Control and Inspection Systems for the Tire production

Be inspired. Move forward.
BST eltromat –
Solutions for Tire Machines

QUALITY, SAFETY AND EFFICIENCY

High demands are placed on control and inspection systems in tire production as a result of progressing automation of the manufacturing processes and ever increasing expectations on the quality of the products.

Through many years’ experience working together with the tire industry, BST eltromat is able to support its customers with solutions for the tasks at hand: With streamlined automation solutions, intelligent quality assurance systems and state-of-the-art control components.

Prepare to be impressed by our products and solutions:
- Web guide control systems for all manufacturing processes
- Web tension measuring systems in all load sizes
- Intelligent, high-precision sensors
- Profile scan systems for extrusion profiles
- Thickness measurement
- High performance camera systems – as easy to use as sensors
- Intelligent controllers

In addition to standard products, BST eltromat develops customer-specific and problem-related customized solutions.
Products and Components for your Machine

SWIVELING ROLLER GUIDE
PIVOTING FRAME GUIDE
EDGE SPREADING SYSTEM
DOUBLE EXPANDER
DOUBLE EXPANDER HT100
SWIVELING-SLIDING ROLLER
SLATTED ROLL GUIDE
WINDER CONTROL
SMART PROFILE MEASURING SYSTEMS (CS100 / CS200)
THICKNESS MEASURING SYSTEMS FOR INNERLINER (CS300-CS500)
THICKNESS MEASURING SYSTEMS FOR RUBBER CALENDER
DOUBLING CONTROL WITH CHASE & FOLLOW FUNCTION
WIDTH MEASUREMENT WITH SPLICE OFFSET DETECTION
CCD CAM 100
SENSORS
SENSOR POSITIONING DEVICES
ELECTRIC MOTOR POWERED ACTUATORS
CONTROLLER AND INPUT DEVICES
WEB TENSION MEASURING SYSTEMS
LASER MARKER LPS100
The SmartGuide.SF corrects the lateral offset of running product webs. In combination with various sensors, that are selected according to the material to be controlled, the actuator turns around an imaginary pivot point at the infeed side and transfers the web to the outfeed side in the correct position. The proportional/integral control algorithm permits a highly accurate and speed-independent web edge or center line guiding of the product web.

**Options**
- Version with 1, 2 or 3 rollers
- Version that can be moved in for applications on cassette winders
- Version for controlling from a loop
- Integrated web tension measurement

**System accuracy**
Depending on the sensor used the achievable system precision can be less than 1 mm.

**Components of the SmartGuide.SF**
- **Sensors**: The sensors detect the position of the material. Analog sensors, full width sensors or CCD digital cameras are used.
- **Drive**: The drive moves the actuating element into the required correction position.
- **Controller**: The controller processes the sensor signals and controls the actuating element drives. It also communicates with other BST eltromat controllers and higher-level logic systems.

**Special features and notes**

**AB = Working width:**
The working width \( AB \) is the width of the material to be processed. There is a differentiation between maximum working width \( AB_{\text{max}} \) and minimum working width \( AB_{\text{min}} \).

**I = Infeed path and S = Outfeed path:**
The infeed path \( I \) and the outfeed path \( S \) are material-dependent. For materials typical of tire production, we recommend twice the maximum material width \( AB_{\text{max}} \) for the infeed path \( I \) and the maximum material width \( AB_{\text{max}} \) for the outfeed path \( S \).

**VI = Preliminary infeed path:**
To minimize any retroactive effect of the swiveling roller guide on the material running in, and to prevent the control system overshooting, the preliminary infeed path \( VI \) must be made considerably shorter than the infeed path \( I \).

**R = Roller width:**
The roller width \( R \) is the width of the rollers.

**LM = Camera distance to the light source:**
The camera distance between the lower edge of the material and the upper edge of the light source.

**D = Camera distance to material:**
\( D \) is the camera distance between the lower edge of the material and the lower edge of the camera lens. The distance required is calculated using the lens opening angle and the material width. \( D \) must not be less than 500 mm. If the required space is not available, a two camera system must be installed.
Pivoting Frame Guide

The SmartGuide.DF corrects the lateral offset of running product webs.

