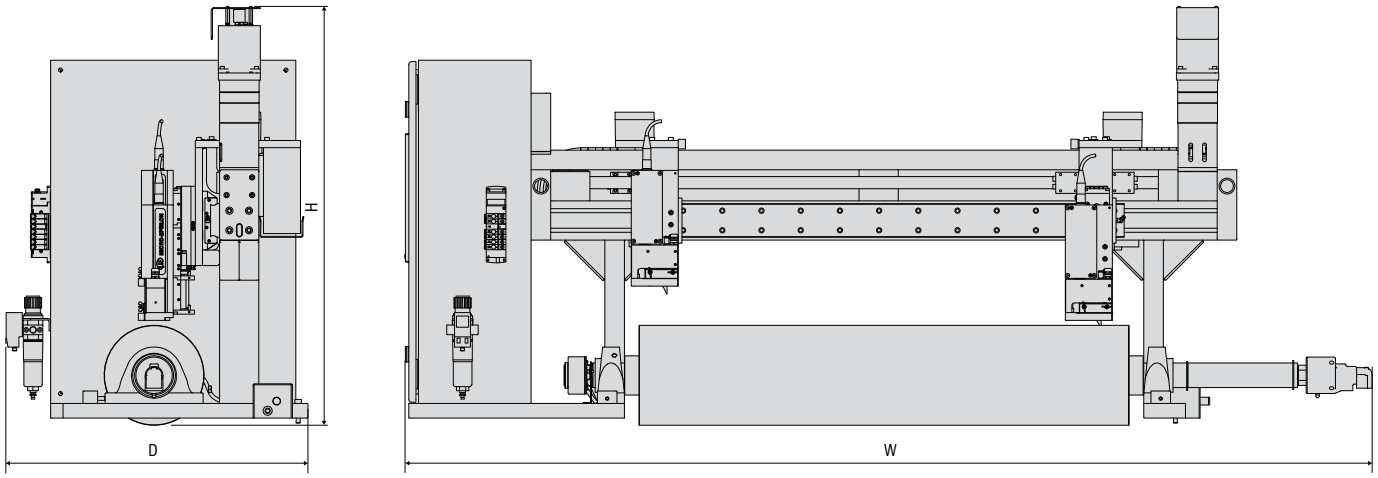
Longitudinal trend for 3 fixed tracks

thicknessCONTROL TCP 7303.ET view in product direction

combiSENSOR of thicknessCONTROL TCP 7303.ET

thicknessCONTROL TCP 7303.ET			
Description (no. of tracks)	-8/900(1)	-8/900(2)	-8/900(3)
Article no.	4350288.20	50288.21	50288.22
Measuring width	700 mm		
Threading range	80 mm		
Operating range	10 mm		
Measuring range	8 mm		
Resolution	2 μm		
Accuracy*	±0.01 mm		
Roller diameter	≥200 mm		
Band angle	>60°		
Sampling rate	2.5 kHz		
Weight	approx. 100 kg packaging included		
Dimensions (W x D x H) in mm	1973.5 x 607.5 x 851		
Protection class	IP54		
Ambient temperature	+15 °C up to +40 °C		
Relative air humidity	max. 75% within the specified temperature range without condensation		

*3 sigma



Tire Width Inspection

dimensionCONTROL TWI 7303.I

Width measurement in

- Extrusion lines for treads and sidewalls

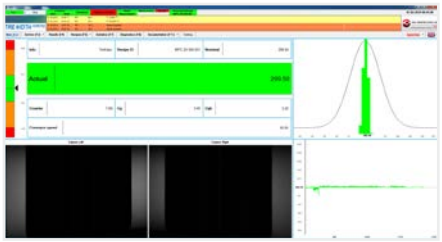
Tire Width Inspection dimensionCONTROL TWI 7303.I is designed for profile width measurement in extrusion lines.

This measuring system is based on camera vision technology involving two cameras inside one measurement box. These cameras are angle mounted to each other and operate according to stereo vision technology which enables high precision measurements in the whole calibration range.

The main advantage of stereo vision technology is a precise measurement in harsh environmental conditions (e.g. vibrations, unpredictable material movements on conveyor in material flow direction, in vertical directions or even combined).

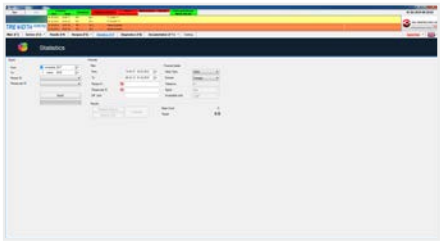
Tire width inspection enables to measure either one or two simultaneously produced profiles (tread or sidewalls). The amount of profiles is automatically detected, measured and evaluated.

Software interface – visualization contains a database of measured profiles, recipes, tools for statistical processing and exportation of measured results for further processing in different formats.



Current result

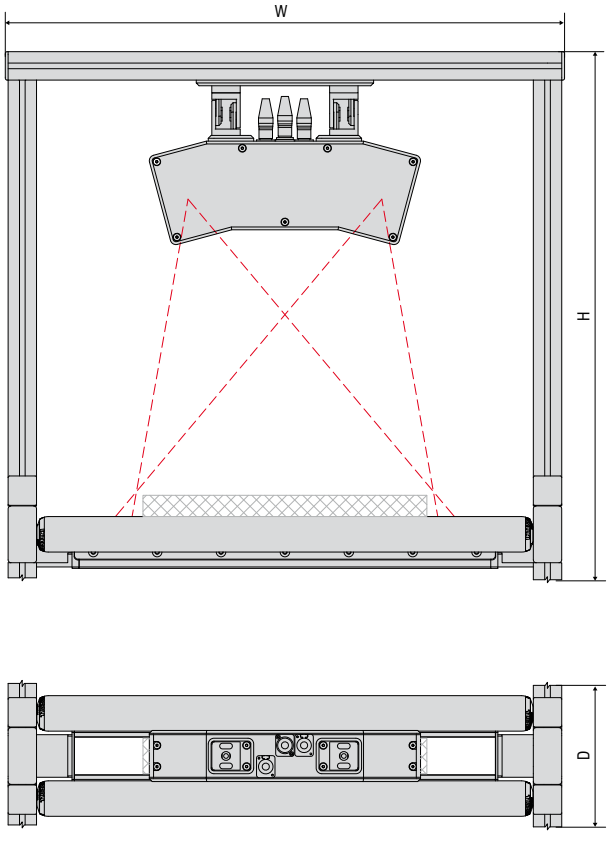
Recipe database



Statistics

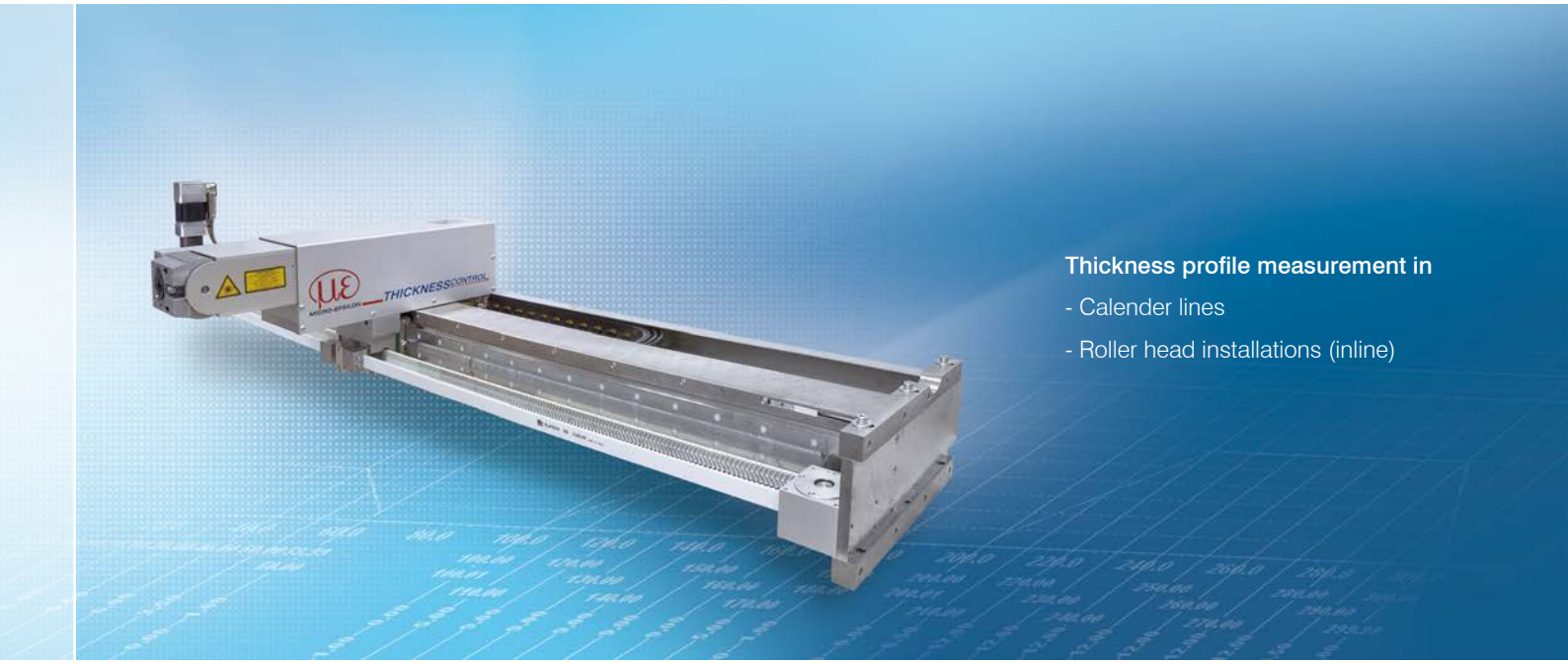
dimensionCONTROL TWI 7303.I			
Description (no. of tracks)	-350	-450	-550
Article no.	4380001.01	4380001.02	4380001.03
Measuring width	350 mm	450 mm	550 mm
Measuring range**	370 x 100 mm	470 x 100 mm	570 x 100 mm
Resolution	10 µm	15 µm	20 µm
Accuracy*	± 50 µm	± 65 µm	± 80 µm
Number of cameras	2		
Sampling rate	50 Hz		
Weight	approx. 100 kg packaging included		
Dimensions (W x D x H) in mm	700 x 150 x 600		
Protection class	IP54		
Ambient temperature	+15 °C up to +40 °C		
Relative air humidity	max. 75 % within the specified temperature range without condensation		

*3 sigma
**size of scanned image W x D



On-Roll Profile Thickness Measurement

thicknessCONTROL TCP 8303.ET



Thickness profile measurement in

- Calender lines
- Roller head installations (inline)

thicknessCONTROL TCP 8303.ET accepts the challenge of profile thickness measurements in calender rolls where it solves complex tasks in harsh environments while providing the data required to optimize the production process.

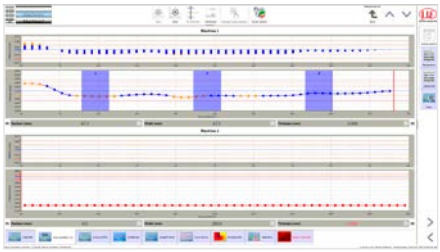
Multi-sensor system achieves maximum precision

Similar to the thicknessCONTROL TCP 7303.ET, the measuring principle of the system is based on the combination of a laser triangulation sensor and an eddy current sensor.

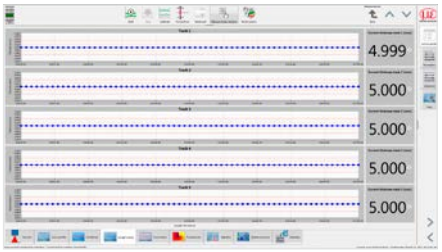
The TCP 8303.ET system offers application-specific adaptions and further accompanying sensors which ensure excellent performance. As the position of the calender rolls changes during production due to thickness control, the sensor technology must be adjustable in lateral direction and in angular position. Additional sensors integrated in the head continuously control the rollers' position and ensure electro-mechanical readjustment

In order to comprehensively monitor and control the calender, a TCP8303.ET system is required for the upper and the lower calender roll respectively, as well as either a thicknessCONTROL TCP 8301.CT or TCP 8301.CLLT to detect the total thickness.

A comprehensive software package allows for these three systems to be clearly organized and transmits the corresponding information to the calender control.



Cross profile of the upper and lower calender roll

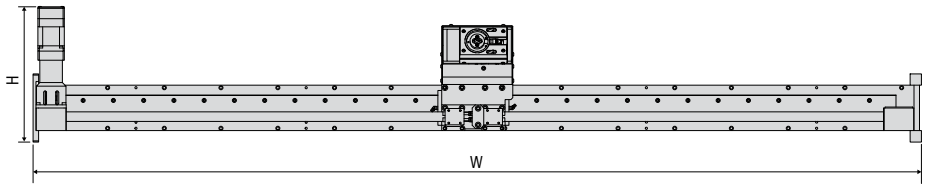


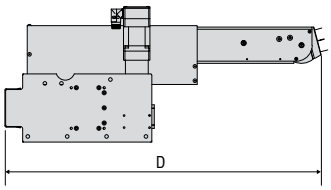
Longitudinal trend of the total thickness for 5 tracks

Sensor in measuring position in calender

thicknessCONTROL TCP 8303.ET						
Description	-10/1400	-10/1600	-10/2200	-20/1400	-20/1600	-20/2200
Article no.	4350284.10	4350284.11	4350284.12	4350284.13	4350284.14	4350284.15
Measuring width	1400 mm	1800 mm	2200 mm	1400 mm	1800 mm	2200 mm
Threading range	486 mm					
Operating range	13 mm			30 mm		
Measuring range	10 mm			20 mm		
Resolution	0.3 μm			0.5 μm		
Accuracy*	± 5 μm			±10 μm		
Sampling rate	4 kHz					
Weight	approx. 150 kg packaging included					
Dimensions (W x D x H) in mm	1973.5 x 607.5 x 851					
Protection class	IP54					
Ambient temperature	+15 °C up to +40 °C					
Relative air humidity	max. 75 % within the specified temperature range without condensation					

