



MICRO-EPSILON

Inspection Systems for the Tire Industry



MICRO-EPSILON SYSTEM DIVISION



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 inside the company group provides unique innovative skills which are mirrored in the product portfolio of Micro Epsilon.

References (extract)



RODOLFO COMERIO



KraussMaffei
Berstorff



EXCELLENCE IN EXTRUSION.



Overview Preparation Area



Tire Component Profilometer
thicknessCONTROL TCP 7303.ET
Page 4 - 5



Tire Component Profilometer
thicknessCONTROL TCP 8301.CT/CLLT
Page 16 - 17



Tire Width Inspection
dimensionCONTROL TWI 7303.I
Page 6 - 7



Tire Component Profilometer
thicknessCONTROL TCP 8301.I
Page 18 - 19



On-Roll Profile Thickness Measurement
thicknessCONTROL TCP 8303.ET
Page 8 - 9



Tire Color Inspection
dimensionCONTROL TCI 8303.I
Page 20 - 21



Tire Component Profilometer
thicknessCONTROL TCP 8302.T/LLT
Page 10 - 11



Tire Length Inspection
dimensionCONTROL TLI 8303.I
Page 22 - 23



Tire Component Offline Profilometer
thicknessCONTROL TCP 8302.T-Offline
Page 12 - 13



Tire Piece Weight Inspection
dimensionCONTROL TWI 8302.C.TT
Page 24 - 25



Tire Component Profilometer
thicknessCONTROL TCP 8301.EO
Page 14 - 15

Tire Component Profilometer

thicknessCONTROL TCP 7303.ET



Installation sites & possible applications

Thickness measurement in

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

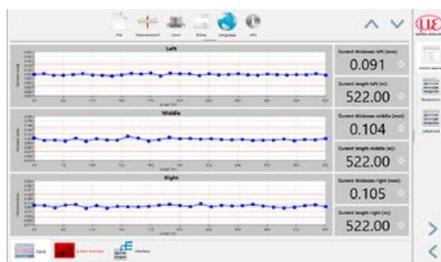
Realized as a gantry, thicknessCONTROL is a cost-effective and precise way to measure the thickness in a fixed position in form of a length profile inside tire component lines.

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

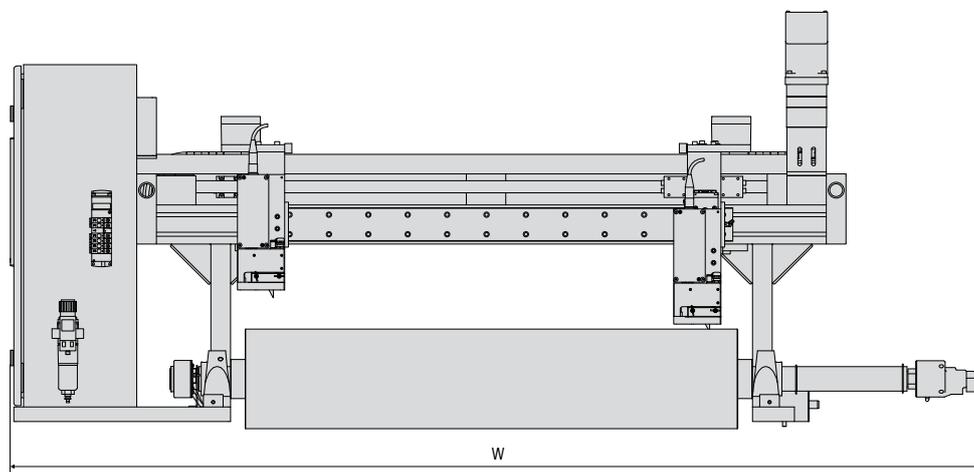
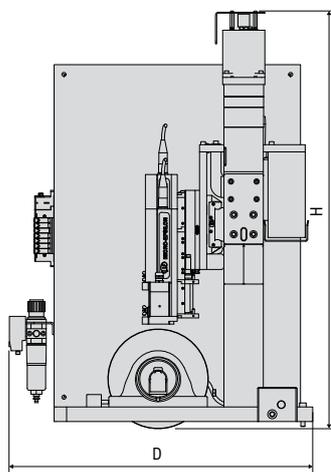


combiSENSOR of thicknessCONTROL TCP 7303.ET

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	700mm		
Threading range	80mm		
Operating range	10mm		
Measuring range	8mm		
Resolution	2 μ m		
Accuracy	\pm 0.01mm		
Roller diameter	\geq 200mm		
Band angle	> 60°		
Sampling rate	2.5kHz		
Weight	approx. 100kg 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 stipulated temperature range without condensation		

*3 sigma



Tire Width Inspection

dimensionCONTROL TWI 7303.I



Installation sites & possible applications

Width measurement in

- extrusion lines for treads and sidewalls

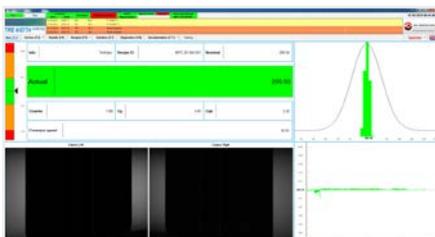
Tire Width Inspection dimensionCONTROL TWI 7303.I is designed for profile width measurement in extrusion lines.

This measurement 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.

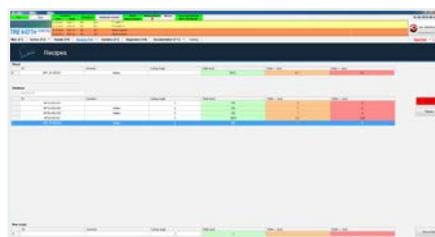
The main advantage of stereo vision technology is a precise measurement in harsh environmental conditions (e.g. vibrations, unpredictable material movements on conveyor in material flow direction, in vertical directions or even combined).

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



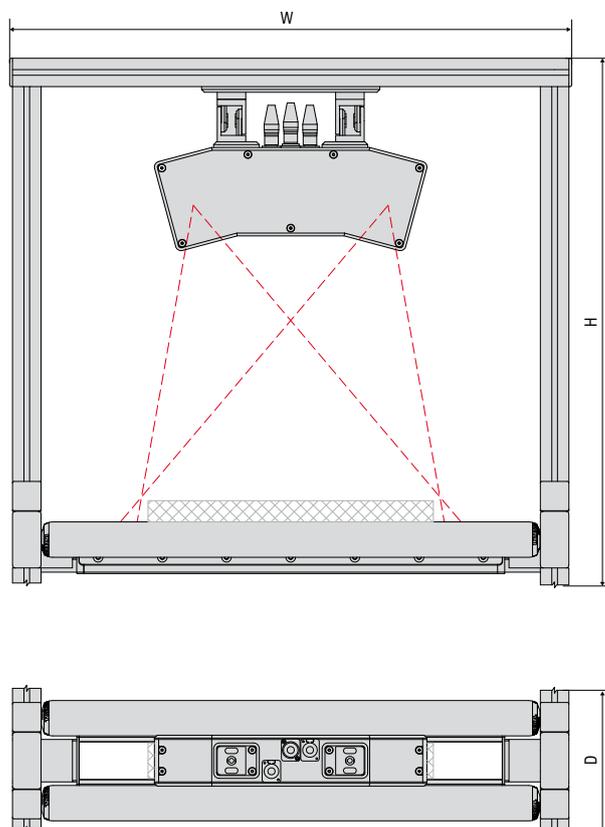
Statistics

dimensionCONTROL TWI 7303.I

Description (no. of tracks)	-350	-450	-550
Article No.	4380001.01	4380001.02	4380001.03
Measuring width	350mm	450mm	550mm
Measuring range**	370 x 100	470 x 100	570 x 100
Resolution	10 μ m	15 μ m	20 μ m
Accuracy*	\pm 50 μ m	\pm 65 μ m	\pm 80 μ m
Number of cameras	2		
Sampling rate	50Hz		
Weight	approx. 100kg 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 stipulated temperature range without condensation		