In combination with various sensors, selected according to the material to be controlled, the actuator turns around its pivoting point at the infeed side and transfers the web to the outfeed side in the correct position.

The proportional / integral characteristic behavior permits a highly accurate and speed-independent web edge or center line guiding of the product web.

System accuracy
Depending on the sensor used the achievable system precision can be less than 1 mm.

Special features and notes

**AB** = Working width:
The working width **AB** is the width of the material to be processed. There is a differentiation between maximum (**ABmax**) and minimum working width (**ABmin**).

**I** = Infeed path and **S** = outfeed path:
The infeed path **I** and the outfeed path **S** are material-dependent. For materials typical of tire production, we recommend twice the maximum material width **ABmax** for the infeed path **I** and the maximum material width **ABmax** for the outfeed path **S**.

**C** = Correction length:
The correction length is approximately equal to **ABmax**.

**LM** = Camera distance to the light source:
The camera distance between the lower edge of the material and the upper edge of the light source **LM**.

**D** = Camera distance to material:
The distance required is calculated using the lens angle and the material width. **D** must not be less than 500 mm. If the required space is not available, a two camera system must be installed.

**R** = Roller width:
The roller width **R** is the width of the rollers.

**Components of the SmartGuide.DF**

<table>
<thead>
<tr>
<th>Sensors</th>
<th>The sensors detect the position of the material. Full width sensors or CCD digital cameras are used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>The drive moves the actuating element into the required correction position.</td>
</tr>
<tr>
<td>Controller</td>
<td>The controller processes the sensor signals and controls the actuating element drives. It also communicates with other BST eltromat controllers and higher-level logic systems.</td>
</tr>
</tbody>
</table>

**Key**
- **K**: web correction
- **AB**: operation width
- **α**: correction angle
- **1**: pivot point (virtual)
- **2**: entry roll
- **3**: pivoting frame
- **4**: exit roll

**Dimensioning of the control system with analog sensors**

A = Working width:
- The working width **A** is the width of the material to be processed. There is a differentiation between maximum (**Amax**) and minimum working width (**Amin**).

I = Infeed path and S = outfeed path:
The infeed path **I** and the outfeed path **S** are material-dependent. For materials typical of tire production, we recommend twice the maximum material width **Amax** for the infeed path **I** and the maximum material width **Amax** for the outfeed path **S**.

C = Correction length:
The correction length is approximately equal to **Amax**.
A correct textile cord width and homogeneous cord distribution are decisive prerequisites for a high quality of preliminary products in the calendaring process. The Triokanter spreads textile cord apart at the edge areas. It is a control device that operates proportionally/integrally. Only this process generates a high-precision and, in particular, speed-independent control result. The control intensity is defined by the three-edge fingers spreader’s mechanical skew, which can be finely adjusted.

**Application areas**
Textile cord calender in tire production and hot stretching systems in textile cord production.

**Options**
Data communication with web guide controller DF and double expander in the BST eltromat control system calender.

**Special features**
The material web must be guided straight through the three rollers. The outfeed path after the three-fingers spreaders should be kept as short as possible to keep the shrinkage of the material after the controller as low as possible. For greater material width adjustments (material change), the three-fingers spreader must be repositioned according to the new material edges.

**System accuracy**
Depending on the sensor used the achievable system precision can be less than 1 mm.

**Components of the Triokanter**

<table>
<thead>
<tr>
<th>Sensors</th>
<th>The sensors detect the position of the material. Analog sensors are used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>The drive closes or opens the 3 fingers and moves them lateral.</td>
</tr>
<tr>
<td>Controller</td>
<td>The controller processes the sensor signals and controls the actuating element drives. It also communicates with other BST eltromat controllers.</td>
</tr>
</tbody>
</table>

**Function**
Speed independent, high positioning accuracy through to 2-axis movement of the guiding rolls.

**Key**
- K: correction
- α: cant angle
- L1: entry span
- L2: exit span
- AB: operational width
- 1: entry roll
- 2: edge spreader
- 3: sensor
- 4: exit roll
- 5: plunge roll

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**DOUBLE EXPANDER**
Correct width and homogeneous distribution of textile cord are decisive prerequisites for the best quality of preliminary products. The spreading system implements these requirements with high accuracy and reliability. It operates in combination with downstream and upstream BST eltromat controllers for control purposes. It regulates the material width and position with two curved spreader rollers that, depending on the measured material width and material position, can be swung onto and away from the material by an actuator.