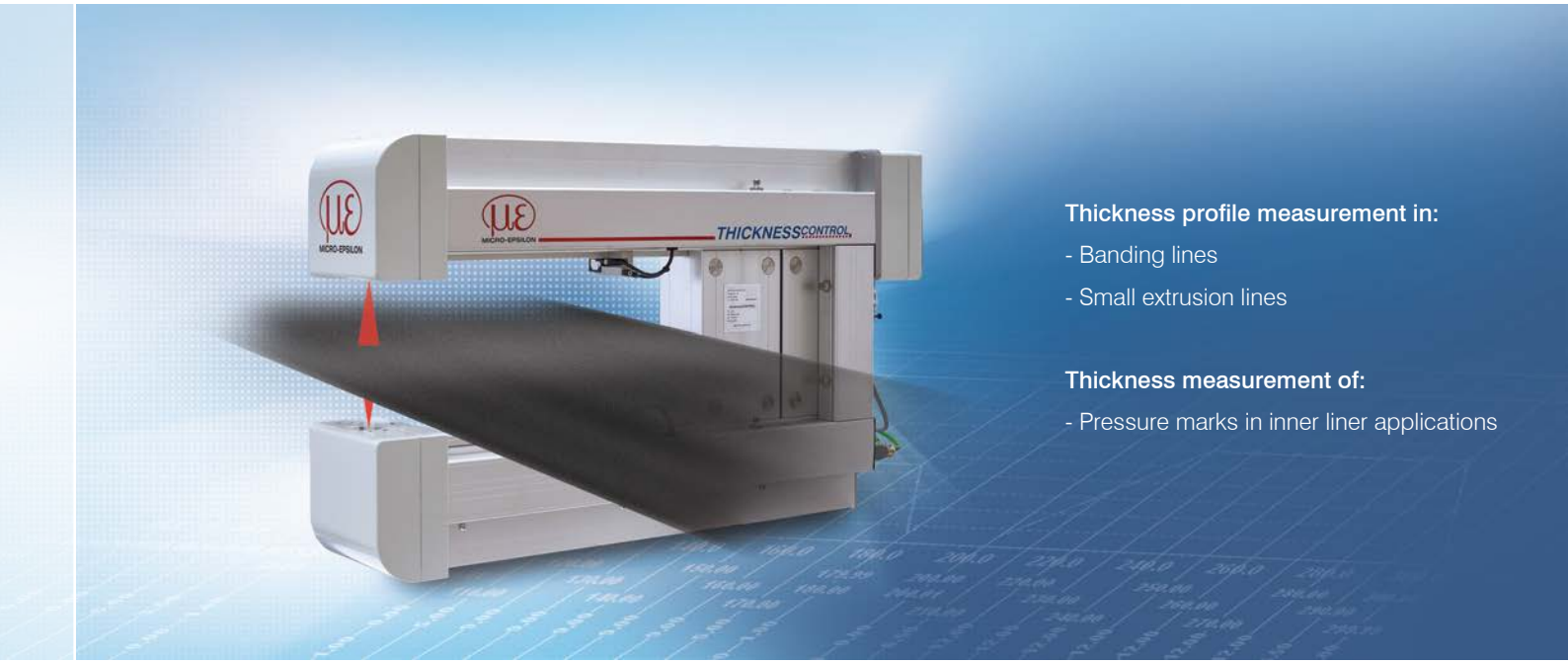
*3 sigma





Tire Component Profilometer

thicknessCONTROL TCP 8302.T/LLT



Thickness profile measurement in:

- Banding lines
- Small extrusion lines

Thickness measurement of:

- Pressure marks in inner liner applications

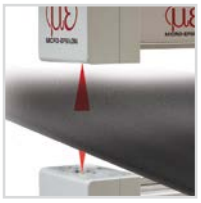
The modularly designed, C-frame based systems of the thicknessCONTROL TCP 8302 series convince due to their flexibility and performance in the long term. Their compact design enables to introduce precise inspection technology also in lines with low packaging space.

High data volume

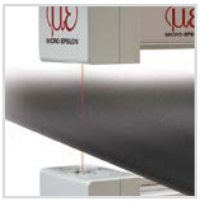
In the upper and lower belts of the C-frame, either laser triangulation point (ILD) or laser triangulation line (LLT) sensors are integrated. The result showing the profile of the target material is calculated with the difference of the added amount of the sensor signals and the calibrated working gap. In combination with highly-efficient signal processing algorithms of the analysis and visualization software, accuracies in the micrometer range are achieved.

A fully-automatic in-situ calibration ensures the measurement to be independent from temperature influences, thus the system can be applied in harsh industrial environments being characterized by permanently providing inline precision. The sensor technologies measure without contact, wear-free and without isotopes or X-rays. This process provides long-term reliable measurement results while avoiding consequential costs.

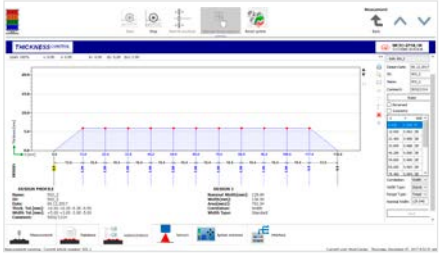
Using integrated laser line sensors, generating a high data volume of 128.000 data points per second, the thicknessCONTROL TCP 8302.LLT offers a unique range of solvable applications regarding profile thickness measurement in the tire industry.



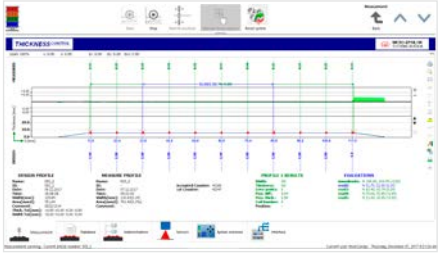
TCP8302.LLT
Laser line triangulation



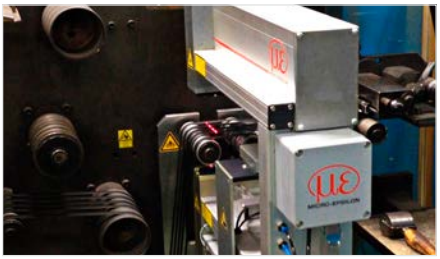
TCP8302.T
Laser triangulation



Profile editor



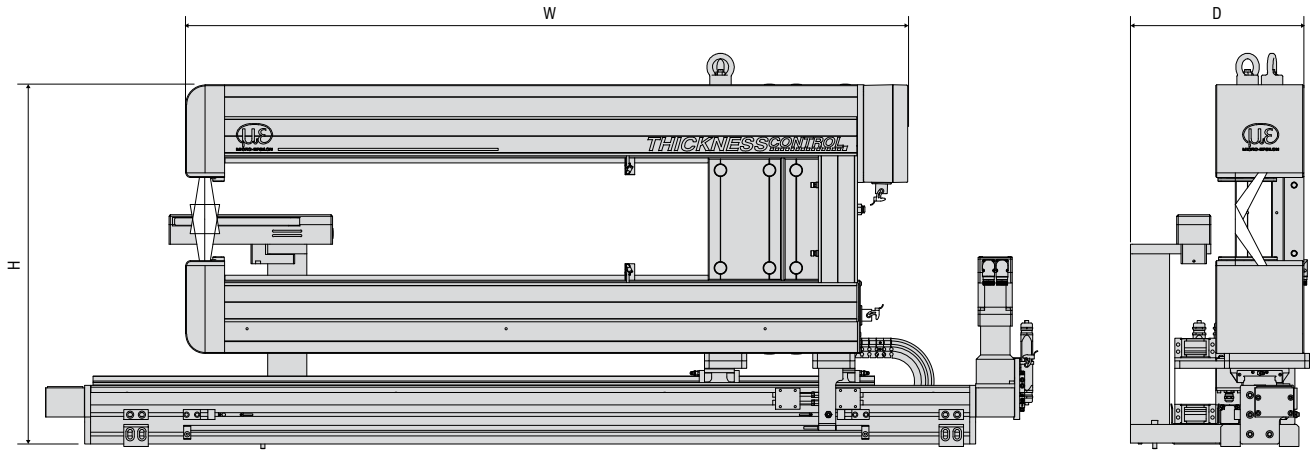
Profile view



C-frame profilometer in production environment

thicknessCONTROL TCP 8302.T/LLT								
Description	-20/500	-50/500	-20/800	-50/800	-25/500	-50/500	-25/800	-50/800
Article no.	4350127.230	4350127.231	4350127.232	4350127.233	4350127.234	4350127.235	4350127.236	4350127.237
Sensor	Laser Point Sensor				Laser Line Sensor			
Measuring width	500 mm		800 mm		500 mm		800mm	
Operating range	70 mm	156 mm	70 mm	156 mm	190 mm	420 mm	190 mm	420 mm
Measuring range	20 mm	50 mm	20 mm	50 mm	60 mm	100 mm	60 mm	100 mm
Resolution	0.45 µm	1.1 µm	0.45 µm	1.1 µm	1 µm	2 µm	1 µm	2 µm
Accuracy*	± 4 µm	± 10 µm	± 4 µm	± 10 µm	± 3 µm	± 7.5 µm	± 3 µm	± 7.5 µm
Sampling rate	20 kHz				128 kHz			
Weight	approx. 80 kg packaging included							
Dimensions (W x D x H)** in mm	973 x 168 x 635	973 x 168 x 665	1273 x 168 x 635	1273 x 168 x 665	818 x 204 x 601	818 x 204 x 813	1208 x 204 x 813	1208 x 204 x 813
Protection class	IP54							
Ambient temperature	+15 °C up to +40 °C							
Relative air humidity	max. 75 % within the specified temperature range without condensation							

*3 sigma
** width without linear axis



Tire Component Offline Profilometer

thicknessCONTROL TCP 8302.T-Offline

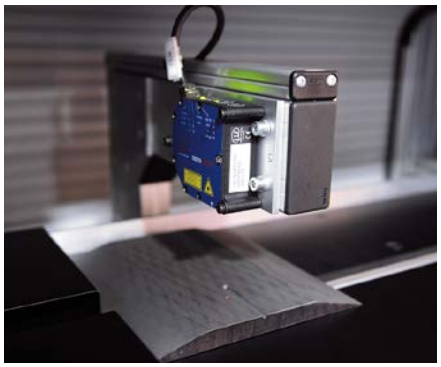
Thickness and width profile measurement in:

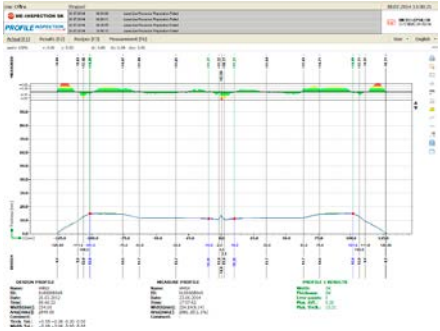
- Extrusion lines
- Innerliner calender
- Ply calender
- Steel cord calender
- Textile or fabric cord calender

With the thicknessCONTROL TCP 8302. T-Offline, a line independent tool measuring the profile thickness and width is available. Multiple lines can be controlled semi-automatically and very cost-effectively.

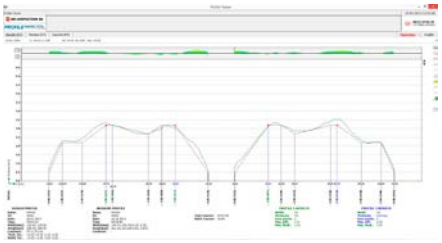
Improving qualitiy control

An integrated, traversing C-Frame with two optical laser triangulation sensors carries out the inspection of the entire profile. The system contains fully automated, integrated calibrations. The process of the calibration and control measurement takes approximately 10 seconds. The visualization software of the profilometer contains tools for statistic processing of measured profile results and for exporting measurement results in different formats for further processing. The measuring system is fully covered; therefore the influence of external light on the measurement process and the creation of parasitic reflections is minimized. This is a cost-effective solution of profile measurements performed outside the line.

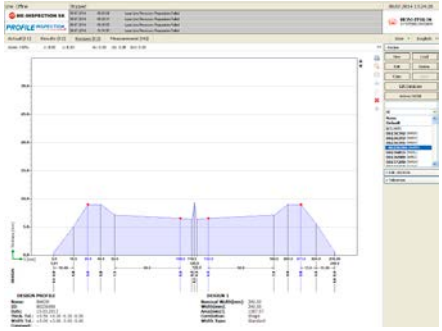




Cross profile - single inspection



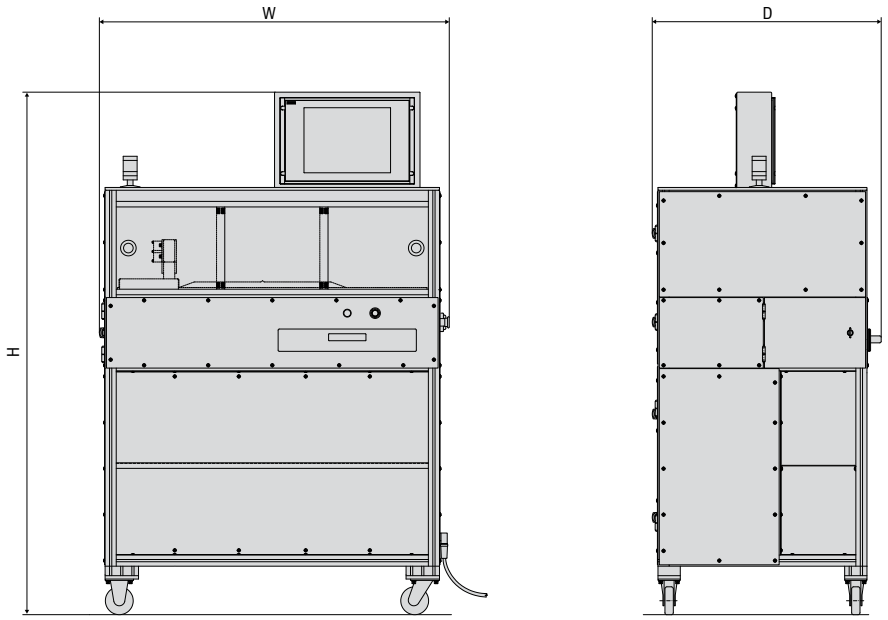
Cross profile - parallel inspection



Recipe editor

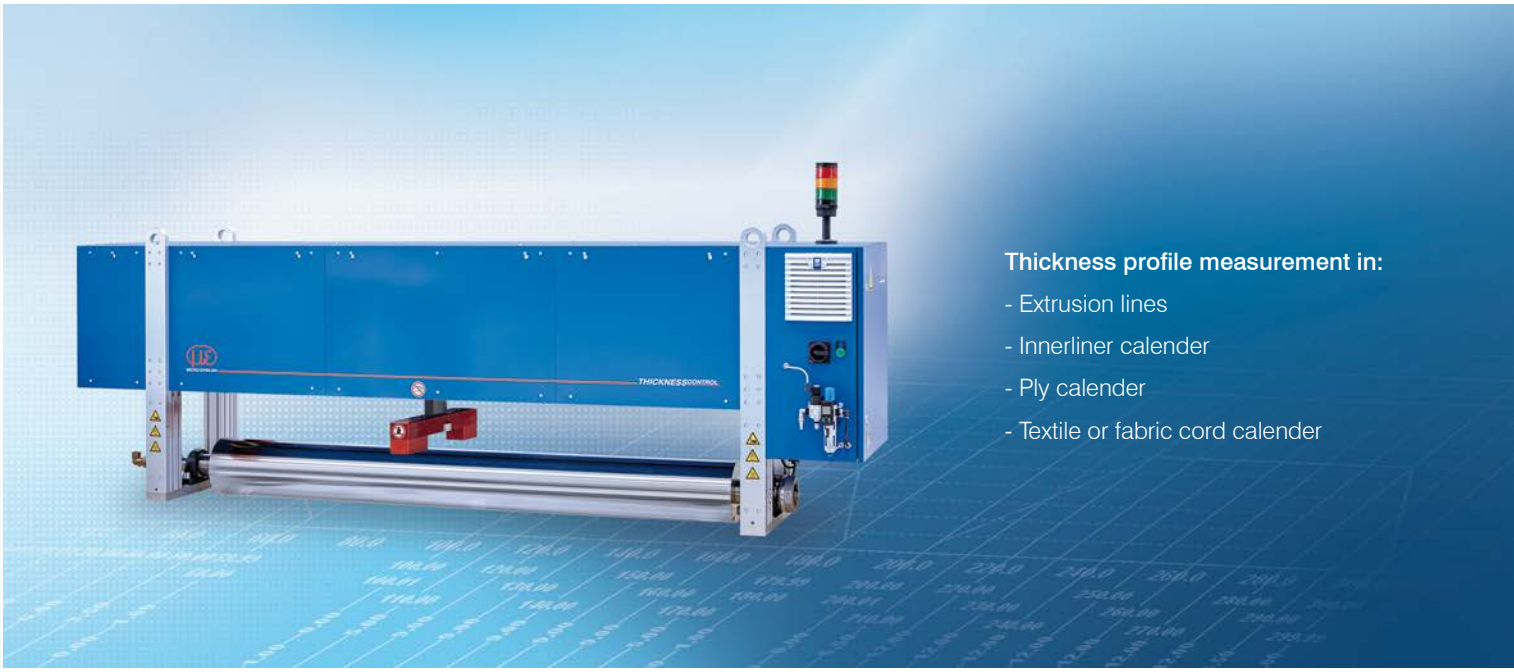
thicknessCONTROL TCP 8302.T-Offline				
Description		-10/600	-10/800	-10/1000
Article no.		4350142.01	4350142.02	4350142.03
Measuring width		580 mm	780 mm	980 mm
Measuring range		50 mm		
Resolution	width	±10 µm		
	thickness	±1 µm		
Accuracy*	width	±50 µm		
	thickness	±10 µm		
Sampling rate		20 kHz		
Traversing speed		600 mm/min		
Weight		approx. 400 kg packaging included	approx. 450 kg packaging included	approx. 500 kg packaging included
Dimensions (W x D x H) in mm		1050 x 800 x 1800	1200 x 800 x 1800	1450 x 800 x 1800
Protection class		IP42		
Ambient temperature		+15° C up to +40 °C		
Relative air humidity		max. 75 % within the specified temperature range without condensation		