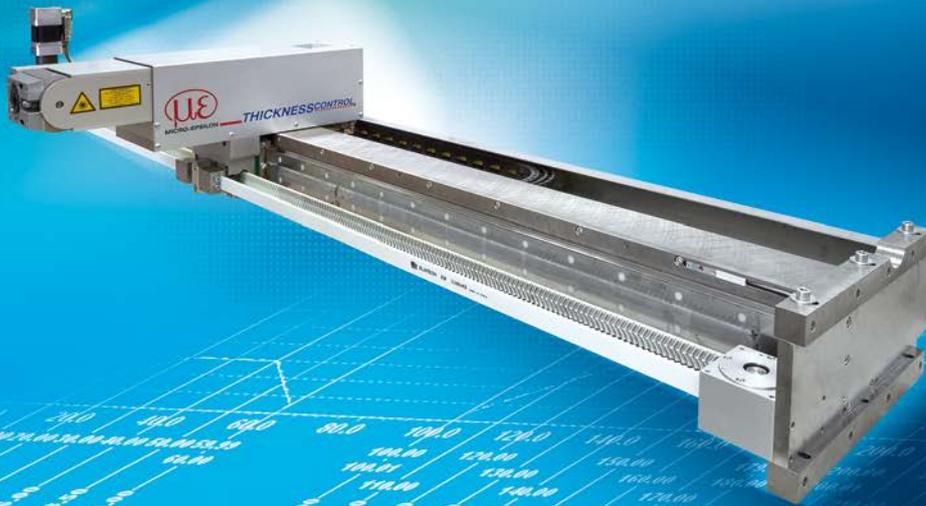
*3 sigma

**(size of scanned image W x D) in mm



On-Roll Profile Thickness Measurement

thicknessCONTROL TCP 8303.ET



Installation sites & possible applications

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 adaptations 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 later

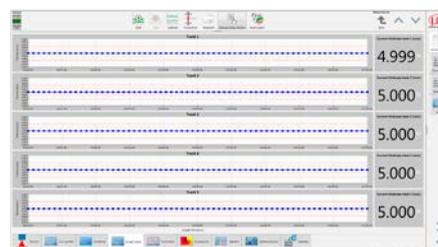
direction and in angular position. Additional sensors integrated in the head continuously control the rollers' position and ensure electro-mechanical readjustment

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

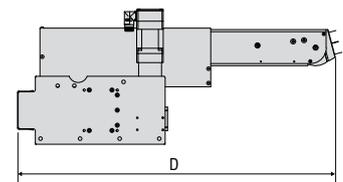
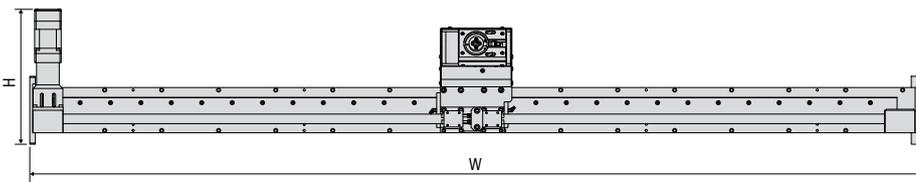


Sensor in measuring position in calender

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	1400mm	1800mm	2200mm	1400mm	1800mm	2200mm
Threading range	486mm					
Operating range	13mm			30mm		
Measuring range	10mm			20mm		
Resolution	0.3 μ m			0.5 μ m		
Accuracy*	\pm 5 μ m			\pm 10 μ m		
Sampling rate	4kHz					
Weight	approx. 150kg 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 stipulated temperature range without condensation					

*3 sigma



Tire Component Profilometer

thicknessCONTROL TCP 8302.T/LLT



Installation sites & possible applications

Thickness profile measurement in

- Banding lines
- Small extrusion lines

Thickness measurement of squeeze in inner liner applications

The modularly designed, C-frame based systems of the thicknessCONTROL TCP 8302 series convinced 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

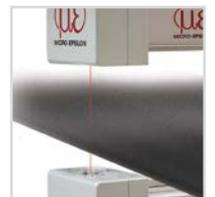
In the upper and lower flange of the C-frame, either laser triangulation point (ILD) or laser triangulation line (LLT) sensors are integrated. The result, showing the profile of the target material is calculated with the difference of the added amount of the sensor signals and the calibrated working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

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.

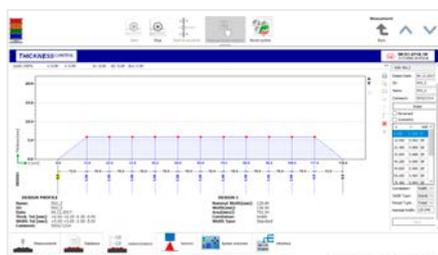
Using integrated laser line sensors, generating a high data volume of 128.000 data points per second, the thicknessCONTROL TCP 8302.LLT offers a unique range of solvable applications regarding profile thickness measurement in the tire industry.



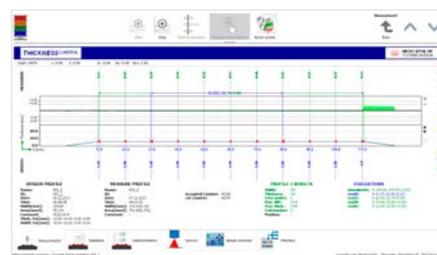
TCP8302.LLT
Laserline triangulation



TCP8302.T
Laser triangulation



Profile editor



Profile view



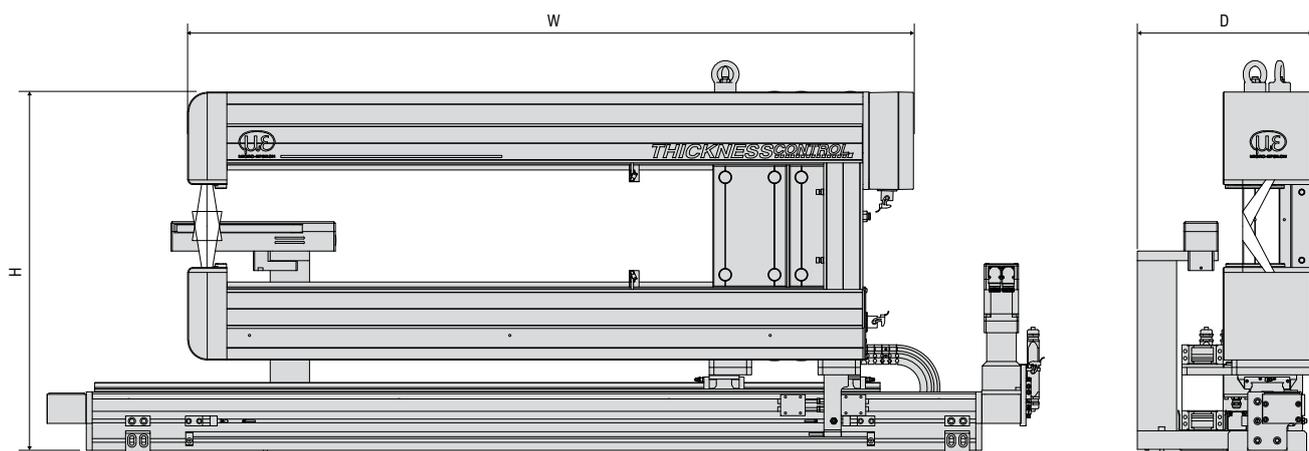
C-frame profilometer in production environment

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	500mm		800mm		500mm		800mm	
Operating range	70mm	156mm	70mm	156mm	190mm	420mm	190mm	420mm
Measuring range	20mm	50mm	20mm	50mm	60mm	100mm	60mm	100mm
Resolution	0.45 μ m	1.1 μ m	0.45 μ m	1.1 μ m	1 μ m	2 μ m	1 μ m	2 μ m
Accuracy*	\pm 4 μ m	\pm 10 μ m	\pm 4 μ m	\pm 10 μ m	\pm 3 μ m	\pm 7.5 μ m	\pm 3 μ m	\pm 7.5 μ m
Sampling rate	20kHz				128kHz			
Weight	approx. 80kg 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 stipulated temperature range without condensation							

*3 sigma

** width without linear axis



Tire Component Offline Profilometer

thicknessCONTROL TCP 8302.T-Offline



Installation sites & possible applications

Thickness and width profile measurement in

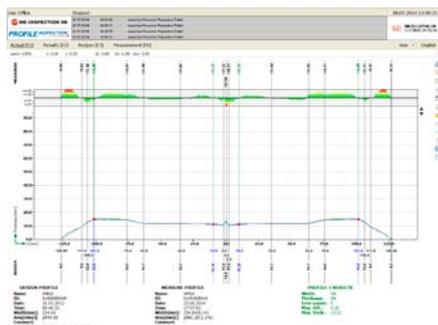
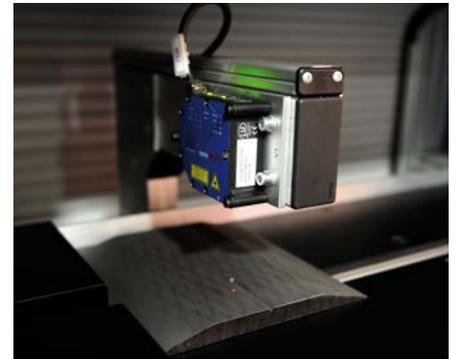
- Extrusion lines
- Innerliner calender
- Ply calender
- Steel cord calender
- Textile or Fabric cord calender

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.