**Application areas**
Textile cord calender in tire production and hot stretching systems in textile cord production.

**Options**
- Scanning with CCD camera sensor
- Scanning with full width sensor
- Output of material width and position
- Stand alone or data communication for fully integrated processes

**Special features**
The infeed path L1 – the distance between the last fixed roll in front of the spreader unit and the first spreader roller – should be approx. twice the average working width. The outfeed path L2 after the last roll of the spreader system to the next processing station should be as short as possible to prevent the material from shrinking.

**System accuracy**
Depending on the sensor used the achievable system precision can be less than 1 mm.

**Components of the Double Expander**

<table>
<thead>
<tr>
<th>Sensors</th>
<th>The sensors detect the position of the material. Full width sensors or CCD digital cameras are used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>The drive turns spreader rollers into the required correction position.</td>
</tr>
<tr>
<td>Controller</td>
<td>The controller processes the sensor signals and controls the drives. It also communicates with other BST eltromat controllers and higher-level logic systems.</td>
</tr>
</tbody>
</table>
DOUBLE EXPANDER HT100

Homogeneous cord distribution during the textile cord production is essential for a high tire cord quality. The specially-designed spreading and web guiding system for textile cord regulation is made up of two sets of rollers. As the upper rollers plunge between the two lower, fixed rollers, the cord is brought into contact with the rollers to a greater or lesser extent. As a result of this contact, and in conjunction with the special roller surface, a transverse deviation of the web occurs, which has a spreading and control effect. In combination with the BST eltromat full width sensor, this forms an accurate, maintenance-free and extremely robust web guiding system.

Special features
The infeed path – the distance between the last fixed roll in front of the spreader unit and the first spreader roller – should be approx. twice the average working width. The outfeed path after the last roll to the next processing station should be as short as possible to prevent the material shrinking.

Application areas
Tire cord treating lines (DIP-Lines)

Options
• Scanning with CCD camera sensor
• Scanning with full width sensor

System accuracy
Depending on the sensor used the achievable system precision can be less then 1 mm.

SWIVELING-SLIDING ROLLER

The Swiveling-Sliding Roller SRD is used for edge or center-line guiding of materials.

The material running in the machine is accurate guided by a lateral adjustment of the positioning roller to the target material position.

Special features
A fixed roller or a conveyor belt, must be provided behind the swiveling-sliding roller. The distance between the positioning roller and the next roller or the conveyor belt is typically 1/4 of the maximum working width, but depends on the material and the incoming error. Since the SRD control system offers solely proportional control, it is only suitable for machines that operate intermittently. During downtime, the material is raised by the free-running roller and the positioning roller moves to the central position.

Application areas
Tire building machines and cutters

System accuracy
Depending on the sensor used the achievable system precision can be less then 1 mm.

Sensors
• Analog IR sensors
• Digital camera CCD CAM 100 for edge scanning
• Sensors for detecting V marks
• Full range sensors

Options
• Manually-operated sensor adjustment device HFVG
• Motorized sensor adjustment device with automatic edge detection FVG
• Swiveling-sliding roller with alternative pneumatic cylinder attachment

Components of the Double Expander HT100

| Sensors | The sensors detect the position of the material. Full range sensors or CCD digital cameras are used. |
| Drive   | Each drive brings one of the three rollers more or less in contact with the material. |
| Controller | The controller processes the sensor signals and controls the actuating element drives. |

Components of the Swiveling-Sliding Roller SRD

| Sensors | The sensors detect the position of the material. |
| Drive   | The drive moves the positioning roller into the required correction position. |
| Controller | The controller processes the sensor signals and controls the actuating element drives. |
SLATTED ROLL GUIDE

The SmartGuide.RS consists of a system of slats that move in axial direction during the rotation of the roller.