*3 sigma



Tire Component Profilometer

thicknessCONTROL TCP 8301.EO



Thickness profile measurement in:

- Extrusion lines
- Innerliner calender
- Ply calender
- Textile or fabric cord calender

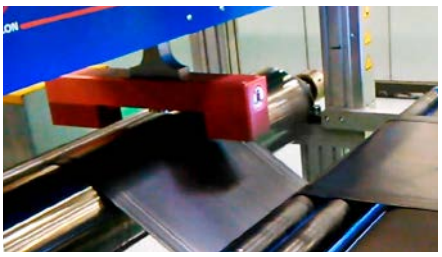
The thicknessCONTROL TCP 8301.EO family is manufactured as O-frame and significantly impresses by large material width and stability as well as high precision during thickness profile measurements.

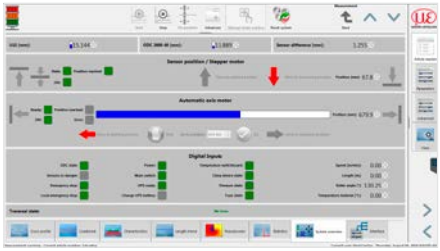
Application-specific sensors

The system measures differentially, i.e. the thickness of the material is calculated from two distance signals. The combination of an eddy current sensor and a Thru-Beam sensor is applied on one side of the thicknessCONTROL TCP 8301.EO whereas the material is guided over a measuring roller. The thickness of the target material is the difference between the sensors to each other and the amount of signals.

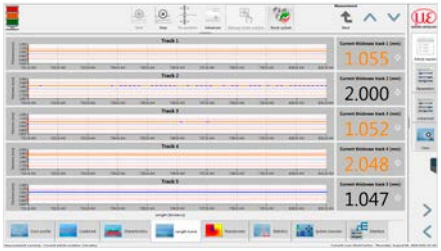
With the color-independent functioning of the integrated Thru-Beam sensor, measuring the upper edge of the rubber, the system supplies results in extraordinary precision. It is also equipped with an efficient cleaning mechanism providing high resistance against steam and particles. Therefore, the system ideal for applications in harsh industrial environments. Furthermore, it offers efficient operation facilities due to large maintenance-free intervals.

Using application-specific customized sensors the thicknessCONTROL TCP 8301.EO is, amongst other things, impressive due to its excellent ratio of measuring range.





Overview of sensors and actuators

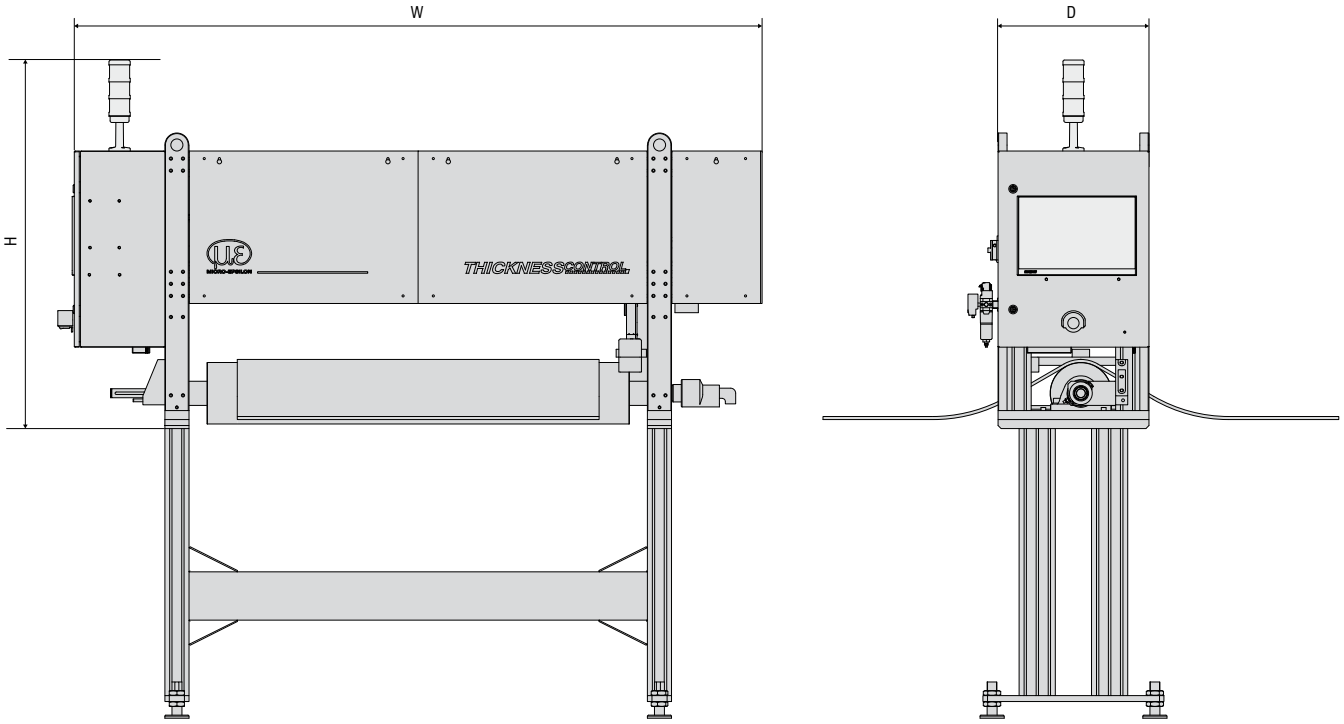


Longitudinal trend for 5 fixed tracks

Thickness measurement with TCP 8301.EO

thicknessCONTROL TCP 8301.EO								
Description	-10/1000	-10/1500	-10/2000	-10/2500	-20/1000	-20/1500	-20/2000	-20/2500
Article no.	4350039.100	4350039.101	4350039.102	4350039.103	4350039.104	4350039.105	4350039.106	4350039.107
Measuring width	1000 mm	1500 mm	2000 mm	2500 mm	1000 mm	1500 mm	2000 mm	2500 mm
Threading range	100 mm							
Operating range	12 mm				21 mm			
Measuring range	10 mm				20 mm			
Resolution	2 μm							
Accuracy*	$\pm$1 μm				$\pm$3 μm			
Roller diameter	$\geq$200 mm							
Band angle	>60°							
Sampling rate	4 kHz							
Traversing speed	6000 to 40000 mm/min							
Dimensions (W x D x H**) in mm	2000 x 500 x 900	2500 x 500 x 900	3000 x 500 x 900	3500 x 500 x 900	2000 x 500 x 900	2500 x 500 x 900	3000 x 500 x 900	3500 x 500 x 900
Protection class	IP54							
Ambient temperature	+15 °C up to +40 °C							
Relative air humidity	max. 75 % within the specified temperature range without condensation							

*3 sigma
**height without base frame



Tire Component Profilometer

thicknessCONTROL TCP 8301.CT/CLLT

Thickness profile measurement in:

- Extrusion lines
- Innerliner calender
- Ply calender
- Steel cord calender
- Textile or fabric cord calender

The systems of the thicknessCONTROL TCP 8301.CT/CLLT family are developed in form of an O-frame where the sensors are integrated in the upper and the lower boom. They work while traversing and succeed through an innovative coordinated package consisting in sensors, mechanics and software.

Closed-loop temperature compensation

The systems measure differentially, i.e. the thickness of the material is calculated from two displacement signals. Two sensors are integrated on the upper and lower boom of the O-frame on a mechanical carriage. The thickness of the target material is the displacement between the sensors to each other and the amount of signals. Offering an efficient cleaning mechanism, high resistance against steam and particles is provided. Therefore, the devices are ideal for applications in harsh industrial environments.

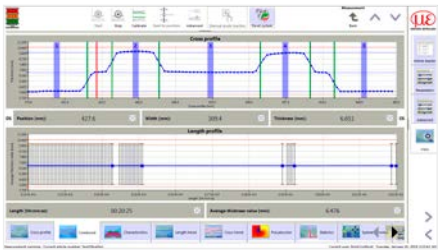
Furthermore, they offer efficient operation facilities due to large maintenance-free intervals. Thanks to integrated in-situ calibrations which do not vary with temperature, they can be also applied under harsh climate environmental conditions, e.g., in the rubber processing industry.

All sensor technologies applied measure without contact, wear-free and without isotopes or X-rays. This process provides long-term reliable measured data while avoiding consequential costs.

Using a patented closed-loop concept for compensation of temperature driven parasitic effects on the mechanics, the thicknessCONTROL TCP 8301.CT and thicknessCONTROL TCP 8301.CLLT present a revolutionary stability in the production.

Thickness measurement with TCP 8301.CT

Overview of sensors and actuators

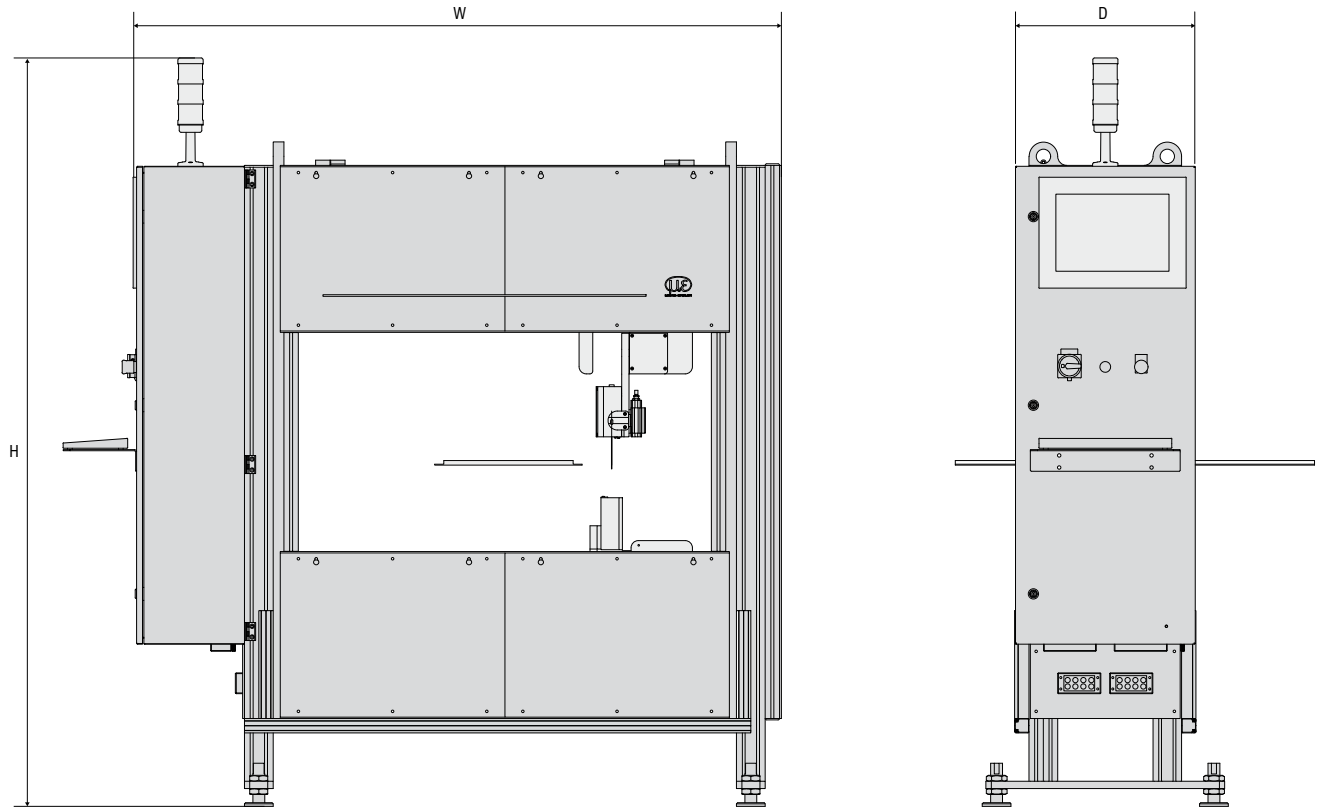


Combined cross profile and average longitudinal profile

Cross profile and display for special features

thicknessCONTROL TCP 8301.CT/CLLT								
Description	-50/700	-50/1200	-50/1700	-50/2200	-75/700	-75/1200	-75/1700	-75/2200
Article no.	4350133.100	4350133.101	4350133.102	4350133.103	4350006.520	4350006.520	4350006.520	4350006.520
Measuring width	700 mm	1200 mm	1700 mm	2200 mm	700 mm	1200 mm	1700 mm	2200 mm
Threading range	400 mm							
Operating range	169.5 mm				179 mm			
Measuring range	50 mm				75 mm**			
Resolution thickness	1 µm							
Resolution width	10 µm							
Accuracy* thickness	± 5 µm				± 3 µm			
Accuracy* width	± 50 µm							
Sampling rate	20 kHz				128 kHz			
Traversing speed	6000 to 40000 mm/min							
Weight	approx. 600 kg packaging included							
Dimensions (W x D x H) in mm	2000 x 585 x 1869.4	2500 x 585 x 1869.4	3000 x 585 x 1869.4	3500 x 585 x 1869.4	2000 x 585 x 1869.4	2500 x 585 x 1869.4	3000 x 585 x 1869.4	3500 x 585 x 1869.4
Protection class	IP54							
Ambient temperature	+15 °C up to +40 °C							
Relative air humidity	max. 75 % within the specified temperature range without condensation							

*3 sigma
**minimum material thickness 15 mm



Tire Component Profilometer
thicknessCONTROL TCP 8301.I

Thickness and width profile measurement in:

- Extrusion lines
- Innerliner calender
- Ply calender
- Steel cord calender
- Textile or Fabric cord calender
- Cap strip lines

The non-traversing profilometers of the thicknessCONTROL TCP 8301.I series enthuse with the complete profile measurements in one single shot. Working nearly without moving parts the systems provide a solution at low maintenance requirements.