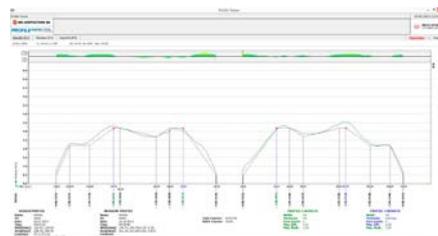
Improving quality control

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 measurement 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

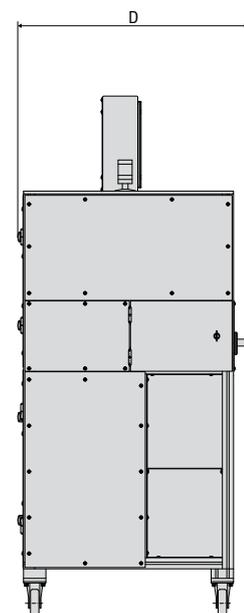
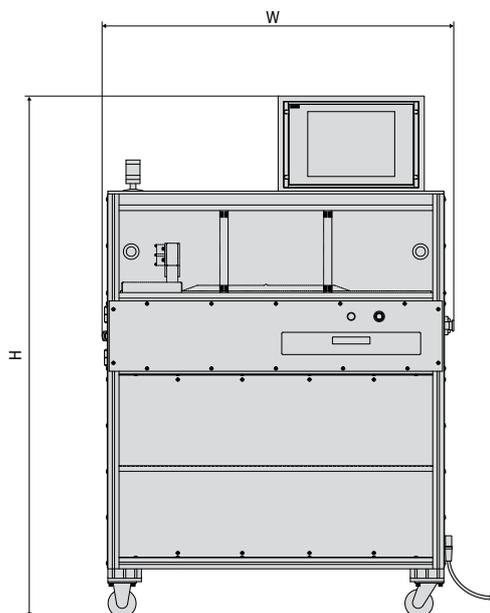


Recipe editor

thicknessCONTROL TCP 8302.T-Offline

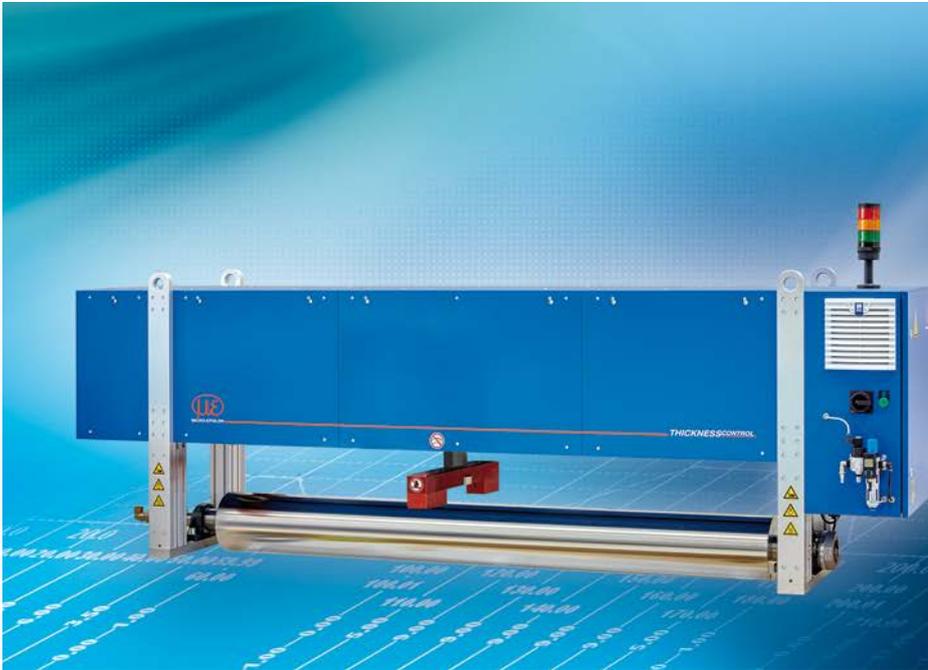
Description	-10/600	-10/800	-10/1000
Article No.	4350142.01	4350142.02	4350142.03
Measuring width	580mm	780mm	980mm
Measuring range	50mm		
Resolution	width	$\pm 10\mu\text{m}$	
	thickness	$\pm 1\mu\text{m}$	
Accuracy*	width	$\pm 50\mu\text{m}$	
	thickness	$\pm 10\mu\text{m}$	
Sampling rate	20kHz		
Traversing speed	600mm/min		
Weight	approx. 400kg packaging included	approx. 450kg 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 stipulated temperature range without condensation		

*3 sigma



Tire Component Profilometer

thicknessCONTROL TCP 8301.EO



Installation sites & possible applications

Thickness profile measurement in:

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

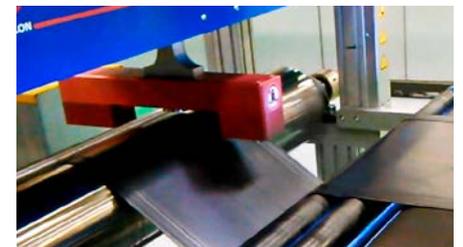
The thicknessCONTROL TCP 8301.EO family is manufactured as O-frame and significantly impresses by large material width and stability as well as high precision during thickness profile measurements.

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 whereat 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



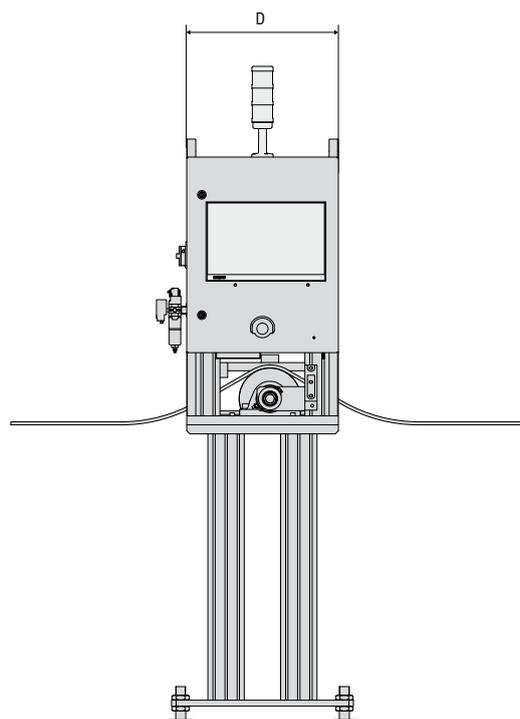
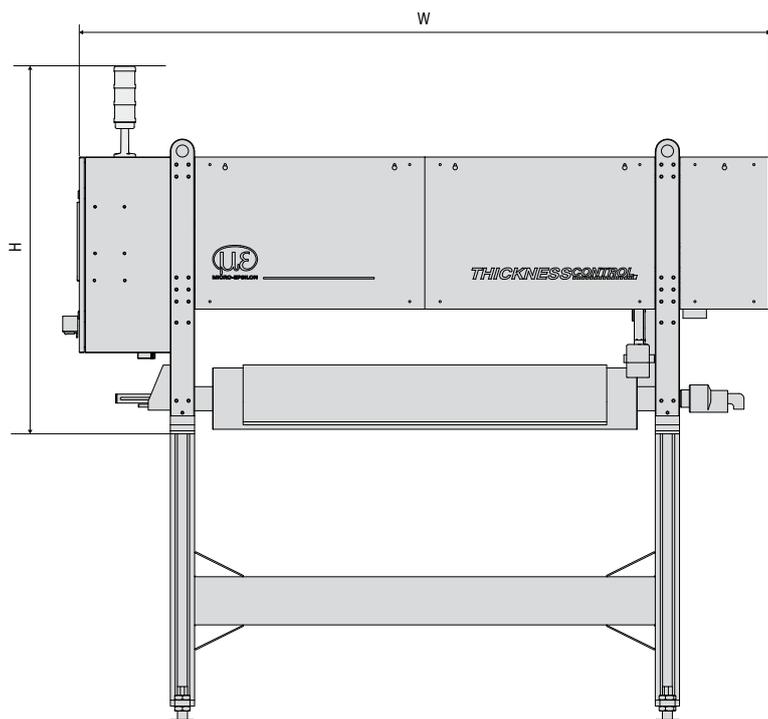
Thickness measurement with TCP 8301.EO

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	1000mm	1500mm	2000m	2500mm	1000mm	1500mm	2000m	2500mm
Threading range	100mm							
Operating range	12mm				21mm			
Measuring range	10mm				20mm			
Resolution	2 μ m							
Accuracy*	$\pm 1\mu$ m				$\pm 3\mu$ m			
Roller diameter	≥ 200 mm							
Band angle	$> 60^\circ$							
Sampling rate	4kHz							
Traversing speed	6000 to 40000mm/min							
Weight	approx. 80kg packaging included							
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	$+15^\circ\text{C}$ up to $+40^\circ\text{C}$							
Relative air humidity	max. 75% within the stipulated temperature range without condensation							

*3 sigma

**height without base frame



Tire Component Profilometer

thicknessCONTROL TCP 8301.CT/CLLT



Installation sites & possible applications

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.