The slats are connected with a guiding plate. The guide plate angle is changed and is controlled with a drive. The offset of the material achieved by this axial movement of the slats is used for the guiding process. The system provides an accurate and reliable rubber stripe guiding.

Components of the SmartGuide.RS

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>correction</td>
</tr>
<tr>
<td>AB</td>
<td>operational width</td>
</tr>
<tr>
<td>1</td>
<td>entry roll</td>
</tr>
<tr>
<td>2</td>
<td>material loop</td>
</tr>
<tr>
<td>3</td>
<td>swivel axis</td>
</tr>
<tr>
<td>4</td>
<td>slatted roller</td>
</tr>
<tr>
<td>5</td>
<td>sensors</td>
</tr>
<tr>
<td>6</td>
<td>exit roll</td>
</tr>
</tbody>
</table>

Application areas
- Guiding the longitudinal cut on steel cord cutters
- Guiding from the loop with doubling systems
- Guiding from the loop at the material infeed on tire building machines

Special features
- Material-friendly
- Accurate
- Easy to use

System accuracy
Depending on the sensor used the achievable system precision can be less than 1 mm.

Application
The centering roller works in combination with the applicable sensors for the respective application. For high accuracy guiding, e.g. the longitudinal cut on steel cord scissors or guiding from the loop in the case of doubling systems, the centering rollers work together with the high-resolution BST eltromat camera CCD CAM 100. For systems with less strict requirements in terms of the positioning accuracy, the system operates with the BST eltromat full width sensor or other sensors. The additional drive on the centering roller ensures that the product is handled in a low-tension and product-friendly manner, in particular from the loop.

Technical data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working width</td>
<td>400 mm up to 2,500 mm</td>
</tr>
<tr>
<td>Max. working speed</td>
<td>150 m/min</td>
</tr>
<tr>
<td>Bar material</td>
<td>Steel or stainless steel</td>
</tr>
<tr>
<td>Operation voltage</td>
<td>400 V AC, 50 Hz, other voltages are available</td>
</tr>
<tr>
<td>Drive</td>
<td>Brushless DC actuator</td>
</tr>
<tr>
<td>Working area temperature</td>
<td>0 to 60 °C</td>
</tr>
</tbody>
</table>
** dimensioning of the control system**

Special features and notes

**I** = Infeed path (Rewinder):
The infeed path \( I \) (that is the distance between the two last fixed rollers in the machine) depends on the material. It should be approx. 0.5 to one times the maximum working width. The sensor should be mounted in the last third of the infeed path.

**C** = Correction path (Rewinder):
The correction path \( C \) (the distance between the last machine roller and the winder) depends on the material. It should be approx. 0.5 to one times the maximum working width.

**C** = Correction path (Unwinder):
The correction path \( C \) (the distance between the last roller of the winder stand and the first machine roller) depends on the material. It should be approx. 0.5 to one times the maximum working width.

**AB** = Working width:
The working width \( AB \) is the width of the material to be processed. There is a differentiation between maximum \( AB_{\text{max}} \) and minimum working width \( AB_{\text{min}} \).

**Infeed and correction paths:**
The infeed and correction paths are decisive for the control process to produce good results and gentle guiding of the material. Paths that are too long reduce the control accuracy. Paths that are too short lead to damage to the material.