Prepared for additional control

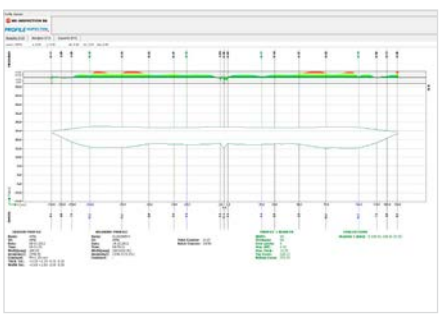
Based on the optical triangulation principle two parallel lines are projected by laser light sources onto the upper and the lower side of the material. The reflection of the laser light is detected by cameras.

The measuring system contains fully automated integrated calibrations. The patented process of the calibration takes approximately 5 minutes.

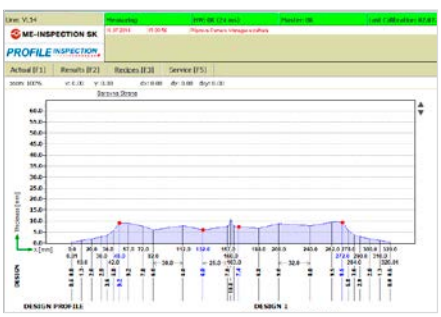
The visualization software of the profilometer contains tools for statistic processing and exporting measurement results in different formats. The measuring system is fully covered; therefore the influence of external light on the measurement process and the creation of parasitic reflections is minimized.

Prepared for additional integration of the length inspection dimensionCONTROL TLI 8303.I and the dimensionCONTROL TPWI 8302.LC, the profilometer is the efficient base for a complete quality control of an extrusion line.

Integration:
TPWI 8302.LC
TLI 8303.I
TCP 8301.I



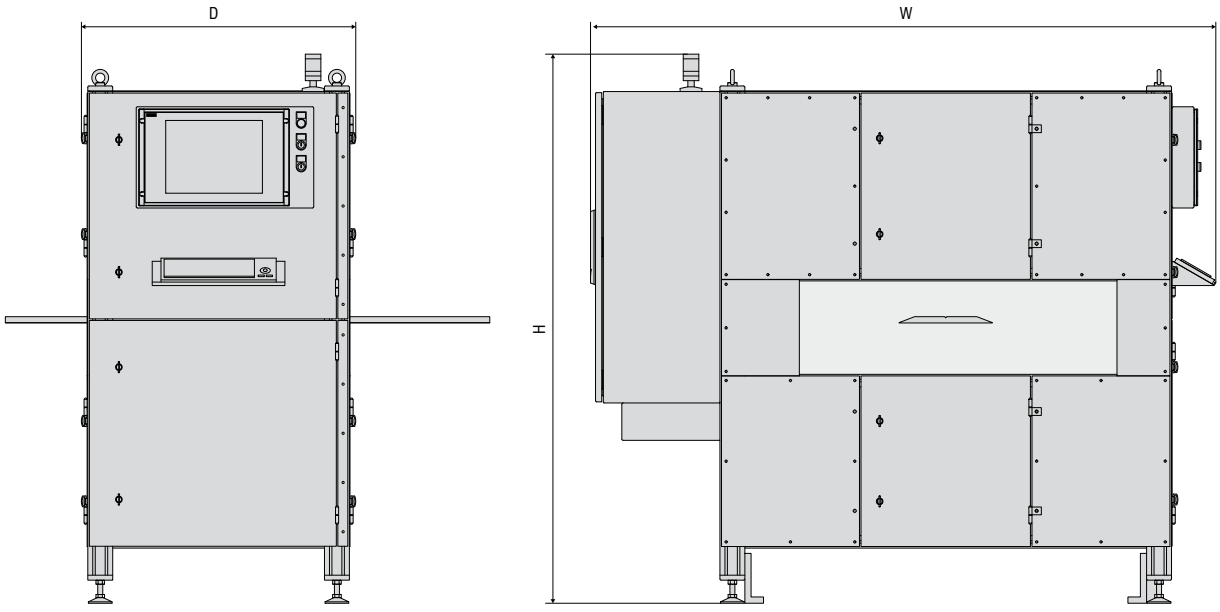
Profile shape mode



Cross profile

thicknessCONTROL TCP 8301.I									
Description		-10/170	-10/350	-10/450	-10/550	-20/550	-20/750	-20/860	-20/1220
Article no.		4350121.105	4350121.106	4350121.107	4350121.108	4350121.101	4350121.102	4350121.103	4350121.104
Measuring width		170 mm	350 mm	450 mm	550 mm	550 mm	750 mm	860 mm	1220 mm
Measuring range		20 mm	40 mm			50 mm			
Resolution	thickness	1 µm							
	width	10 µm				20 µm			
Accuracy*	thickness	± 12 µm				± 20 µm			
	width	± 100 µm	± 150 µm			± 200 µm			
Sampling rate		40 Hz**							
Max. material tilt		≤ 50°							
Weight		500 kg to 700 kg (without packaging)							
Dimensions (W x D x H) in mm		1600 x 800 x 1650	1600 x 800 x 1650	1800 x 800 x 1650	2000 x 800 x 1650	2000 x 800 x 1650	2300 x 800 x 1650	2400 x 800 x 1650	2500 x 800 x 1650
Protection class		IP42							
Ambient temperature		+15 °C up to +40 °C							
Relative air humidity		max. 75 % within the specified temperature range without condensation							

*3 sigma
**profiles per second



Tire Color Inspection

dimensionCONTROL TCI 8303.I

Color coding, color code inspection, width measurement in:

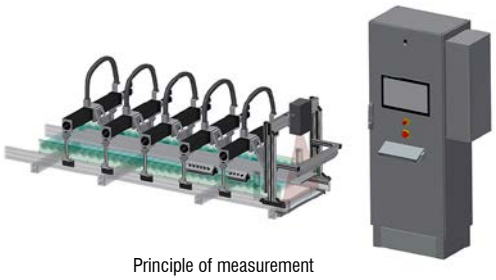
- Extrusion lines for tread profiles

The fully equipped dimensionCONTROL TCI 8303.I Tire Color Inspection system provides comprehensive color coding, color code inspection and width inspection of extruded tread. The system therefore represents a powerful component in a modern extrusion line.

The basic model of dimensionCONTROL TCI8303.I (Camera box solution) is designed for inspection of color code applied on running profiles after extrusion. As the correct width position of the color code has to be checked, the system also measures the complete width of the tread. The inspection is based on a vision system, containing one color camera and two surface light sources. During the continuous measurement process, the average value of the position and width of respective colors in one image are calculated.

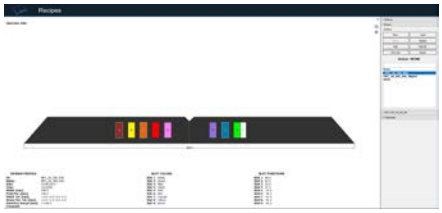
As well as overflow and interruption of color strips, the system also detects incorrect colors on defined positions. Due to its robust construction, the inspection system is ideally suited to harsh environments especially behind the extruder head.

In addition to the camera box solution (CB), a full-automatic solution (FA) with a multi-axis positioning system is available. Based on motion control, the FA system inspects every color track separately. An advantage over manual adjustment of tracks during recipe changings or standstill is that the inspection system significantly reduces the material waste.



Principle of measurement

Main screen

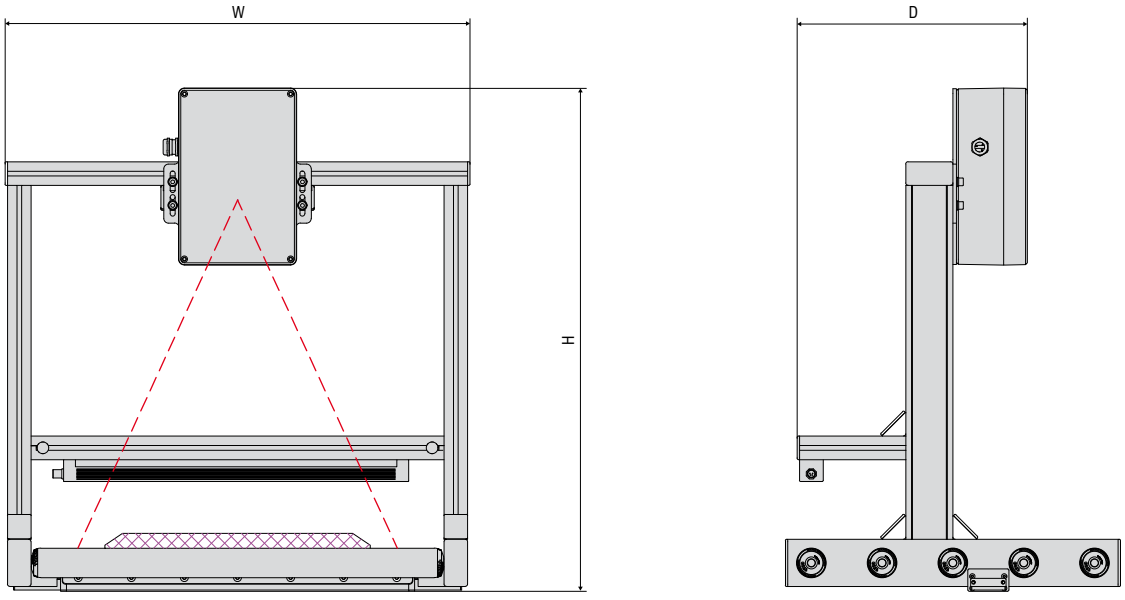


Recipe screen

Statistics screen

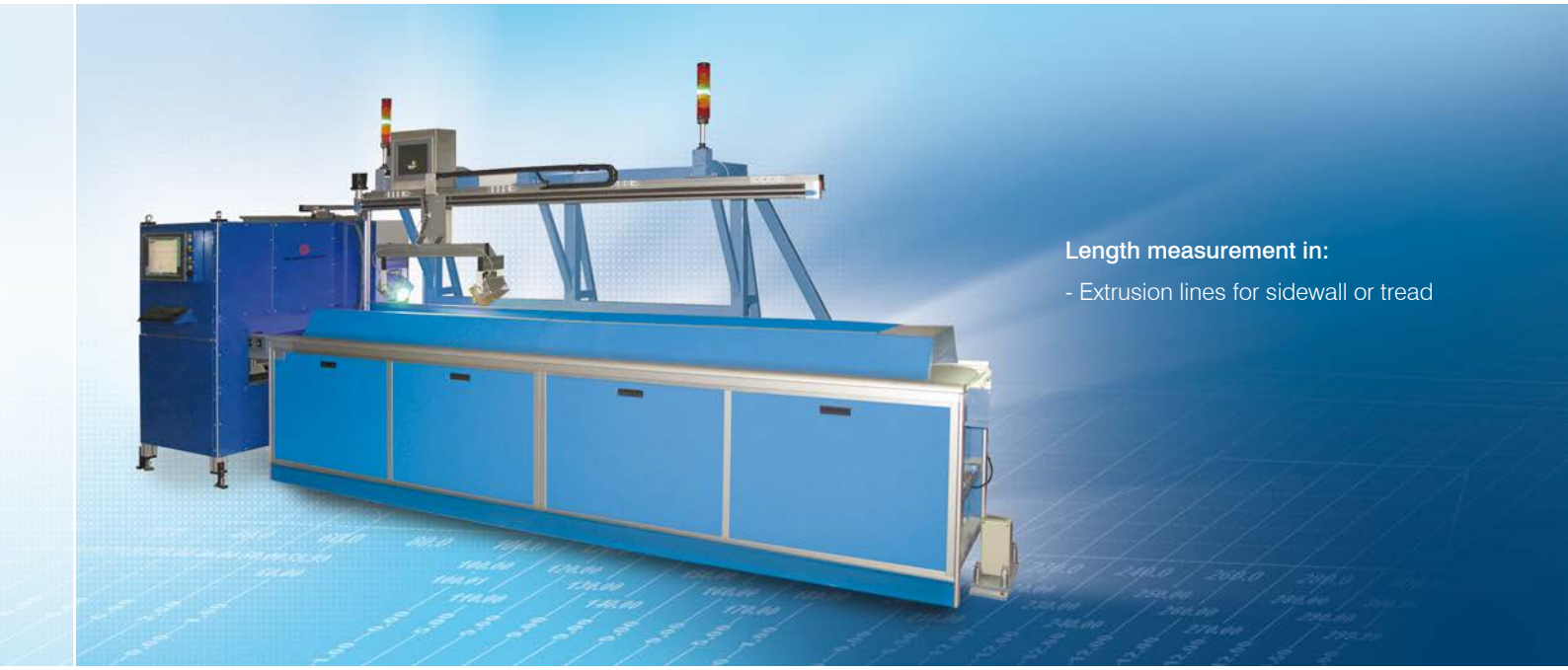
dimensionCONTROL TCI 8303.I		
Description	-450-CB (Camera box solution)	-450-FA (Full automatic solution - multi axis positioning system)
Article no.	4350148.02	4350148.03
Measuring width	450 mm	
Measuring range (D x W)	470 mm x 40 mm	
Resolution	50 µm	
Accuracy*	± 150 µm	
Sampling rate (adjustable based on the material speed)	20 - 30 fps	
Max. material speed	55 m/min	
Minimum width of color detected	1 mm	
Number of color lines	up to 10	up to 6
Stroke of electrical axis	-	± 200 mm from the middle of conveyor
Weight (without packing)	250 kg	550 kg
Dimensions (W x D x H) in mm	800 x 400 x 600	800 x 3500 x 600
Protection class	IP42	
Ambient temperature	min. +15 °C max. +45 °C	
Relative air humidity	max. 75 % within the specified temperature range without condensation	

*3 sigma



Tire Length Inspection

dimensionCONTROL TLI 8303.I



Length measurement in:

- Extrusion lines for sidewall or tread

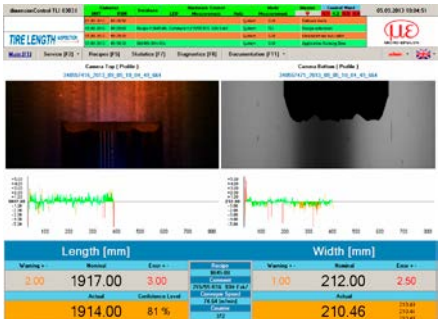
Highly efficient image processing algorithms award the dimensionCONTROL TLI 8303.I for precisely mapping the needs of later process steps in the tire building.

Optimized process mapping

The vision system dimensionCONTROL TLI 8303.I contains two cameras for profile length inspection in extrusion lines. The first camera is mounted on an electrical axis at the beginning of the profile - above the scale, the second is installed at the end of the profile.