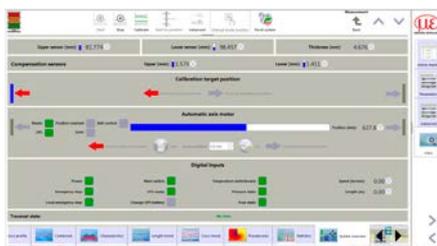
Furthermore, they offer efficient operation facilities due to large maintenance-free intervals. Thanks to integrated in-situ calibrations which do not vary with temperature, they can be also applied under harsh climate environmental conditions e.g. in the rubber processing industry.

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.



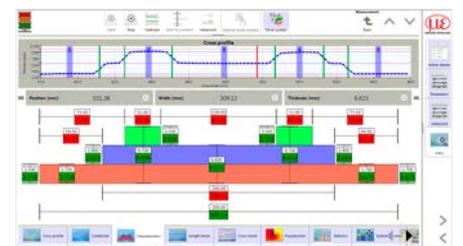
Thickness measurement with TCP 8301.CT



Overview of sensors and actuators



Combined cross profile and average longitudinal profile



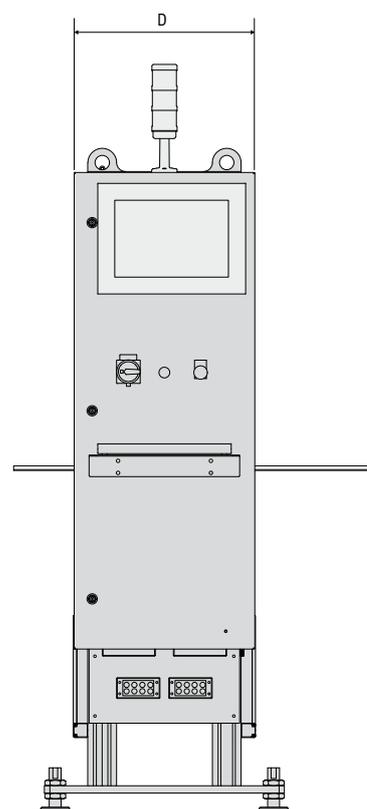
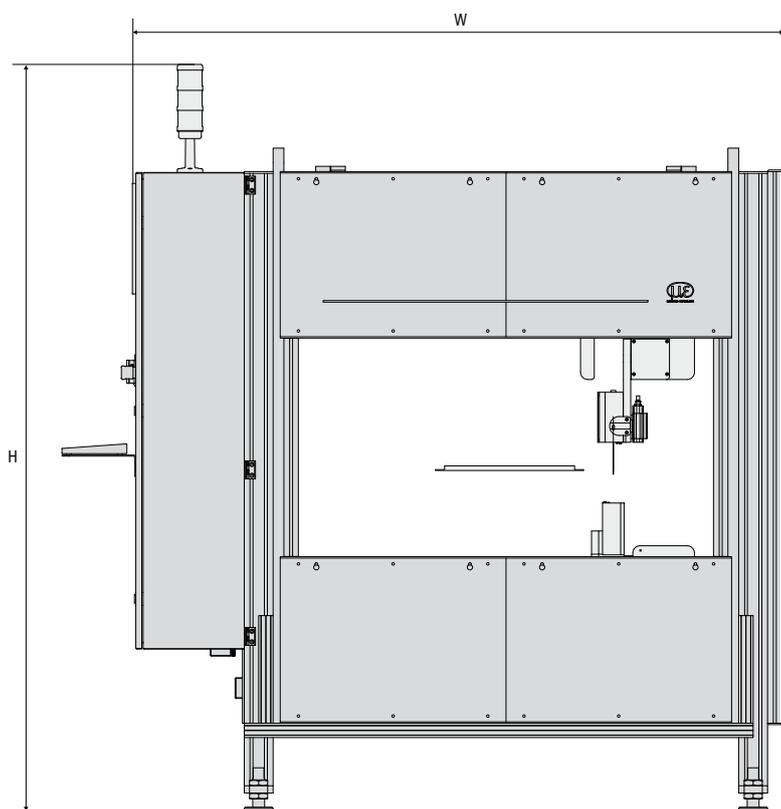
Cross profile and display for special features

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	700mm	1200mm	1700mm	2200mm	700mm	1200mm	1700mm	2200mm
Threading range	400mm							
Operating range	169.5mm				179mm			
Measuring range	50mm				75mm**			
Resolution	thickness				1 μ m			
	width				10 μ m			
Accuracy*	thickness				$\pm 5\mu$ m			
	width				$\pm 50\mu$ m			
Sampling rate	20kHz				128kHz			
Traversing speed	6000 to 40000mm/min							
Weight	approx. 600kg 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 stipulated temperature range without condensation							

*3 sigma

**minimum material thickness 15mm



Tire Component Profilometer

thicknessCONTROL TCP 8301.I



Installation sites & possible applications

Thickness and width profile measurement in

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

The non-traversing profilometers of the thicknessCONTROL TCP 8301.I series entuse 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.

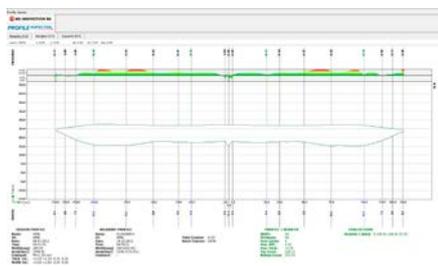
The measurement system contains fully automated integrated calibrations. The patented process of the calibration takes approximately 5 minutes.

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

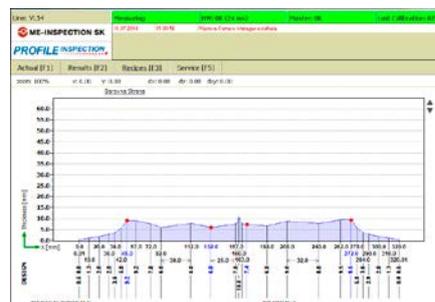
Prepared for additional integration of the length inspection dimensionCONTROL TLI 8303.I and the dimensionCONTROL TPI 8302.C.TT, the profilometer is the efficient base for a complete quality control of an extrusion line.



Integration:
PWI 8302.C-TT
TLI 8303.I
TCP 8301.I



Profile shape mode



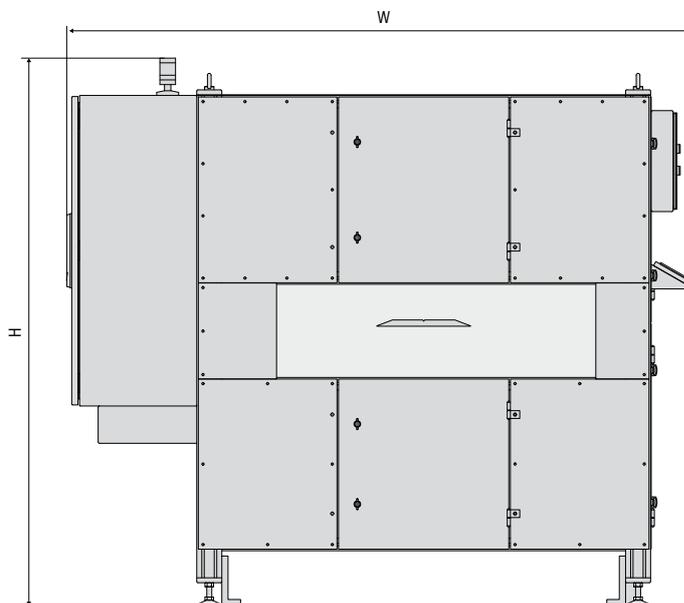
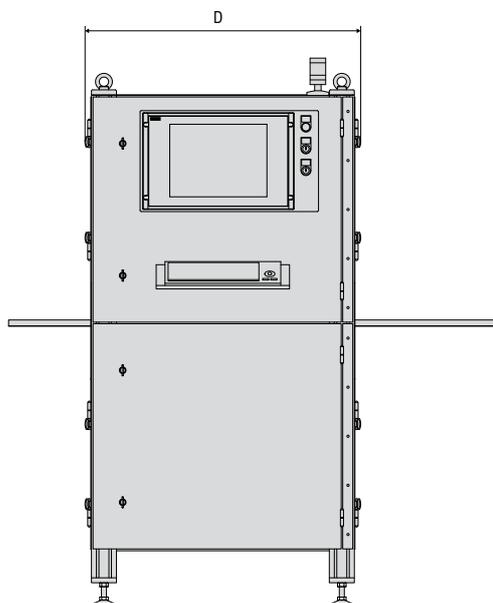
Cross profile