**Use**
Static and minor dynamic errors in the position of the incoming material

**Application areas**
All unwinder and rewinder applications

**Options**
- Rewinder control with CCD cameras
- Manually-operated sensor adjustment device HFVG
- Motorized sensor adjustment device FVG with automatic edge detection

**System accuracy**
Depending on the sensor used the achievable system precision can be less than 1 mm.

**Components of the Winder Control**

| **Sensors** | The sensors detect the position of the web. Analog sensors, full range sensors or CCD digital cameras are used. |
| **Drive** | The drive moves the winder stand or positioning rollers into the required correction position. |
| **Controller** | The controller processes the sensor signals and controls the actuators. Optionally it communicates with other BST eltromat controllers or PLCs. |

**Use**
Static and minor dynamic errors in the position of the incoming material

**Application areas**
All unwinder and rewinder applications

**Options**
- Rewinder control with CCD cameras
- Manually-operated sensor adjustment device HFVG
- Motorized sensor adjustment device FVG with automatic edge detection

**System accuracy**
Depending on the sensor used the achievable system precision can be less than 1 mm.

**Components of the Winder Control**

| **Sensors** | The sensors detect the position of the web. Analog sensors, full range sensors or CCD digital cameras are used. |
| **Drive** | The drive moves the winder stand or positioning rollers into the required correction position. |
| **Controller** | The controller processes the sensor signals and controls the actuators. Optionally it communicates with other BST eltromat controllers or PLCs. |
The smart profile measuring system is used for the high-precision measuring of extruded semi-finished products for tire production. It is primarily intended for use on extrusion systems for treads or side walls, directly after the extruder and after cooling.

It uses the contact-free 3D laser triangulation method and projects a laser line onto the material. This laser line is detected and processed by CCD cameras. By applying different methods of filtering and signal processing, a high-precision representation of the cross-section of the extruded material is produced.

**Special features**
Both the operator panel and the profile measuring system can be adapted for mobile use and used at different measuring positions. The measuring heads can be fitted in such a way that the height may be varied. A compressed air adapter allows the sensors to be kept clean and cool.

**Options**
- Depending on the material the width variants with 2 or 4 measuring heads
- Thanks to the modular construction, different working widths can be implemented in combination with standard sensors
- The software offers comprehensive options for processing the signal, e. g.:
  - an alarm when specified limit values are exceeded
  - quality reports, etc.

**Technical Data Inline-Version CS200**
- Working width: 530 mm or 1,000 mm
- Measuring resolution: > 0.05 mm
- Measuring frequency: 50 Hz
- Vertical measuring accuracy: 0.1 mm
- Horizontal measuring accuracy: 0.17 mm
- Protection class: IP 54
- Working area temperature: 0 to 50 °C without cooling

**Technical Data Offline-Version CS100**
- Working width: 1,000 mm
- Measuring resolution: > 0.05 mm
- Measuring frequency: 16 kHz
- Vertical measuring accuracy: 0.025 mm
- Horizontal measuring accuracy: 0.05 mm
- Protection class: IP 54
- Working area temperature: 0 to 50 °C without cooling
THICKNESS MEASURING SYSTEM FOR INNERLINER CALANDER

The exact material thicknesses in the innerliner production process are the basis for the best product quality. BST eltromat thickness measuring systems especially developed for innerliner applications, offer high accuracy, reliability and simplicity. Depending on the application, different versions are available.

Technical data CS400

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Range</td>
<td>Customized</td>
</tr>
<tr>
<td>Clearance distance</td>
<td>Standard 100 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>Laser Class</td>
<td>2 (ref EN 60825-1 and IEC 60825-1)</td>
</tr>
<tr>
<td>Spot Size</td>
<td>2 mm</td>
</tr>
<tr>
<td>Interface</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 67</td>
</tr>
<tr>
<td>Working area temperature</td>
<td>0 to 50 °C without cooling</td>
</tr>
</tbody>
</table>

Technical data CS500

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working width</td>
<td>530 mm or 1,000 mm</td>
</tr>
<tr>
<td>Measuring resolution</td>
<td>&gt; 0.05 mm</td>
</tr>
<tr>
<td>Frequency measurement</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Vertical measuring accuracy</td>
<td>0.1 mm</td>
</tr>
<tr>
<td>Horizontal measuring accuracy</td>
<td>0.17 mm</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 54</td>
</tr>
<tr>
<td>Working area temperature</td>
<td>0 to 50 °C without cooling</td>
</tr>
</tbody>
</table>