Depending on the concept it is either under the rollers at the end of the scale or above the scale. The moveable camera is positioned according the nominal length received from the master of the extrusion line. The calculation of the profile length is based on the form of the cuts at each edge. To optimize the mapping of the inspection result and the real profile fit in the building machine, the edges are connected virtually to each other according to the scanned surfaces. Based on these values and the position between the cameras the final length is calculated.

Principle of measurement

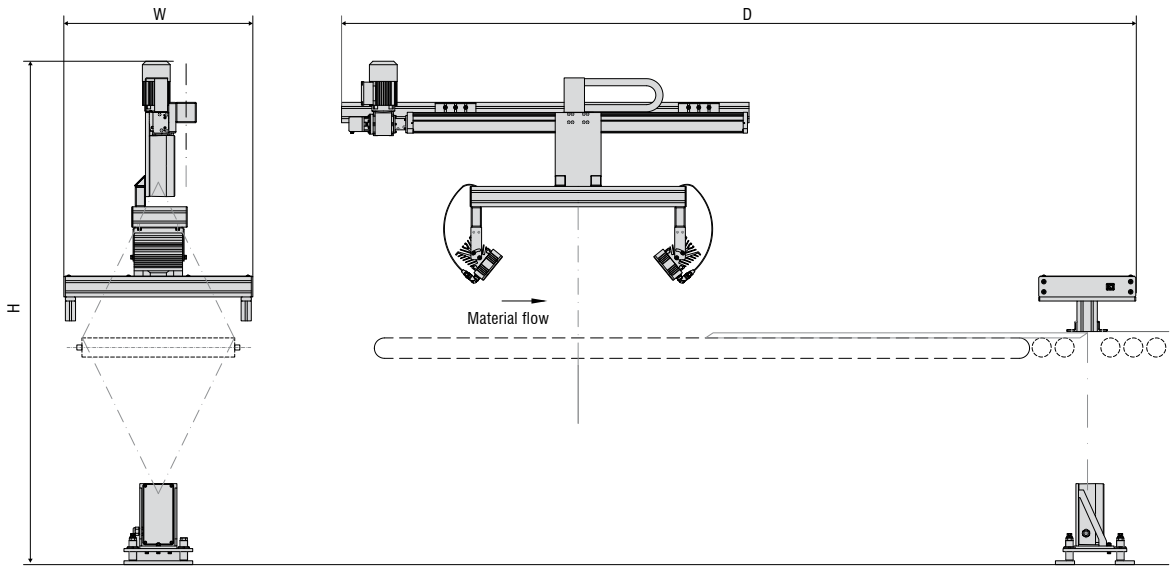


Visualization of the cutted edges, the length and the width

Illumination for the upper side

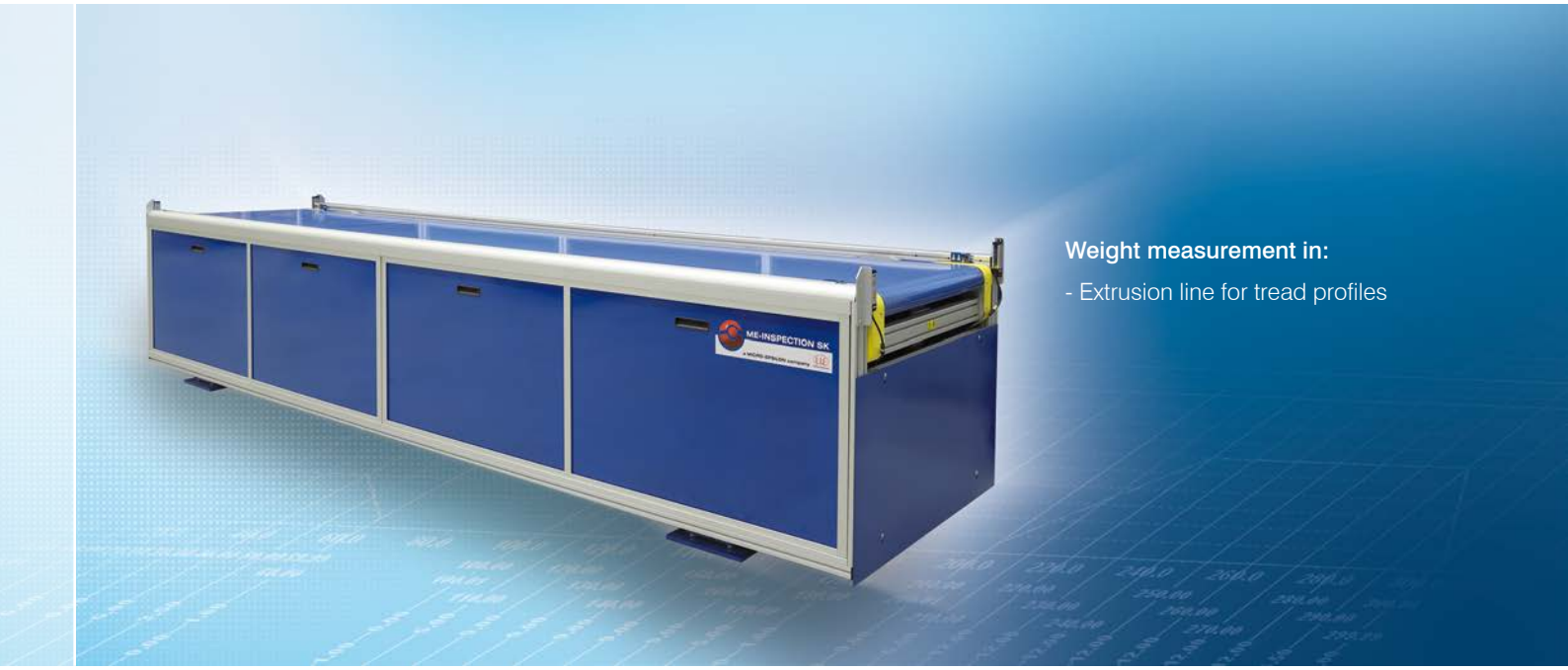
dimensionCONTROL TLI 8303.I				
Description	-1000(DU)	-1000(UU)	-2700(DU)	-2700(UU)
Article no.	4350149.02	4350149.03	4350149.04	4350149.05
Measuring length	1500 mm to 2500 mm		1300 mm to 4000 mm	
Measuring range**	5 mm to 50 mm			
Resolution	100 µm			
Accuracy*	±100 µm	±200 µm	±200 µm	±30 µm
Max. material speed	110 m/min			
Evaluation area of profile width	350 mm			
Permissible vertical material movement	10 mm			
Permissible material rotation	10 mm			
Weight	180 kg (without packaging)		250 kg (without packaging)	
Dimensions (W x D x H) in mm	850 x 3100 x 1920		850 x 4400 x 1920	
Protection class	IP42			
Ambient temperature	+15 °C up to +40 °C			
Relative air humidity	max. 75 % within the specified temperature range without condensation			

*3 sigma
** thickness



Tire Piece Weight Inspection

dimensionCONTROL TPWI 8302.LC



Weight measurement in:

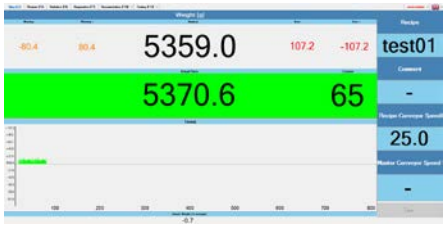
- Extrusion line for tread profiles

The TPWI 8302.LC Tire Piece Weight Inspection system is designed for inline weight inspection of cut running tread profiles used for passenger and truck tires. Based on the force measurement principle, the measuring system uses four high precision load cells which measure the deflection of the measurement conveyor.

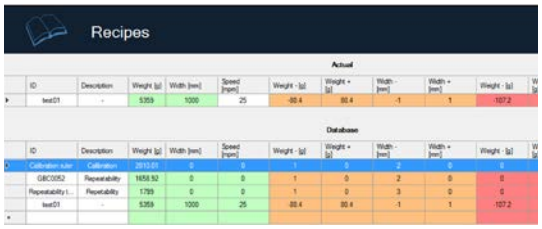
These sensor elements are attached to a massive construction, which ensures a long-term mechanical stability of the system. Due to its robust design, the inspection system is ideally suited to harsh environments prevailing in the preparation area.

Data obtained from the load cells are processed in the implemented PLC cards which determine the measured weight mathematically. The software included offers a variety of measurement data processing, definition of design profiles, statistical analysis of measured profiles and diagnostic tools.

Integration:
TLI 8303.I
TCP 8301.I



Main screen

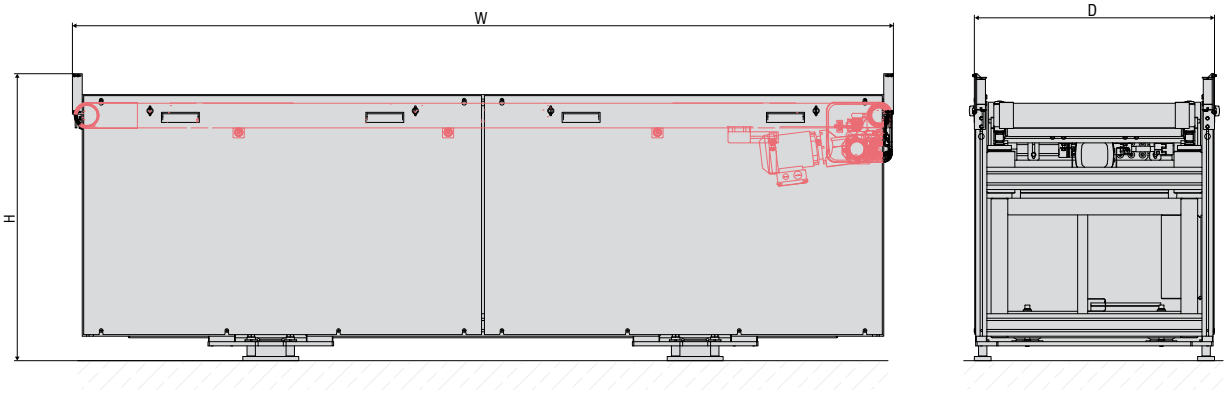


Recipe screen

Statistics screen

dimensionCONTROL TPWI 8302.LC		
Description	-3500-10/20-PLT (Passenger and light truck tires)	-4500-50/80-TT (Truck and agroculture tires)
Article no.	4380293.01	4380293.02
Max. length of the profiles	3000 mm	4000 mm
Measuring range - weight	10/20 kg	50/80 kg
Resolution	0.1 g	
Accuracy*	± 10 g/± 20 g	± 30 g/± 50 g
Sampling rate	1 kHz	
Max. material speed	100 m/min	80 m/min
Weight (without packing)	1000 kg	1250 kg
Dimensions (W x D x H) in mm	3500 x 900 x 900	4500 x 900 x 900
Protection class	IP42	
Ambient temperature	min. +15 °C max. +45 °C	
Relative air humidity	max. 75 % within the specified temperature range without condensation	

*3 sigma



Tire Meter Weight Inspection

dimensionCONTROL TMWI 8302.LC

Weight measurement in:

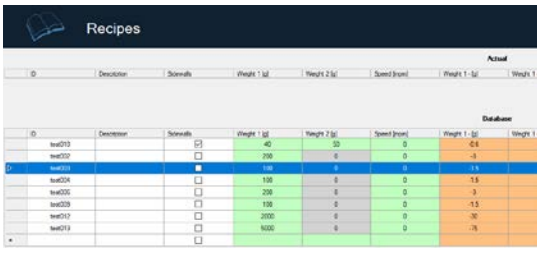
- Extrusion line for tread or sidewall profiles

The TMWI 8302.LC (Load Cell) Tire Meter Weight Inspection is designed for inline weight inspection of running tread profiles intended for passenger and truck tires. Based on the force measurement principle, the measuring system uses two high precision load cells which measure the deflection of the measurement conveyor.

These sensor elements are attached to a massive construction, which ensures a long-term mechanical stability of the system. The measurement conveyor uses precise and balanced aluminum rollers with special surface treatment. This ensures a low deadweight, avoids influence of unbalance and eliminates material sticking.

Due to its robust design, the system is ideally suited to harsh environments prevailing in the preparation area. Data obtained from the load cells are processed in the implemented PLC cards which determine the measured weight mathematically. The software included offers a variety of measurement data processing, definition of design profiles, statistical analysis of measured profiles and diagnostic tools.