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	170mm	350mm	450mm	550mm	550mm	750mm	860mm	1220mm	
Measuring range	20mm	40mm			50mm				
Resolution	thickness	1 μ m							
	width	10 μ m			20 μ m				
Accuracy*	thickness	±12 μ m			±20 μ m				
	width	±100 μ m	±150 μ m			±200 μ m			
Sampling rate	40Hz**								
Max. material tilt	≤50°								
Weight	500kg to 700kg (without packaging)								
Dimensions (W x D x H) in mm	1600x800x1650	1600x800x1650	1800x800x1650	2000x800x1650	2000x800x1650	2300x800x1650	2400x800x1650	2500x800x1650	
Protection class	IP42								
Ambient temperature	+15°C up to +40°C								
Relative air humidity	max. 75% within the stipulated temperature range without condensation								

*3 sigma

**profiles per second



Tire Color Inspection

dimensionCONTROL TCI 8303.I



Installation sites & possible applications

Color coding, color code inspection, width measurement in
 - Extrusion lines for sidewall or tread

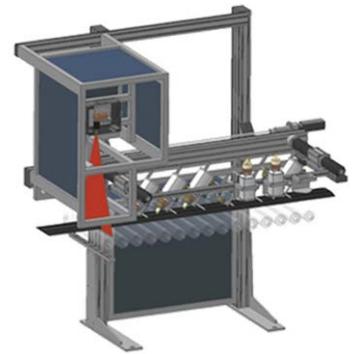
The Tire Color Inspection dimensionCONTROL TCI 8303.I provides fully equipped color coding, color code inspection and width inspection of extruded tread, and therefore represents a powerful component of a modern extrusion line.

Reducing waste

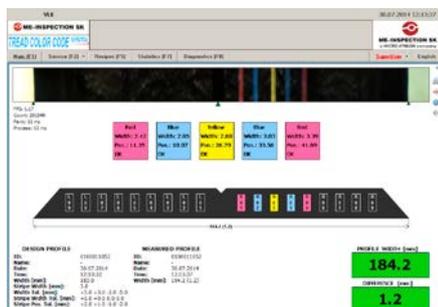
The basic model of dimensionCONTROL TCI 8303.I has been designed for inspection of color code applied on running profiles behind the extruder. Due to the fact that the correct width position of the color code has to be checked, the system measures also the complete width of the tread. The inspection is implemented as vision system, containing one color camera and two surface light sources. The measurement is continuous; position and width of respective colors are calculated as an average value in one image.

The system detects overflow or interruption of color strips and incorrect colors on defined positions. It is covered as much as possible in order to resist harsh environments especially behind the extruder head.

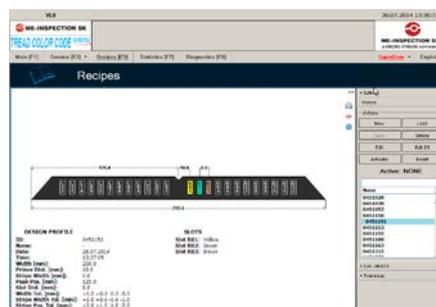
Beside the inspection, two different upgrades of dimensionCONTROL TCI 8303.I are available enabling an automatic color application. In the first version the single color tracks have a fixed distance to each other and a whole frame is controlled in relationship to the edge of profile. In the enhanced version every color track is controlled separately with an own motion control. The performance of the system reduces the waste material dramatically, compared to manual adjustment of tracks during recipe changings or while starting the extrusion line.



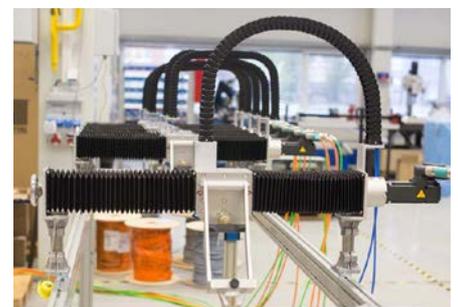
Principle of measurement



Visualization of inspected color code



Recipe editor



Multi axis positioning system

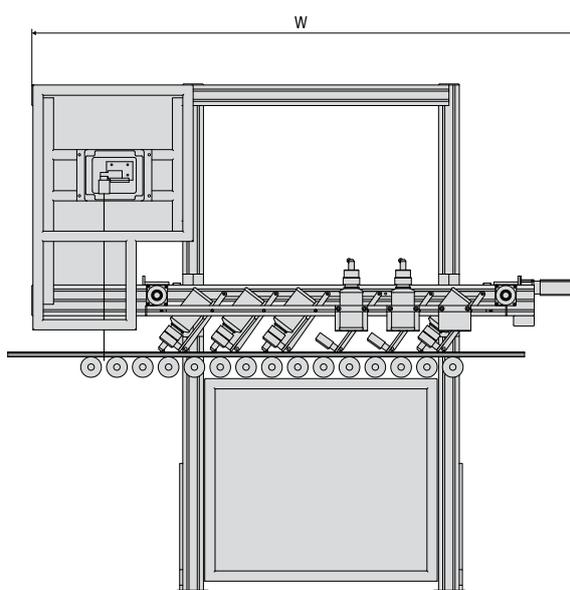
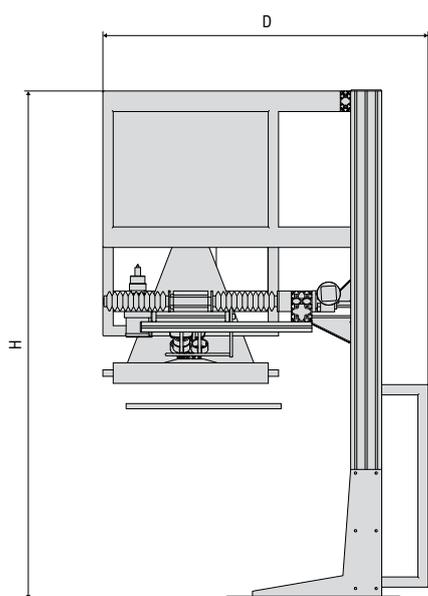
dimensionCONTROL TCI 8303.I

Description	-350	-550
Article No.	4350148.01	4350148.01
Measuring width	350mm	550mm
Measuring range **	400mm x 135mm	600mm x 135mm
Resolution	100 μ m	
Accuracy*	$\pm 150\mu$ m	
Sampling rate***	20Hz***	
Max. material speed	40000mm/min	
Minimum width of color detected	1mm	
Number of color bottles	6	
Stroke of electrical axis	± 200 mm from middle of conveyor	
Weight	400kg (without packaging)	
Dimensions (W x D x H) in mm	1400 x 1400 x 1800	
Protection class	IP42	
Ambient temperature	+15°C up to +40°C	
Relative air humidity	max. 75% within the stipulated temperature range without condensation	

*3 sigma

**(size of scanned image W x D) in mm

*** images per second



Tire Length Inspection

dimensionCONTROL TLI 8303.I



Installation sites & possible applications
 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.

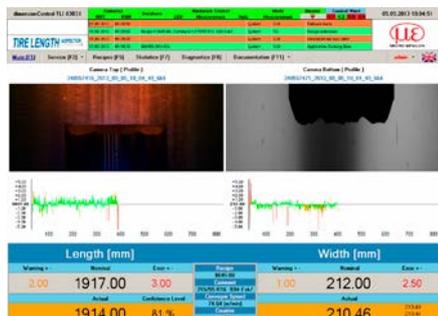
Optimized process mapping

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.