Technical data CS300

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working width</td>
<td>1,000 mm</td>
</tr>
<tr>
<td>Measuring resolution</td>
<td>&gt; 0.05 mm</td>
</tr>
<tr>
<td>Frequency measurement</td>
<td>16 kHz</td>
</tr>
<tr>
<td>Vertical measuring accuracy</td>
<td>0.025 mm</td>
</tr>
<tr>
<td>Horizontal measuring accuracy</td>
<td>0.05 mm</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 54</td>
</tr>
<tr>
<td>Working area temperature</td>
<td>0 to 50 °C without cooling</td>
</tr>
</tbody>
</table>

Application areas

Innerliner calender lines

Options

- Using 3D laser triangulation technology thickness measurement in combination with width measurement
- Direct measurement with four 2D single spot laser sensors
- Measurement on a roller with two 2D single spot laser sensors

Special features

Three systems are available. All systems are using laser sensors for the measurement thickness. The high-end version with the 3D laser sensor offers up to 60 thickness measuring positions and a contemporarily width information.

The 2D single spot laser systems offer direct material measurement from the top and the bottom or a one side measurement on a roller.

All versions allow data display, tolerance setting, alarm output and optional data communication with the customers PLC.
**THICKNESS MEASURING SYSTEM FOR RUBBER CALENDER**

Exact material thicknesses in the calender process are the basis for a high end product quality in tire production. The BST eltromat ProControl Indicon thickness measuring system makes it possible to determine the thickness of individual rubber plates on the top and bottom calender rollers and of the calendared material after the calender. High-precision, low-level radioactive isotopic sensors or laser sensors are used for measuring.

The values of the individual measuring positions are evaluated in a controller. In the data exchange with the calender controller, the positions and the axis positions of the calender rollers can be controlled over several closed control circuits. Comprehensive software tools are available for processing the measurement values in process data management systems.

**Options**
- Versions with either two or three fixed sensors on the calender rollers
- Version with one traversing sensor on the calender rollers
- Single system, only for thickness measurement on the rollers or after the calender

**Sensors**
- Low-level radioactive isotopic sensors (Strontium 90; 0.37 GBq, type X.117)
- Laser- triangulation-sensors

**The measurements in detail**
- Measurement of the top and bottom rubber plate directly on the calender rollers
- Measurement of the total thickness or the weight per unit area
- Determination of the steel cord height position within the overall composition
- Measurement of the humidity of the textile cord in front of the calender

**The control procedures in detail**
- Gap control
- Bending control
- Cross axis control
- Wire position control
- Cascade control

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**Technical data rubber calender**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working width</td>
<td>500 mm … 2,500 mm</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>Frequency measurement</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 65</td>
</tr>
<tr>
<td>Max. work temperature</td>
<td>70 °C with air cooling</td>
</tr>
<tr>
<td>Max. humidity</td>
<td>95 %, non-condensing</td>
</tr>
<tr>
<td>Compressed air</td>
<td>6 bar, consumption, approx. 2 m³ / h</td>
</tr>
</tbody>
</table>

**Technical data measuring system ‘shadex’**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range, typical</td>
<td>0 - 5.000 μm or 0 – 10.000 μm</td>
</tr>
<tr>
<td>Measuring accuracy, typical</td>
<td>+/- 3 μm or +/- 6 μm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.25 %</td>
</tr>
<tr>
<td>Light source</td>
<td>Laser, class II</td>
</tr>
<tr>
<td>Wavelength</td>
<td>780 nm</td>
</tr>
<tr>
<td>Power</td>
<td>3 mW</td>
</tr>
<tr>
<td>Measuring spot (CD x MD)</td>
<td>1 x 5 mm, 1 x 10 mm (1 x 30 mm)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0…+45 °C</td>
</tr>
<tr>
<td>Max. Humidity</td>
<td>90 %, non-condensing</td>
</tr>
</tbody>
</table>
DOUBLING CONTROL WITH CHASE & FOLLOW FUNCTION

Doubling systems permit different strips to be placed on top of each other with precise edge alignment. The doubling control places a slave strip symmetrically or asymmetrically on top of a master material. The application position is specified via recipes.