Main screen

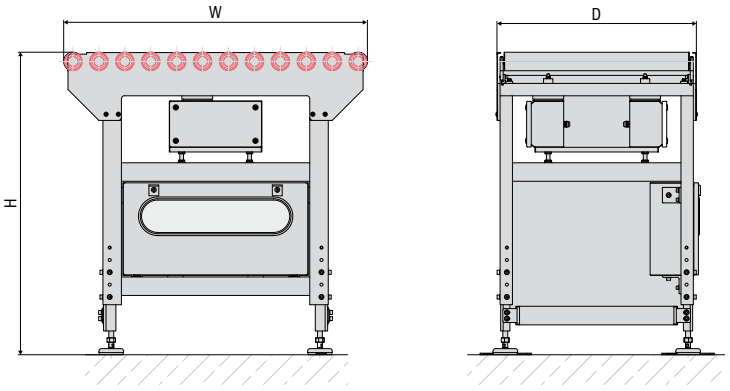


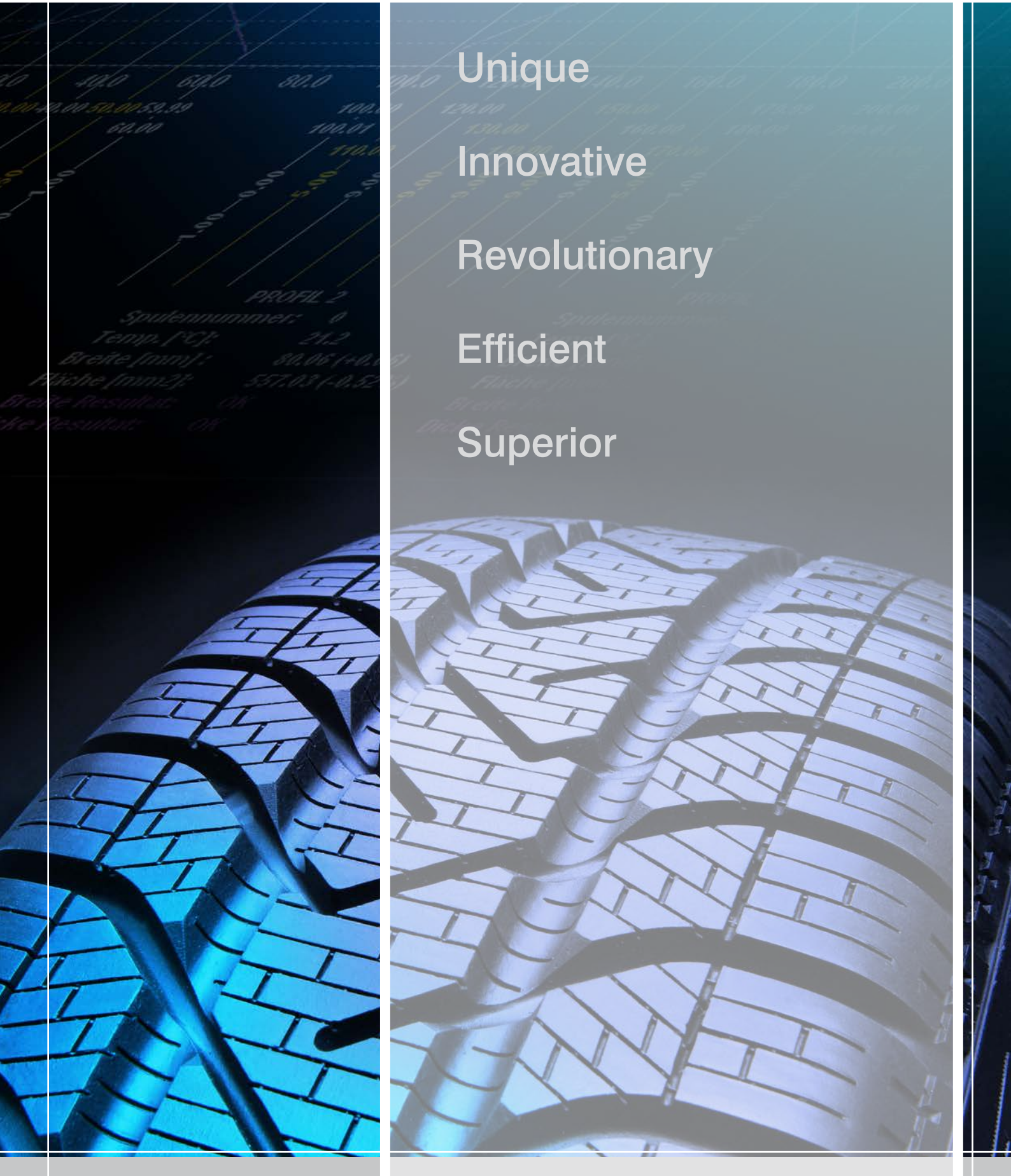
Recipe screen

Statistics screen

dimensionCONTROL TMWI 8302.LC		
Description	-500-5-single (Tread production)	-500-2.5-double (sidewall production)
Article no.	4380294.01	4380294.02
Measuring range - weight	5 kg/m	2.5 kg/m per sidewall
Resolution	0.1 g	
Static accuracy*	±1 g	
Dynamic accuracy*	± 5 g	
Sampling rate	600 Hz	
Max. material speed	100 m/min	100 m/min
Weight (without packing)	350 kg	375 kg
Dimensions (W x D x H) in mm	1000 x 650 x 900	
Protection class	IP42	
Ambient temperature	min. +15 °C max. +45 °C	
Relative air humidity	max. 75 % within the specified temperature range without condensation	

*3 sigma





Unique

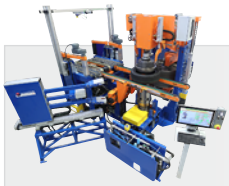
Innovative

Revolutionary

Efficient

Superior

Overview **Final Finishing**



Tire Uniformity and Geometry line
uniformityCONTROL Titan.21
Page 30 - 31

Tire Geometry Inspection
dimensionCONTROL TGI 8302.PLT/TT
Page 32 - 33

Tire Marking Station
TMS
Page 34 - 35

Central Marking System
CMS
Page 36 - 37

Central Tire Marking Inspection
markingCONTROL TMI 8303.I
Page 38 - 39

Retrofit Tire Geometry Line
RTG
Page 40

Retrofit Tire Uniformity Line
RTU
Page 41

Retrofit of Balancing Line
RTB
Page 42

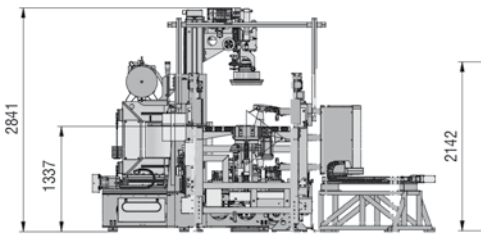
Tire Uniformity and Geometry line

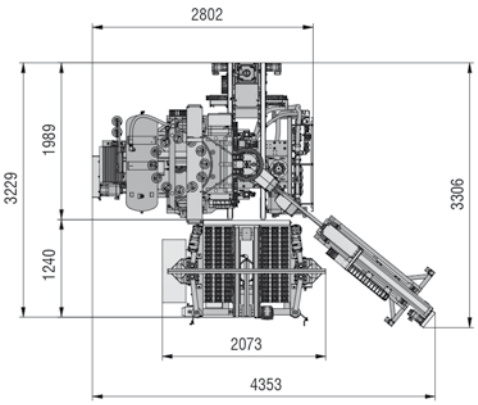
uniformityCONTROL Titan.21

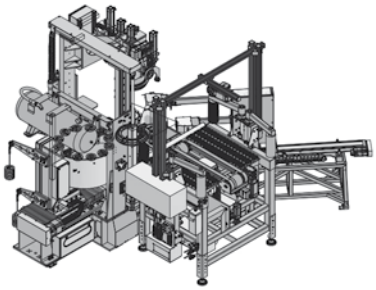
- High machine production stability
- Full automatic configuration of test sequence
- High measurement repeatability
- Adaptive machine cycle time
- External spotting
- Low footprint
- Energy efficient
- Without hydraulic unit
- Recipe controlled inflation
- Small transportation dimensions
- Fast start up machine in factory
- Maintenance friendly
- Predictive maintenance

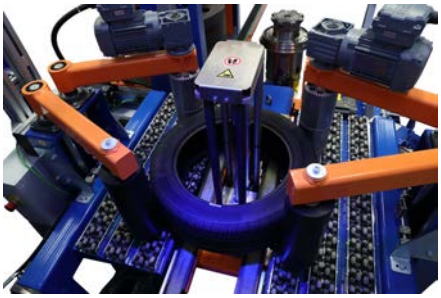
Machine parameters	
Cycle time TG	<20 s
Cycle time TU	<20 s
Cycle time TUG	<24 s
Rim width range	6''
Rim range	14-24'' (ETRTO)
Max load	1800 daN
Inflation	1 - 5,5 bar
Collapsed bead compensation	up to 2''
Harmonics analysis	up to 16-th harmonics
Measuring speed	60 rpm
Production capacity	up to 3000 tires/day (in TUG LOT mode)
Radial forces repeatability*	<3,5 N
Lateral forces repeatability*	<2 N
Conicity repeatability*	<2 N
Measuring load repeatability*	<20 N
Inflation accuracy*	<10 mBar
Inflation repeatability*	<20 mBar

* Reference tire: 205/55 R15, Load 500 daN, springrate 166 daN, measuring pressure 2 bar



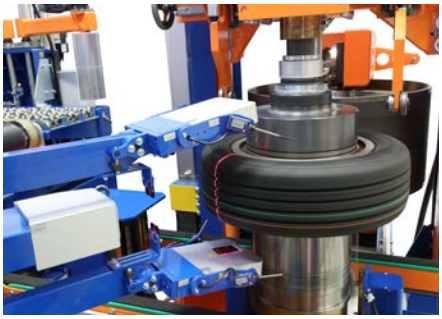






Tire spotting

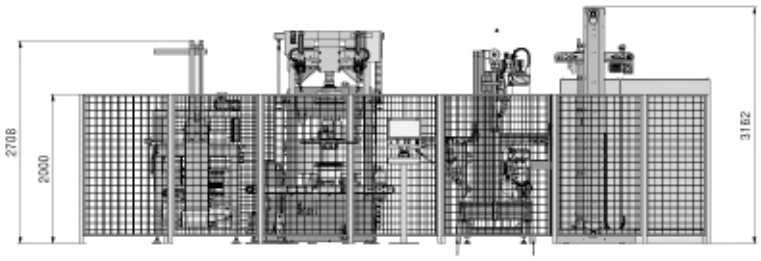
Uniformity measurement

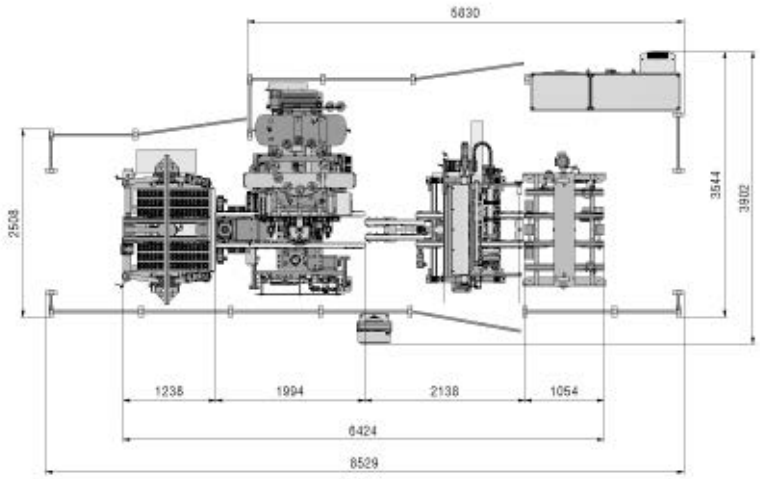


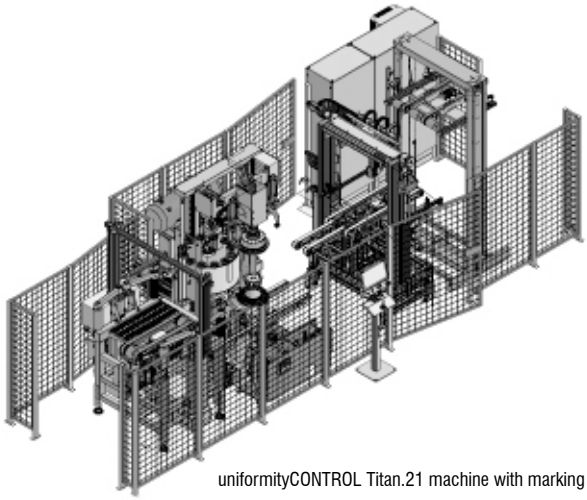
Geometry measurement

Tire	
Tire diameter	550 - 950 mm
Tire width	95 - 400 mm
Tire rim diameter	14” - 24” (ETRTO)
Tire rim width	5” - 14”
Weight	5 - 50 kg

Machine Characteristic	
Working dimension (W x L x H)	2802 mm x 1510 mm x 2847 mm
Transport dimension (W x L x H)	2802 mm x 1510 mm x 2142 mm
Weight	3700 kg
Electric supply	3x400V, 63 A
Electric power	5.5 kW
Air supply	6 - 10 bar, 2’’ (connection)
Average air consumption	0.768 m³/min
Radial and lateral run-out of (mounted) top and bottom rims	≤ 0.025 mm
Radial and lateral run-out of top / bottom spindle assembly (without rims)	≤ 0.008 / 0.013 mm
Spindle end play	0.020 < x < 0.050 mm







uniformityCONTROL Titan.21 machine with marking station and lift

Tire Geometry Inspection

dimensionCONTROL TGI 8302.PLT/TT

Application area in tire industry or tire wheel assembly:

- Bulge and dents measurement
- Radial and lateral runout measurement
- Automatic selection of the measuring range
- Optimized design for TU machines retrofit
- Applicable in various TU machines
- Reliable letter elimination
- Integrated system for tread monitoring

With the precise inspection of radial and axial runout, as well as bulges and constrictions on the tire, the dimensionCONTROL TGI 8302. PLT/TT series make an important contribution regarding quality during the production of the tire.

Compatible for various TG/TU types

Using customized laser line triangulation sensors, located on a solid and precisely positioned frame which ensures optimal reading of the sides and patterns, dimensionCONTROL TGI 8302.PLT/TT measures the size of defects (bulges, depressions) and evaluates the radial and lateral runout. The system processes displacement data in relationship to angular positions, detected by an encoder, to create a partial 3D model of the shell. It can eliminate imprinting, detect positions of defects and state the size. During the inspection of the runout, the system creates a harmonic analysis and applies filtrations for the suppression of high frequency noise.

The mechanical basis of dimensionCONTROL TGI 8302.PLT/TT is a C-frame where the upper and the lower sidewall sensor as well as the tread sensor are controlled according to the tire size due to fully automatic controlling methods. The actuators can be alternatively operated by servo or stepper motors. The controlling parameter can be written in a database.

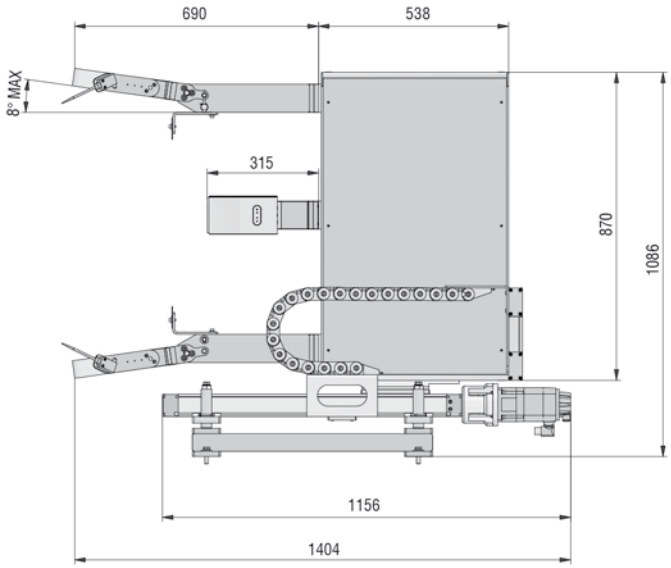
With the laser line triangulation sensors, optimized regarding packaging situation of the application, the system is compatible to be applied in various existing TU machines. Due to the special arrangement of optics, they have an excellent ratio of line length and measurement range to installation space.

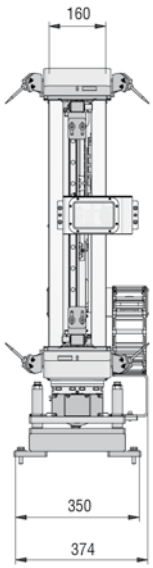
Visualization of sidewall inspection

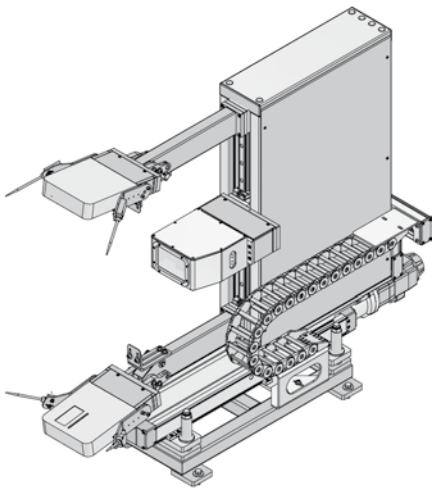
Integration to Tire Uniformity machine

Integration to Balancing machine

dimensionCONTROL TGI 8302	.PLT	.TT
Article no.	4350136,04	4350136,05
Area of use	Passanger and light truck tires	Truck tires
Tire tread width	min. 95 mm max. 400 mm	min. 135 mm max. 610 mm
Tire outside diameters	min. 500 mm max. 900 mm	min. 700 mm max. 1500 mm
Bead diameters	min. 13 inch max. 24 inch	min. 16 inch max. 24 inch
Tire rotation speed	max. 60 rpm	max. 60 rpm
Sensor technology	sheet-of-light sensors	sheet-of-light sensors
Sidewall measuring witdh in one rotation	max. 120 mm	max. 120 mm
Tread measuring witdh in one rotation	max. 350 mm	max. 600 mm
Measurement speed	2000 measurements / second	2000 measurements / second
Laser class sensors	3B	3B
Number of sensors	2 sidewall sensors 1 tread sensor	2 sidewall sensors max. 2 tread sensors
Repeatability (1σ)	< 0.02 mm	< 0.02 mm
Protection class	IP43	IP43
Ambient temperature	min. +15 °C max. +40 °C	min. +15 °C max. +40 °C
Relative air humidity	max. 75 % within the specified temperature range without condensation	max. 75 % within the specified temperature range without condensation
Machine interface	OPC UA	OPC UA







TGI 8302.PLT, dimension adaptation based on machines needs.