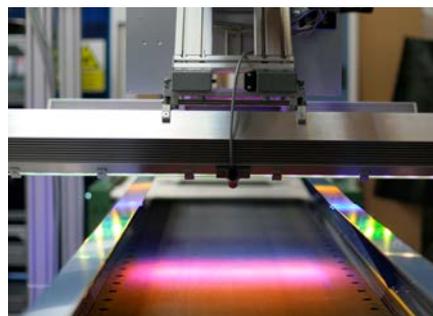
Depending on the concept it is either under the rollers at the end of the scale or above the scale. The moveable camera is positioned according the nominal length received from the master of the extrusion line. The calculation of the profile length is based on the form of the cuts at each edge. To optimize 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



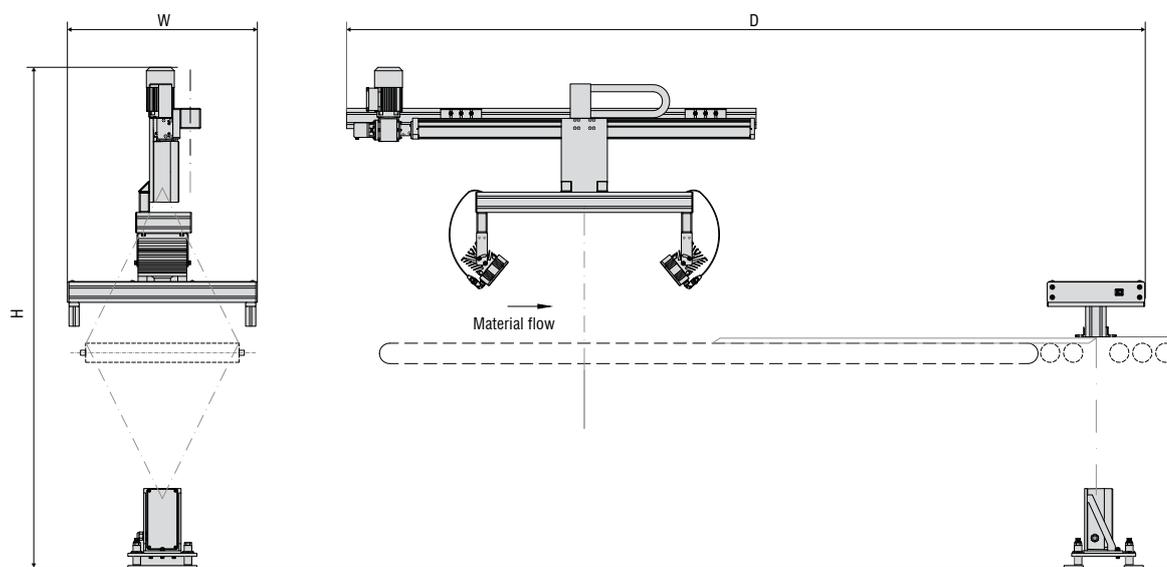
Illumination for the upper side

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	1500mm to 2500mm		1300mm to 4000mm	
Measuring range **	5mm to 50mm			
Resolution	100 μ m			
Accuracy*	$\pm 100\mu$ m	$\pm 200\mu$ m	$\pm 200\mu$ m	$\pm 30\mu$ m
Max. material speed	110000mm/min			
Evaluation area of profile width	350mm			
Permissible vertical material movement	10mm			
Permissible material rotation	10mm			
Weight	180kg (without packaging)		250kg (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 stipulated temperature range without condensation			

*3 sigma

** thickness



Tire Piece Weight Inspection

dimensionCONTROL TWI 8302.C.TT



Installation sites & possible applications
 Weight measurement in
 - Extrusion line for sidewall or tread

When taking a new direction by using displacement sensors, dimensionCONTROL TWI 8302.C.TT stands for extraordinary precision in inspecting running tread profiles for truck tires.

Completing quality control

The device is based on a steel C-frame, containing two highly precise capacitive sensors. The deflection of a steel beam is measured with a high sampling rate. The data processing of the obtained sensor values is implemented in an electronic system and the weight is determined mathematically. The C-frame is attached to a massive construction, which ensures a long-

term mechanical stability of the TWI 8302.C.TT. Covered in a high degree it resists harsh environments in the preparation area. The included software contains a wide range of statistic measurement processing, definition of design profiles, statistical analysis of measured profiles and diagnostic tools. Together with the dimensionCONTROL TCI 8303.I, the dimensionCONTROL TLI 8303.I and the thicknessCONTROL TCP 8301.I it allows the complete quality assurance and also a closed loop control of the extrusion line.



Integration:
 TWI 8302.C.TT
 TLI 8303.I
 TCP 8301.I

Weight [g]		Width [mm]	
Mean	Max	Mean	Max
37.5	37.5	266.0	2.5
Actual: 23746.0		Actual: 266.1	

Visualization of weight and width results

IC	Description	Weight [g]	Width [mm]						
1	07-30-00	227%	238	37.5	37.5	1	1	50	2.5
1	07-30-00	100%	223	37.5	37.5	1	1	50	2.5
1	07-30-00	100%	223	37.5	37.5	1	1	50	2.5
1	07-30-00	100%	223	37.5	37.5	1	1	50	2.5

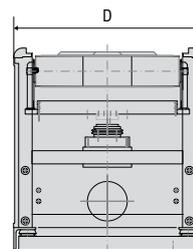
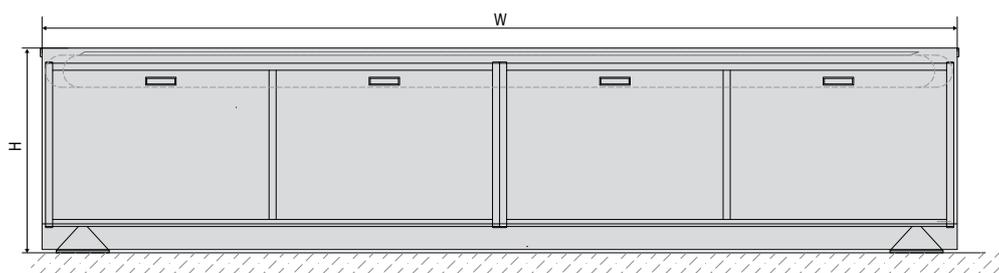
Display for SPC data

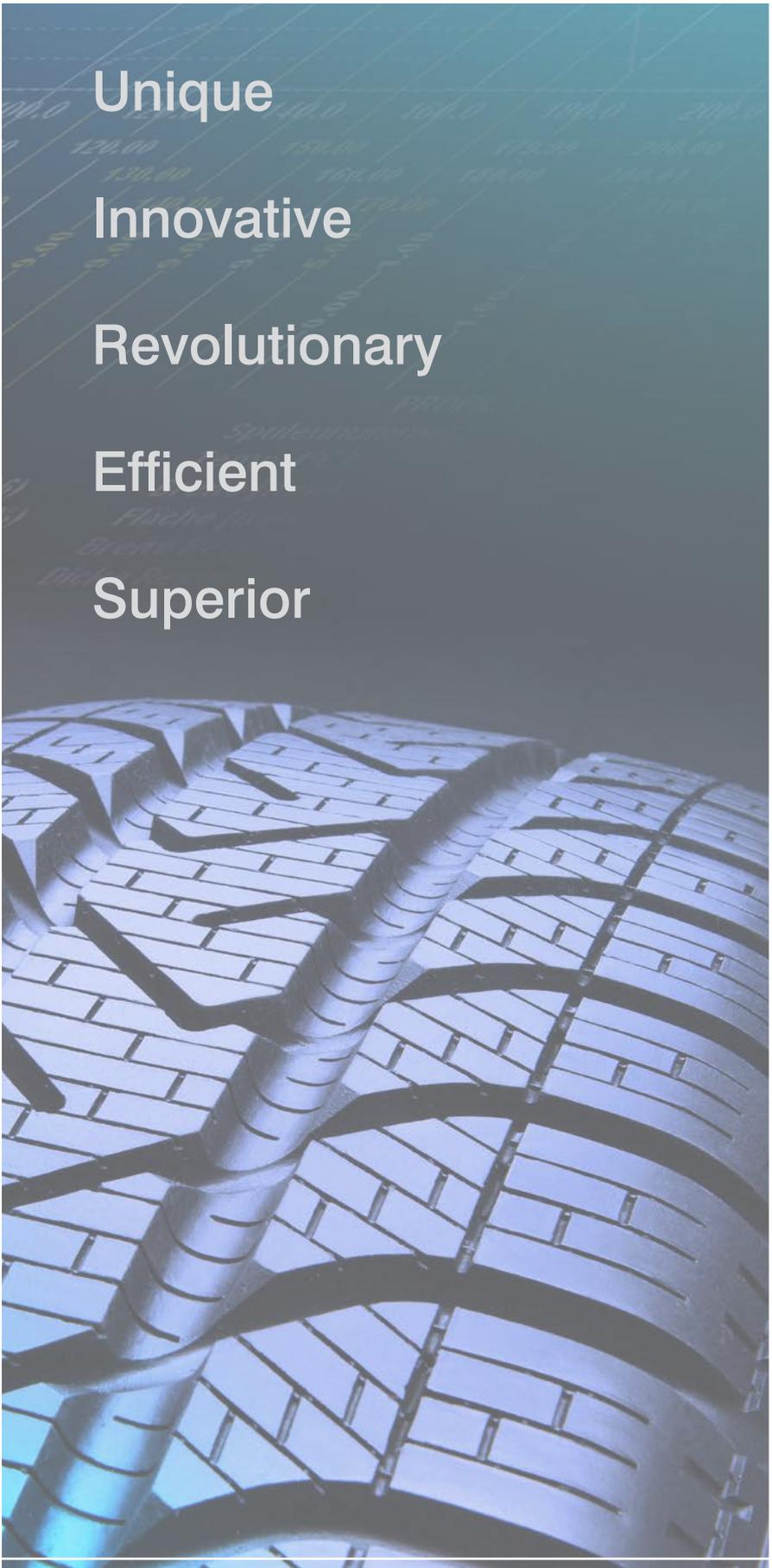
dimensionCONTROL TWI 8302.C.TT

Description	-3800
Article No.	4350220
Measuring length	3750mm
Measuring range**	4kg
Resolution	5g
Accuracy*	±25g
Sampling rate	1kHz
Max. material speed	70000mm/min
Weight	800kg (without packaging)
Dimensions (W x D x H) in mm	4800 x 1400 x 1800
Protection class	IP42
Ambient temperature	+15°C up to +40°C
Relative air humidity	max. 75% within the stipulated temperature range without condensation