CCD cameras detect the position of the master material and guide the strip to be applied to the master material. The movement of the strips is carried out in two phases. The first phase is pre-positioning. The fine positioning of the strips is carried out in a second phase via a machine speed-dependent controller with higher-ranking disturbance elimination.

Application areas
- Extrusion lines
- Calender lines
- Assembly lines

Options
- Symmetrical doubling to the machine center
- Symmetrical doubling to the machine center with chase & follow function
- Monitoring
- Asymmetrical doubling to the machine center with chase & follow function

Components of the Doubling Control with Chase & Follow Function

Sensors
- The sensors detect the position of the material. Analog sensors or CCD cameras are used.

Drive
- Drive move correction rollers to the required position.

Controller
- The controller processes the sensor signals and controls the actuating element drives.

WIDTH MEASUREMENT WITH SPLICE OFFSET DETECTION

The BST eltromat width measurement can be used to measure material widths using the reflected light or transmitted light procedure. The material edges detected by the camera or the sensors are converted to web width values in a controller. The width values can be displayed on the device or via large displays, or transferred to a higher level controller.

Measuring range / working width
One or two cameras are used depending on the maximum material width. When using analog sensors, two sensors are used, regardless of the working width. These are mounted on sensor positioning devices with diverse specifications.

Splice offset detection
With splice offset detection, splice offsets are detected at the material edges. The number of faults determined per material edge and the time of the last fault occurring is represented on the display or transferred to a higher level process control system.

Options
- Data exchange via Ethernet, other interfaces on request
- Hardware extension output to a large display
- Splice offset detection
- Changing the language
- Material thickness compensation when using recipes
- Display of the width path for the previous minutes
- Sensor positioning device in the following variants: manual, symmetrically by motor or asymmetrically by motor
- Potential-free contacts for output of width fault messages
- Application-related programmable digital inputs and outputs, 24 VDC

System accuracy
up to 0.01 mm

Components of the Width Measurement with Splice Offset Detection

Sensors
- Analog edge sensors or digital cameras detect the edge value of the material and transfer these to the BST eltromat controller.

Calibration template
- The template is used to calibrate the measuring system.

Controller
- The controller generates the width values using the edge values transferred by the sensors.
**CCD CAM 100**

High End CCD color line scan camera for high-resolution and quick detection of edges, elements and surfaces. 10,000 pixels physical resolution and up to 6-fold sub-pixel interpolation. High resolution paired with a high scanning rate – the ideal basis for accurate edge and center-line guiding, surface inspections, hole detection, width measurement, splice monitoring, cord inspection and other inspection tasks.

**Components of the CCD CAM 100**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chip / physical resolution</td>
<td>Color chip RGB / 3 x 10,000 pixels</td>
</tr>
<tr>
<td>Max. resolution with interpolation</td>
<td>3 x 60,000 pixels</td>
</tr>
<tr>
<td>Scanning rate</td>
<td>up to 10 kHz</td>
</tr>
<tr>
<td>Lens</td>
<td>The measuring range can be varied using the zoom lens</td>
</tr>
<tr>
<td>Installation and setting aids</td>
<td>Representation of the measuring range using LED projection points</td>
</tr>
<tr>
<td>Connectivity</td>
<td>CAN-Bus, Ethernet (including POE Power over Ethernet)</td>
</tr>
<tr>
<td>Inputs / outputs</td>
<td>2 electric trigger inputs (isolated visually)</td>
</tr>
<tr>
<td></td>
<td>4 universal outputs</td>
</tr>
<tr>
<td>Parameter backup</td>
<td>Storage on an SD card</td>
</tr>
<tr>
<td>Color display 320 x 240 pixels with the following functions</td>
<td>Setting the parameters</td>
</tr>
<tr>
<td></td>
<td>Representation of the operating modes</td>
</tr>
<tr>
<td></td>
<td>Output of the video curve</td>
</tr>
<tr>
<td></td>
<td>Output of error messages in clear text etc.</td>
</tr>
<tr>
<td>Operation / Set-up</td>
<td>Using the integrated touchscreen</td>
</tr>
<tr>
<td>Maximum number of edges that can be read</td>
<td>256 (only useful via Ethernet)</td>
</tr>
<tr>
<td>Connections</td>
<td>Via plug connectors</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Functionally compatible with previous BST eltromat CCD cameras</td>
</tr>
</tbody>
</table>