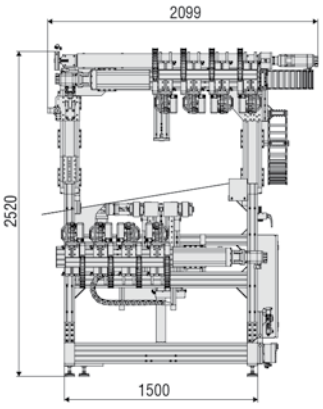
Tire Marking Station

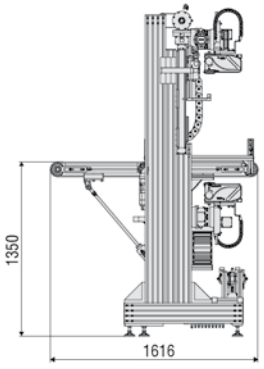
TMS

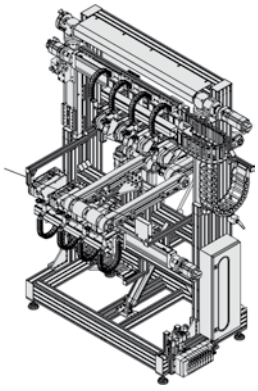
Tire Marking Station:

- PLT tires and truck tires
- Up to 4 marking heads for top sidewall
- Up to 4 marking heads for bottom sidewall
- Different types of marking technologies – Hot Stamp / LTA
- Different types of marking heads
- InkJet marking for top and bottom sidewall
- Marking quality inspection

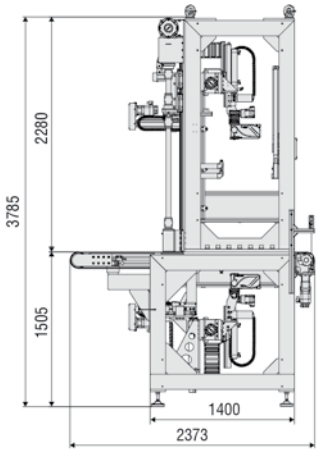
Tire marking station for PLT tires

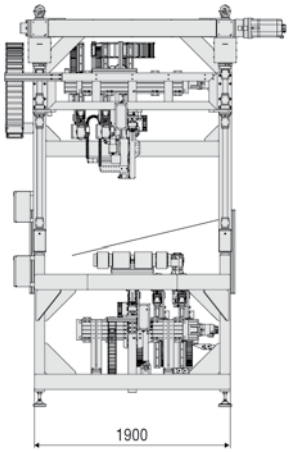


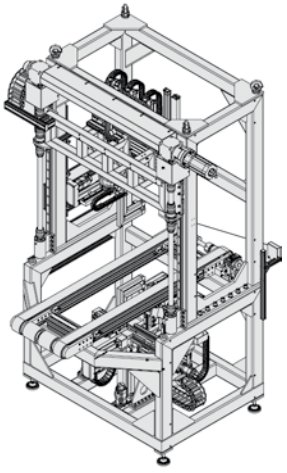




Tire marking station for truck tires







Marking stations for PLT tires

Type of machine	Integration to TU machine 3 top / 3 bottom	Integration to TU machine 4 top / 4 bottom
Movement horizontal axis	pneumatic cylinder option: electric axis (in case of further extension)	electric axis
Control system	Siemens / Rockwell	
Tire size	Tire width: 95 - 400 mm; tire outer-diameter: 550 - 900 mm; weight: 50 kg	
Cycle time	13 sec. / one mark; 18 sec. / double marking	
LTA markers	3 top / 3 bottom HpdSYSTEM mono, vario HpdSYSTEM TR or combination of moto, vario and TR	4 top / 4 bottom (max. 5 / 5) HpdSYSTEM mono, vario HpdSYSTEM TR or combination of moto, vario and TR
Inkjet markers	one top / one bottom (up to 3 inkjets)	
Camera vision system for sidewall (during tire movement)	80 x 80 mm inspection of marking area 900 x 80 mm inspection of whole sidewall	
Safety	Safety lock of movable top part during maintenance; self-holding system with pneumatic breaker for movable top part	

Marking stations for truck tires

Type of machine	Integration to TU machine 3 top / 3 bottom	Central marking station 4 top / 4 bottom
Movement horizontal axis	electric axis	
Control system	Siemens / Rockwell	
Tire size	Tire width: 184 - 660 mm; tire outer-diameter: 700 - 1500 mm; weight: 300 kg	
Cycle time	30 sec. / one mark; 35 sec. / double marking	
LTA markers	3 top / 3 bottom (max. 5 / 5) HpdSYSTEM mono, vario HpdSYSTEM TR or combination of moto, vario and TR	3 top / 3 bottom (max. 5 / 5) HpdSYSTEM mono, vario HpdSYSTEM TR or combination of moto, vario and TR
Inkjet markers	one top / one bottom (up to 3 inkjets)	
Camera vision system for sidewall (during tire movement)	80 x 80 mm inspection of marking area 900 x 80 mm inspection of whole sidewall	
Safety	Safety lock of movable top part during maintenance; self-holding system with pneumatic breaker for movable top part	
Included in delivery	Tire entrance marking station already in correct position for marking	Centering and spotting station; Datalogic / Sick barcode reader

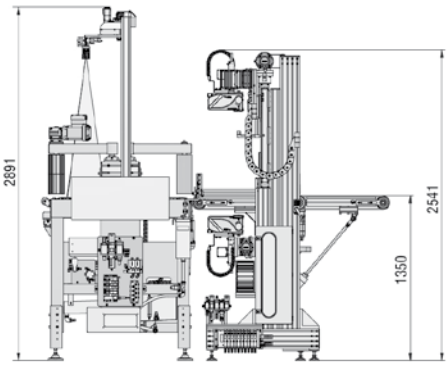
Please contact us in case of OEM marking station setup.

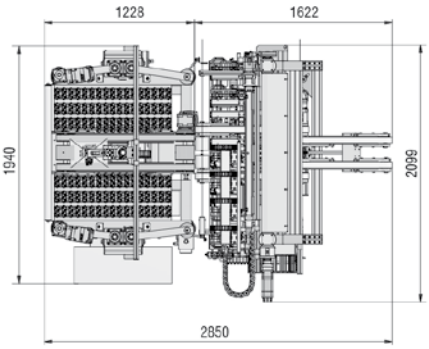
Central Marking System

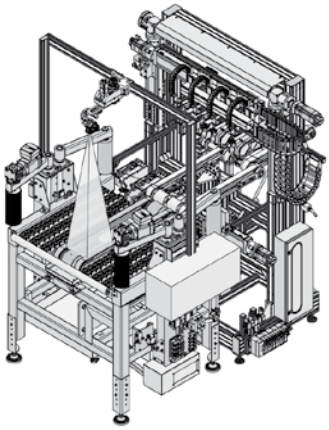
CMS

Tire Marking Station:

- PLT tires
- Up to 4 marking heads for top sidewall
- Up to 4 marking heads for bottom sidewall
- Different types of marking technologies – Hot Stamp / LTA
- Different types of marking heads
- InkJet marking for top and bottom sidewall
- Marking quality inspection





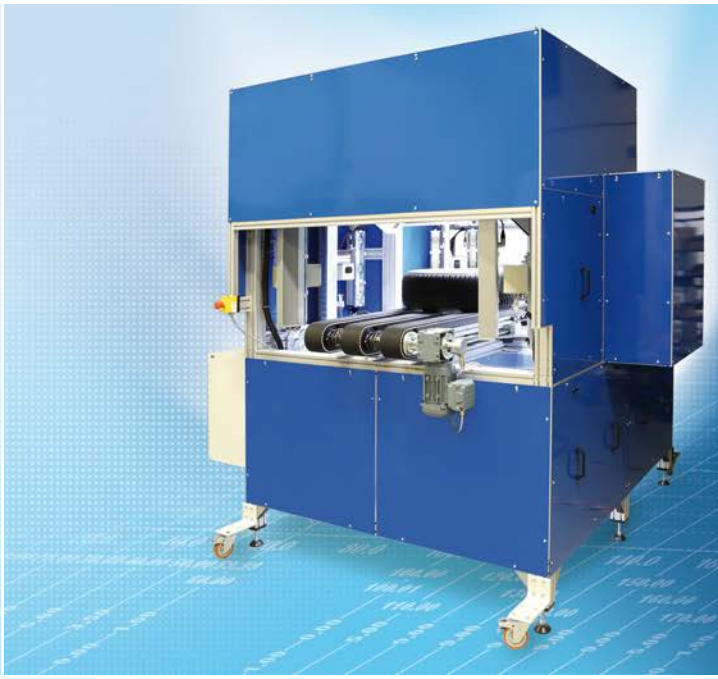


CMS Central Marking System	
Area of use	Passenger and light truck tires
Tire tread width	min. 95 mm max. 400 mm
Tire outside diameters	min. 500 mm max. 900 mm
Bead diameters	min. 13 inch max. 24 inch
Weight	up to 50 kg
Cycle time	14 sec. one mark / 18 sec. double marking
Marking technology	Label transfer application - LTA Hot stamp InkJet or combination of technology *
Protection class	IP43
Ambient temperature	min. +15 °C max. +40 °C
Relative air humidity	max. 75 % within the specified temperature range without condensation
Machine interface	OPC UA

* Marking station is designed for combination of marking technology like LTA / Hot Foil / InkJet in one station.
OEM solution up to request

Central Tire Mark Inspection

markingCONTROL TMI 8303.I



Installation possibilities:

- Central conveyor
- Directly after marking systems behind TG/TU

Inspection:

- Type of marks
- Geometry of marks
- Color of marks
- Quality of marks
- Marking diameter
- Reference angles

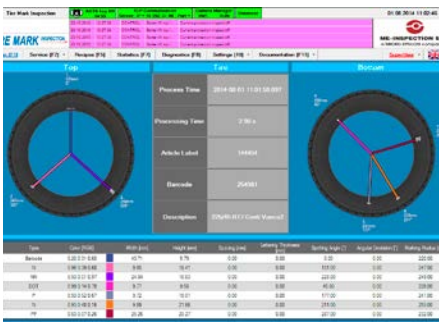
To complete quality assurance, markingCONTROL TMI 8303.I secures with efficient vision technology the documentation of the classification of tires or wheels displayed by marks on the sidewall.

Closed loop quality assurance

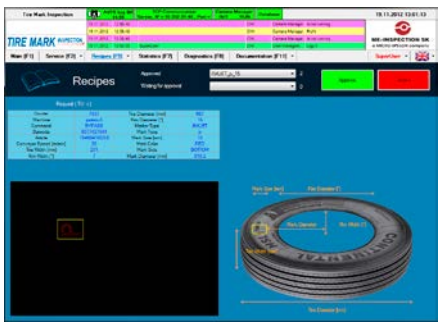
High-speed cameras are the central component of the markingCONTROL TMI 8303.I. They read the illuminated surface at the sidewall by analyzing the images in each instance.

The imprinting of the sides and reflections originating on the surface are eliminated. The detected marks are qualitatively evaluated ofdepending on type, physical dimensions, turning towards the barcode, deformation and color.

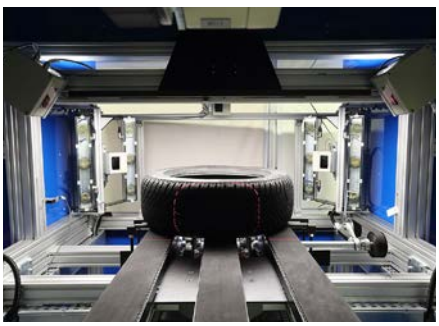
Checking even the quality of marks and showing the quality classification, the markingCONTROL TMI 8303.I closes the loop of a modern quality assurance.



Position and Classification of inspected Marks



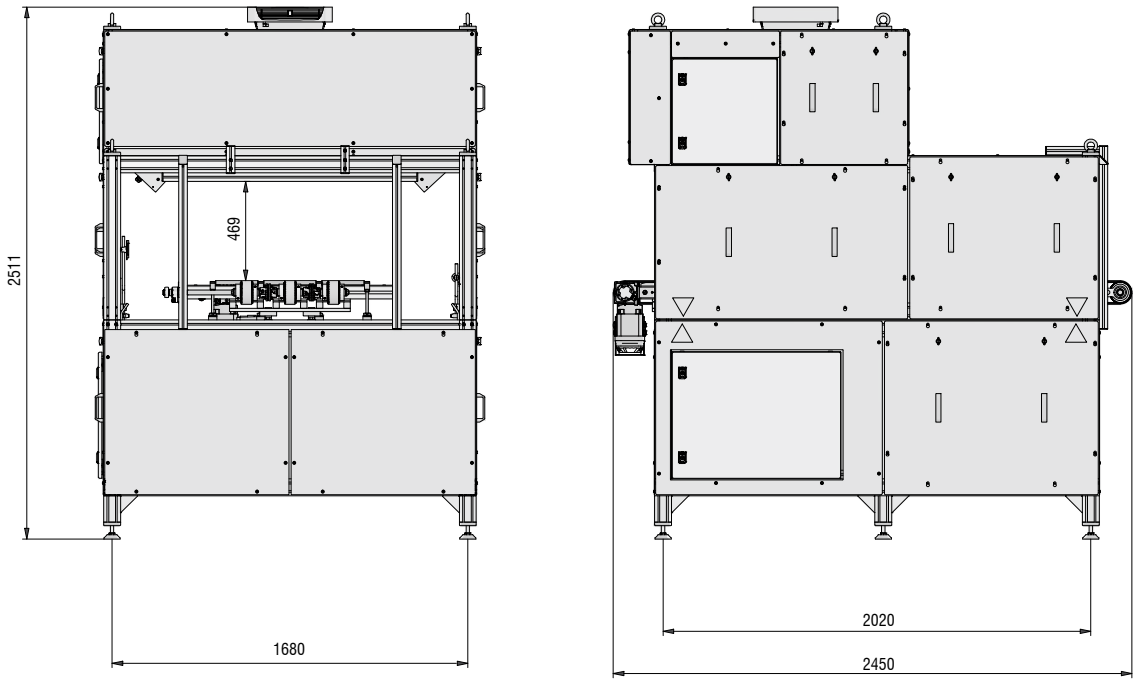
Recipe Editor



Visualization of SPC-Data

markingCONTROL TMI 8303.I	
Article no.	4350290,01
Area of use	Passenger and light truck tires
Tire tread width	min. 95 mm max. 400 mm
Tire outside diameters	min. 500 mm max. 900 mm
Bead diameters	min. 13 inch max. 24 inch
Tire movement	max. 30 m / sec.
Sensor technology	Cameras / Sheet-of-light sensor
System measuring range - Tire width parameter	min. 90 mm max. 405 mmm
System measuring range - Tire outside parameter	min. 500 mm max. 950 mm
Laser class sensors	3B
Mark / Label height repeatability (1σ)*	< 0.4 mm
Mark / Label width repeatability (1σ)*	< 0.4 mm
Marking radius repeatability (1σ)*	< 0.4 mm
Spotting angle repeatability (1σ)*	< 1 o
Fill rate repeatability (1σ)	< 1 %
Type of marks	LTA, HotStamp Premium, Labels, InkJet
Protection class	IP43
Ambient temperature	min. +15 °C max. +40 °C
Relative air humidity	max. 75 % within the specified temperature range without condensation
Machine interface	OPC UA

* Repeatability test realized with not damaged marks.