*3 sigma

**weight





Unique
Innovative
Revolutionary
Efficient
Superior

Overview Final Finishing



Tire Geometry Inspection
dimensionCONTROL TGI 8302.LLT/T
 Page 28-29



Retrofit of Tire Uniformity Line
RTU
 Page 33



Tire Mark Inspection
identityCONTROL TMI 8303.I
 Page 30-31



Retrofit of Balancing Line
RTB
 Page 34



Retrofit Tire Geometry Line
RTG
 Page 32

Tire Geometry Inspection

dimensionCONTROL TGI 8302.LLT/T



Application area in tire industry or tire wheel assembly:

- Bulge and dents measurement
- Radial and lateral run out 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 run out, as well as bulges and constrictions on the tire, the dimensionCONTROL TGI 8302.LLT/T series make an important contribution regarding quality during the production of the tire.

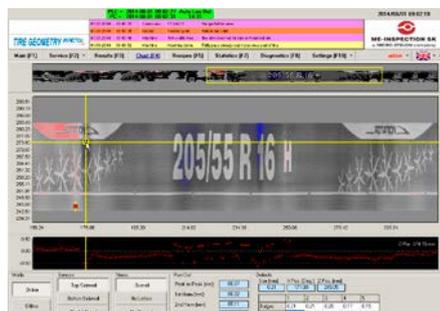
Compatible for various TG/TU types

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.LLT/T measures the size of defects (bulges, depressions) and evaluates the radial and lateral run out. 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 run out, the system creates a harmonic analysis and applies filtrations for the suppression of high frequency noise.

The mechanical basis of dimensionCONTROL TGI 8302.LLT/T 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



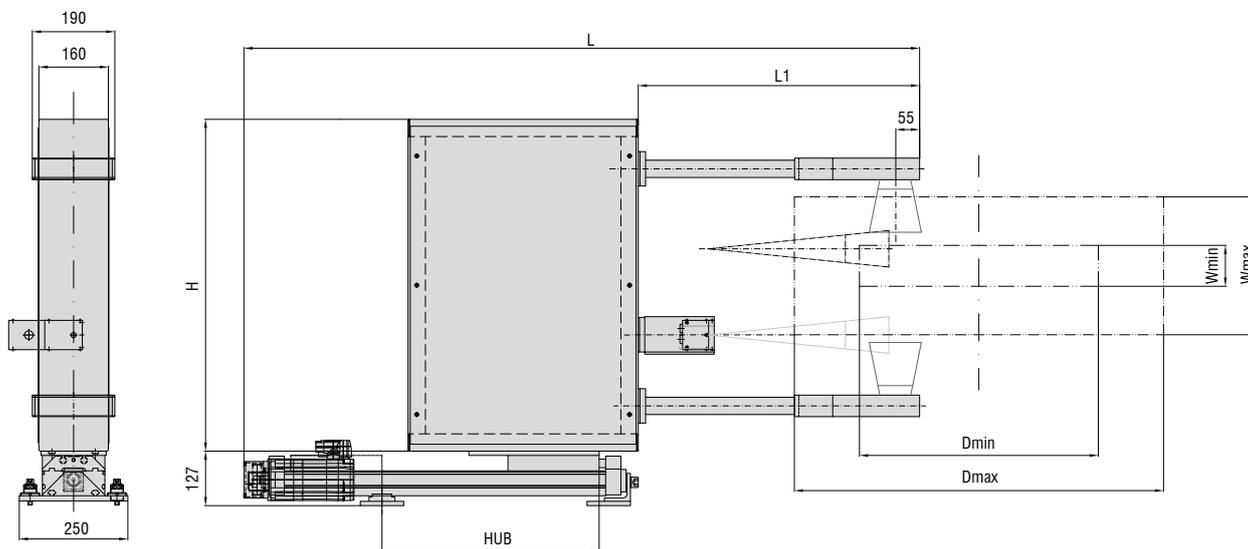
Integration to Tire Uniformity machine



Integration to Balancing machine

dimensionCONTROL TGI 8302	.LLT	.T
TGI sensors	Laser line triangulation sensors	Laser point triangulation sensors
Article No.	4350136.04	4350136.05
Laser class sensors	3B	
Measurement speed	2000 measurements / second	up to 10 000 measurements / second
Number of sensors	3 or 4	
Tire rotation speed	max. 60rpm	max. 560 rpm
Measurement object	Tire / Wheel	
Tire tread width	min. 95mm max. 400mm	
Tire outside diameters	min. 500mm max. 900mm	
Bead diameters	min. 13inch max. 24inch	
Repeatability (1σ)	<0.02mm	
Communication	Ethernet (TCI/IP, UDP), Digital I/O	
Protection class	IP43	
Ambient temperature	min. +15°C max. +40°C	
Relative air humidity	max. 75% within the stipulated temperature range without condensation	

OEM solution for truck tires



Tire Mark Inspection

identityCONTROL 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, identityCONTROL 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

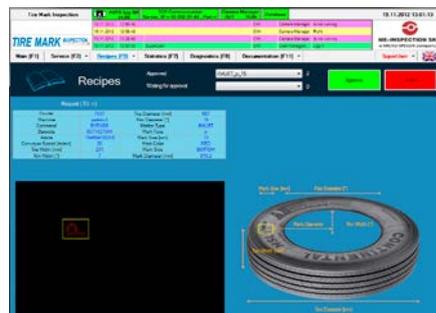
High-speed cameras are the central component of the identityCONTROL TMI 8303.I. They read the illuminated surface at the sidewall by analyzing the images in each instance.

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

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



Position and Classification of inspected Marks

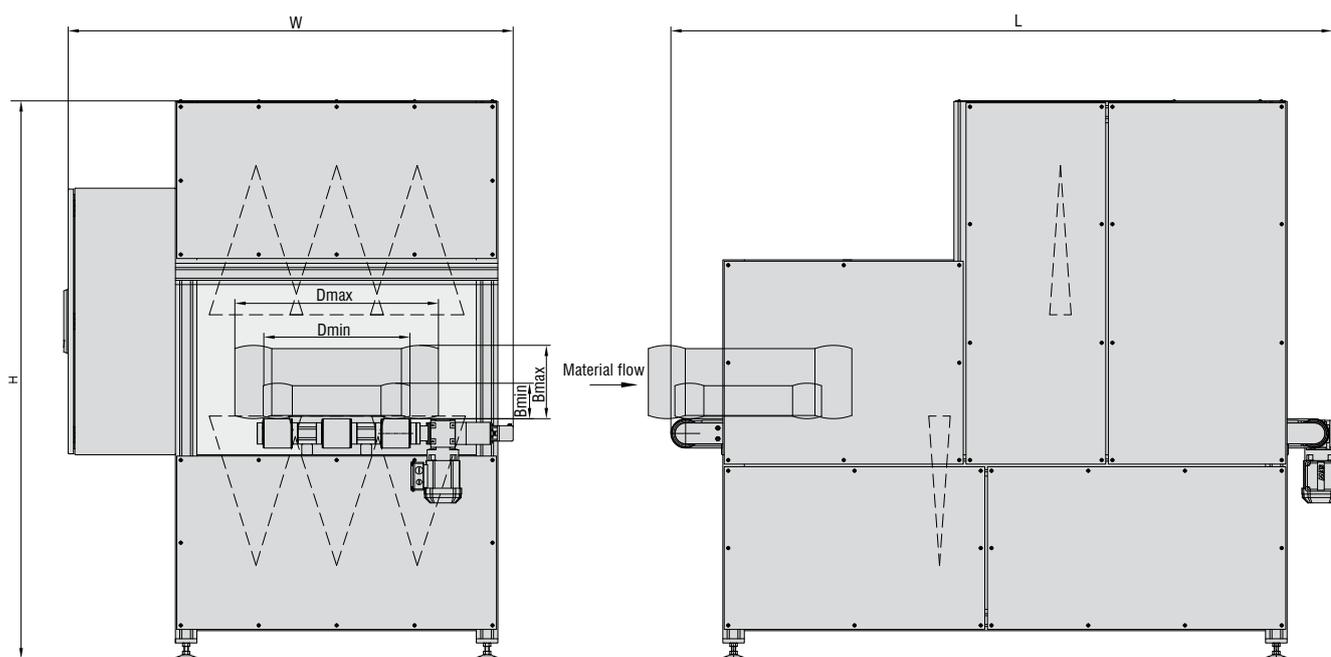


Recipe Editor



Visualization of SPC-Data

identityCONTROL TMI 8303.I		
Description	-200(TU)	-250(CV)
Article No.	4350290.01	4350290.02
Measuring range (X x Y x Z)	150 x 100 x 200mm	850 x 850 x 250mm
Measured material (X x Y x Z)	150 x 100 x 200mm	800 x 800 x 240mm
Resolution: X and Y	125 μ m	200 μ m
Type of camera	Color CCD / CMOS	Color CCD / CMOS
Daily capacity of inspection	7200 tires	20.000 tires
Dimensions (L x W x H) in mm	1050 x 800 x 1800	1200 x 800 x 1800
Weight app. (exclusive transport case)	400kg	420kg
Protection class	IP42	
Ambient temperature	min. +15°C max. +40°C	
Relative air humidity	max. 75% within the stipulated temperature range without condensation	



identityCONTROL TMI 8303.I - 200(TU)

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.LLT
- 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.LLT 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.LLT/T measuring system ensures the measurement of the size of defects (bulges, depressions) and the evaluation of the value of the radial and lateral run out with the use of laser line sensors. Its characteristics can be seen on the previous pages.

Possible control systems:

SIEMENS
BECKHOFF
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 run out 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
BECKHOFF
Rockwell Automation



Process visualization



Marking station integrated with:

- Service conveyor
- Mark quality inspection
- Sorting conveyor

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

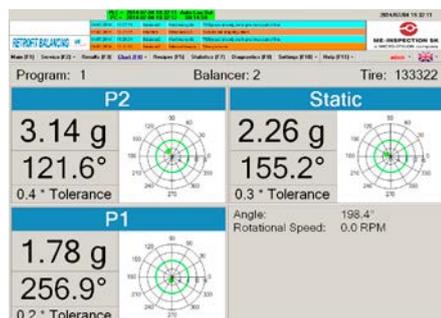
New performance until the marking

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 non-balance and the dynamic non-balance 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

Information		Geometry	
Run Time	2014-07-04 17:53:14	Sensor	Runout
Simulation ID	1	TERR	Top Sidewall 0.50
Program	1	BLRD	Bottom Sidewall 0.94
Queue Number	1189	CRGT	Hubside Tread 0.63
Run Number	133107	WOBBLE	0.23
DOT Code			0.53
GI Enabled	1	Balance Measurement	
TGI OK	1	Balance 1	Balance 2
Sensor 2 OK	1	P1	11.82 3.46
Total OK	1	P2	12.41 2.61
Run 1 Time [s]	18.62	Static	2.26 1.72
Reason Time [s]	0.00	Clear Data	
Run 2 Time [s]	14.53		

Result in table form

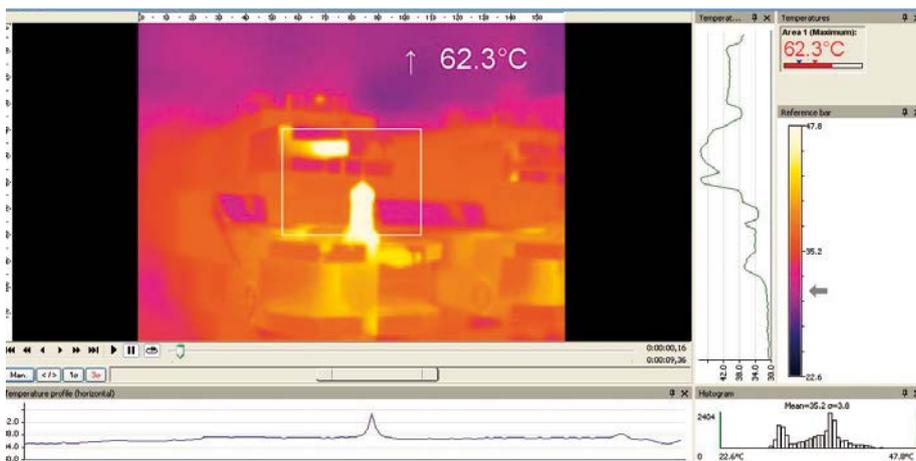
Micro-Epsilon

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 radiometric 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.

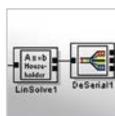
As components, they are often indispensable integral parts in the products of many machine and line constructors and electrical equipment suppliers worldwide.

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:

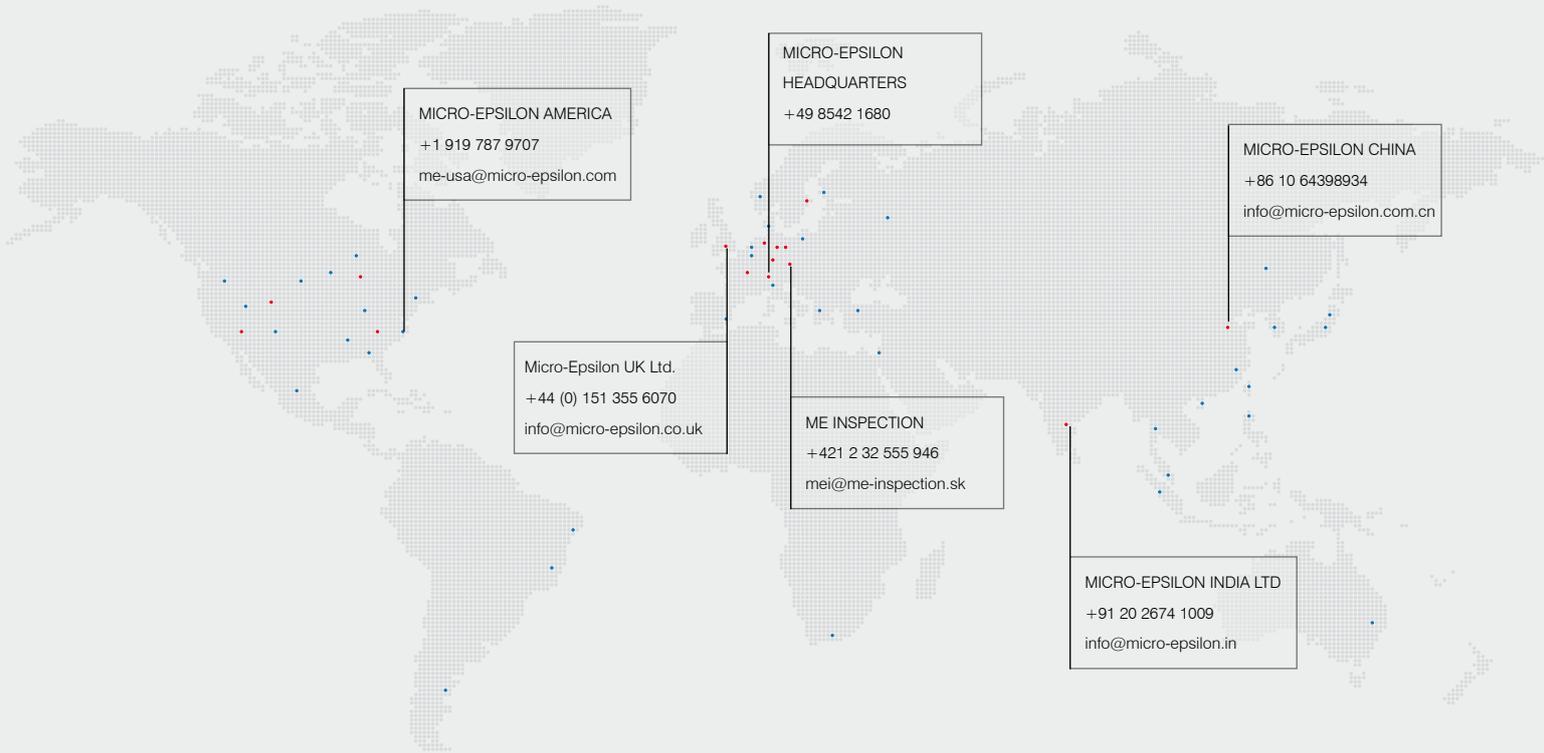
electrical design, PLC programming and assembly



Service:

technical support 7days 24hours

Your local support



Successful installations in following countries



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