Retrofit Tire Geometry Line

RTG

Retrofit includes:

- Mechanical retrofit
- Electrical retrofit
- Control&Drive retrofit
- New software for control of line and visualization
- Integration of TGI 8302.PLT
- Integration of tread color inspection
- Delivery of new lubber station
- Delivery of feeding device station
- Delivery of conveyors
- Delivery of marking station
- Delivery of sorter / lift
- Delivery of computer controlled inflation system

Bringing old TG lines to the state of the art regarding precision and collection of shop floor data with a retrofit of the measuring technology, is an excellent opportunity to optimize the tire production and cost.

Precision by sheet of line technology

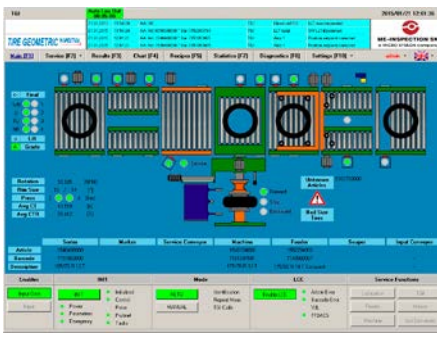
The retrofit of TG lines consists in the replacement of electric and pneumatic components including the dimensionCONTROL TGI 8302.PLT measuring system.

A new control system ensures the stable operation of the whole line, as well as the proper communication with the other components (conveyors, master systems for control and collection of data). The dimensionCONTROL TGI 8302.PLT/T measuring system ensures the measurement of the size of defects (bulges, depressions) and the evaluation of the value of the radial and lateral runout with the use of laser line sensors. It's characteristics can be seen on the previous pages.

Possible control systems:

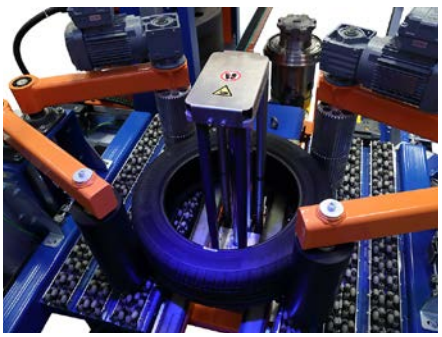
SIEMENS

Rockwell Automation



Process visualization

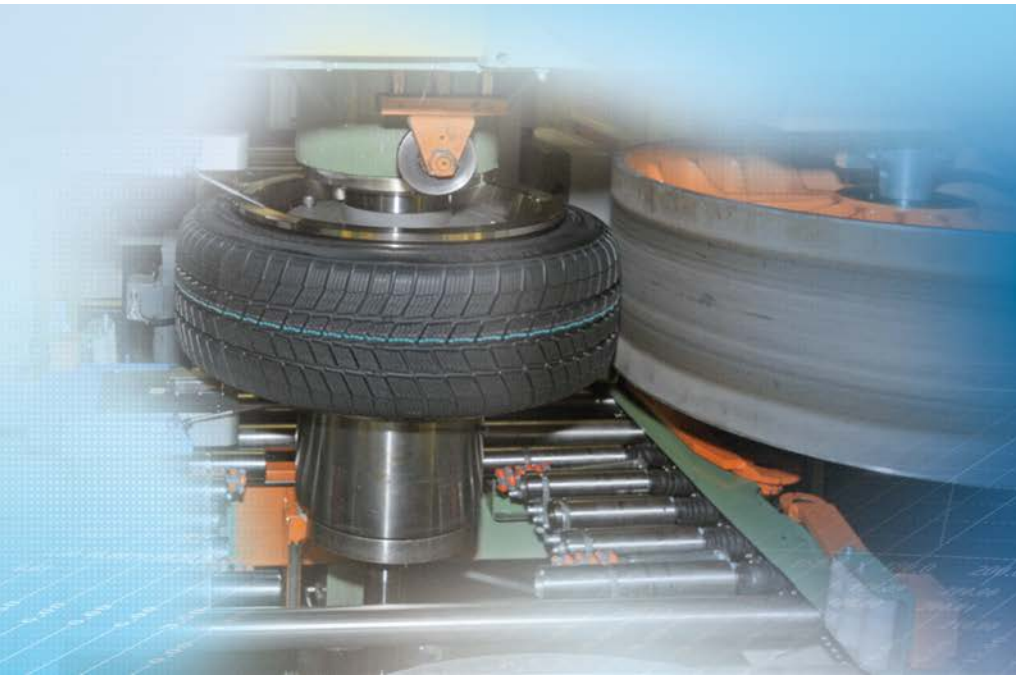
Geometry inspection



Lubber station

Retrofit of Tire Uniformity Line

RTU



Application area in tire industry or tire wheel assembly:

- Bulge and dent measurement
- Radial and lateral runout measurement
- Automatic selection of the measuring range
- New software for control of line and visualization
- Optimized design for TU machines retrofit
- Applicable in various TU machines
- Reliable letter elimination
- Integrated system for tread monitoring

One of the most cost-effective ways for increasing productivity is upgrading an existing TU line with a new control system including a comprehensive interface to the measuring system.

Precision by elimination of parasitic influences

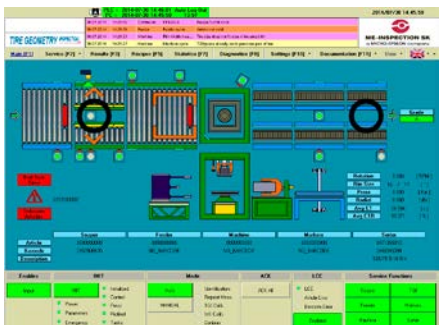
The reconstruction of TU lines is composed of replacing electric and pneumatic components as well as the measuring system for detecting the tensiometric forces. Coming up with an efficient control system the reliability of the whole line is ensured. Also the communication with other parts such as conveyors, master systems for control and collection of data is performed by this renewed system. The measuring system, recording the values of radial and lateral forces - absolute values, peak - peak values, harmonic analysis and calculating conicity and plysteer, is calibrated by a set of certified ballasts.

The consequent elimination of various external influences such as compensation of electric noise on analog inputs, compensating real nominal down pressure and pressure variations during measurement distinguishes the retrofitted line. Monitoring of the parameters influence the overall class of the shell on the basis of which the shell is marked or classified at the end of the line.

Possible control systems:

SIEMENS

Rockwell Automation



Process visualization

Marking station:
- Up to 4 marker heads on top
- Up to 4 marker heads on bottom
- Mark quality inspection for sidewalls

Retrofit of Balancing Line

RTB

Application area in tire industry or tire wheel assembly:

- Mechanical retrofit
- Electrical retrofit
- Control&Drive retrofit
- New software for control of line and visualization
- New PC based software for balancing measurement
- Integration of TGI 8302.T

The renewing of the measurement technology of a balancing line is an investment with an outstanding cost to service relationship to provide new evidence about the production

New performance until the marking

For the revision of the balancing lines new electric and pneumatic components are installed together with an up-to-date measuring system for reading the forces. Another important module is a new control system, which runs the whole line and coordinates the communication of the single subsystems. The static imbalance and the dynamic imbalance are measured in two areas.

Due to fact, that the monitored characteristics have a significant influence on the tire quality, a quality classification based on the results of the inspection is carried out. The tire is marked in accordance with the above-mentioned quality classification at the end of line or in the central marking station. These items are also part of the machine retrofit, beside the possibility to install a new marking station.

Possible control systems:

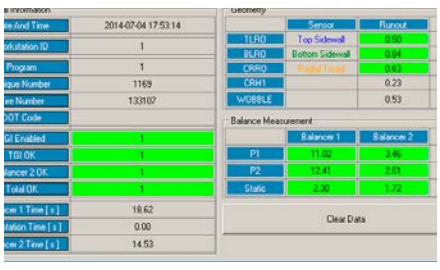
SIEMENS

BECKHOFF

Rockwell Automation

Graphical display of the result

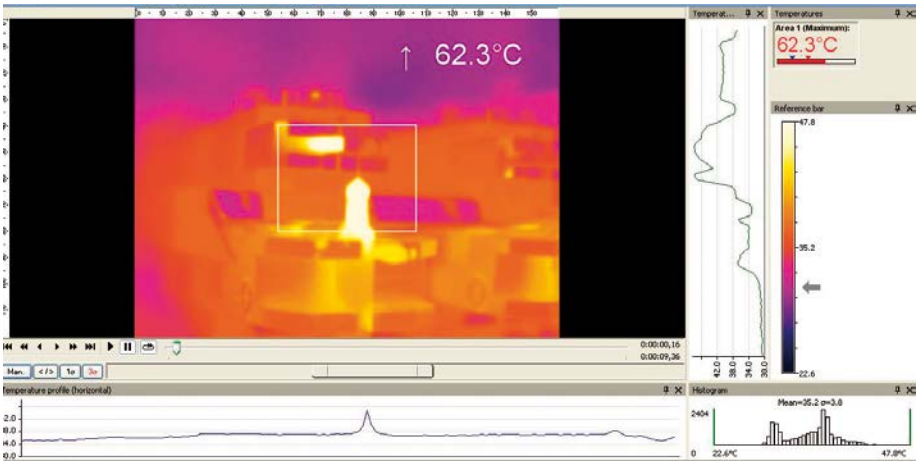
Process visualization



Result in table form

Micro-Epsilon
in the rubber and tire industry

Temperature measurement in the rubber and tire industry
Micro-Epsilon offers a wide range of infrared thermometers, pyrometers and ratiometric pyrometers as well as IR cameras which allow you to precisely measure the temperature of the object temperature.



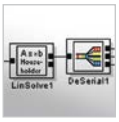
Micro-Epsilon has been a reliable industrial partner for more than 40 years for precision measurement technology applied in inspection, monitoring and automation. Systems and components from Micro-Epsilon are used in the rubber and tire industry in order to develop efficient production.

The medium sized company employs approx. 800 people throughout the world and provides Europe's most comprehensive range of measuring technology for measuring thickness, width, profile and surface – however also temperature, length and speed, for measuring vibration, impact, gap and many other factors.

As components, they are often indispensable integral parts in the products of many machine and line constructors and electrical equipment suppliers worldwide.

Furthermore, the company, specialized in measurement technology, is also known for unconventional solutions where requirements have to be strictly observed in processing lines. Solutions are devised in the shortest time and matched on site.

Sensors:
worldwide market and proven sensors as base of the systems, with the possibility for adaptation increasing the precision



Software:
graphical software development environment guarantees group wide synergetic development

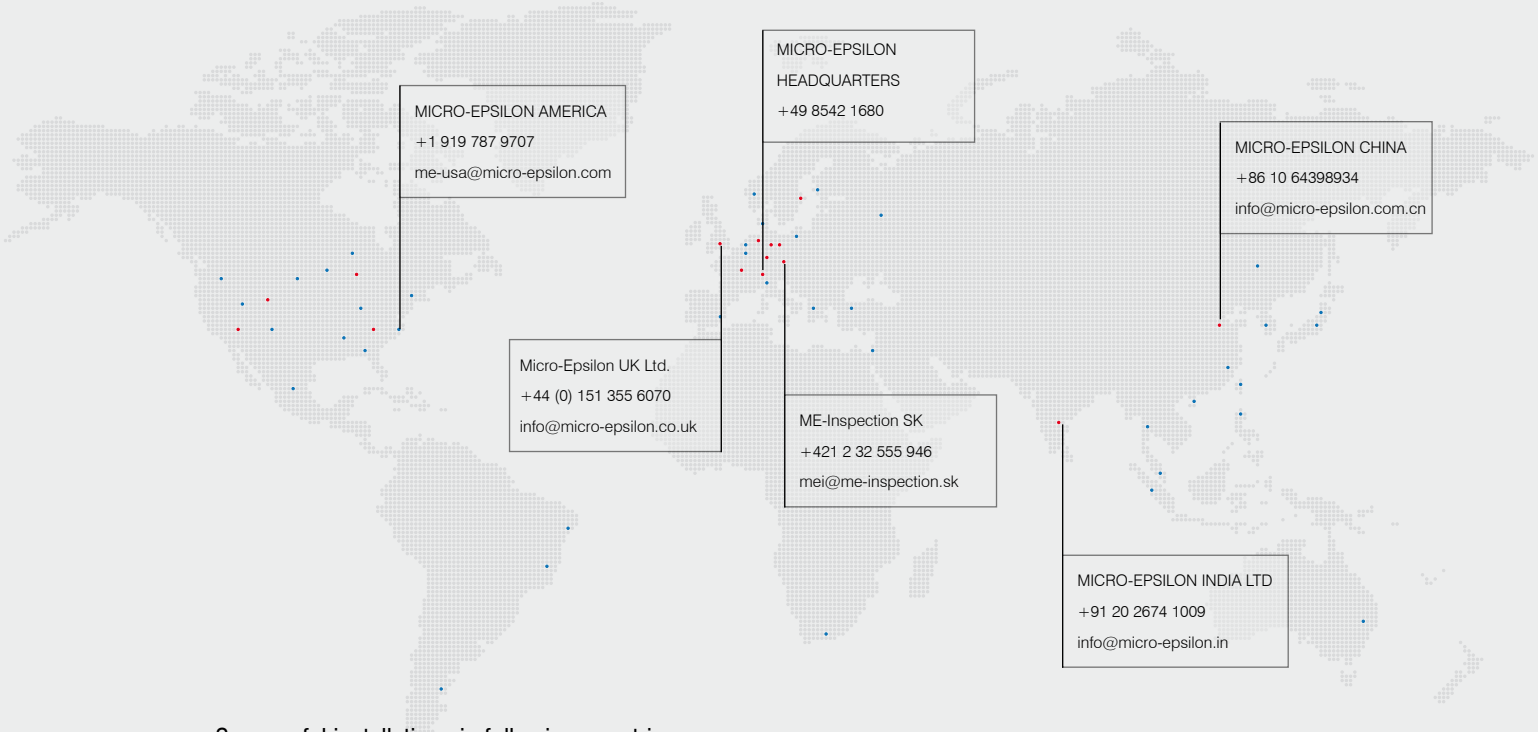
Mechanics:
high quality mechanical design, mechanical manufacturing and assembly

Machinery:
for tire industry, tire wheel assembly and automotive

Automation:
electrical design, PLC programing and assembly

Service:
technical support 7days 24hours

Your local support



Successful installations in following countries

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