**Features**

- **Built-in LEDs**
  Three light spots are emitted via the lens’ original optical beam path. This allows quick and accurate 3-axis adjustment of the camera to the material position.

- **Lens with variable zoom**
  In conjunction with the 3 light spots, the lens permits quick and accurate adaptation of the measuring width to the product width. The distance of the camera to the product can thus be varied within a wide range. This is beneficial both for new constructions and also when replacing cameras and with defined space conditions.

- **Backup on an SD card**
  All parameters are saved on an SD card. This reduces the downtimes when a camera is replaced in the event of maintenance.

- **Mechanical fine adjustment**
  Ergonomic – Simple – Precise: simple mechanical features are helpful during fine adjustment.

- **Touchscreen**
  User navigation on the touchscreen simplifies the parameterization required for installation. (e. g., setting the IP address, definition of the function modes, etc.)

**Special features**

- **Performance – High end camera**
- **Handling – as simple to use as a sensor**

**Quick setup**

In addition to its excellent technical performance, the camera includes features that have been specially developed to ensure quick and simple installation, commissioning, maintenance and interchangeability, and also keep the commissioning time and downtimes to a minimum. The cameras are equipped with integrated LEDs that emit light via the lens. The interaction with the highly-simplified mechanical fine adjustment and other specially developed features permit a high-precision, simple and extremely quick installation or re-adjustment of the camera.
Sensors

Properties of the CLS Pro 600 sensors
The scanning of the material is carried out contact-free by detecting light contrasts.
• Accurate scanning of lines, printing edges or web edges with color sensors
• Optimum lighting conditions from automatically controlled LED lighting
• Extremely reliable, even at the highest web guide speeds
• Clearly arranged display on the color display
• Simple operation from intuitive user navigation
• Positioning aid using a laser
• Convenient selection of the print line, print edge or web edge thanks to the colored display of the contrast transition points

Application area CLS Pro 600 sensors
• Guiding of the contrast edges
• Web edge or printed line

Technical data

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Design</th>
<th>Measuring range</th>
<th>Measuring media</th>
<th>Measuring distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLS Pro 600</td>
<td>Camera</td>
<td>25 mm</td>
<td>2 LED (white)</td>
<td>25 mm</td>
</tr>
<tr>
<td>Full width sensor</td>
<td>1,400 – 3,000 mm</td>
<td>LED (infrared)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SENSOR POSITIONING DEVICES

If the position of the sensor is difficult to access or the scanning position has to be changed frequently due to varying web widths, a BST eltromat sensor positioning device (FVG) undertakes the adjustment of the sensor position. Depending on the requirements, you are able to select from different automatic systems with electric motor drives.

Sensor positioning device FVGPro 2/MK
The FVGPro 2/MK sensor positioning devices are equipped with two sensor fixings and two separate drives which allows both sensors to be adjusted independently from one another. The device is used for both web edge guiding and web center-line guiding. Using a synchronous control of the drives, web displacement is possible over the entire range and is also recommended for (half) webs running off-center.

Sensor positioning device FVGPro 1/K
The simplest electric motor version of the sensor positioning device permits one sensor to positioned. It is used for web edge guiding.

Sensor positioning device FVGPro 1/MK
The FVGPro 1/MK sensor positioning device permits the positioning of two sensors at the same time. They are used for the web center-line guiding with a fixed web center. The position of the sensors is adjusted symmetrically to the center of the web in opposite directions using a driven positioning system.

Special features
• Accurate
• Easy to use
• Robust

Technical data
Type | Control | Function | Special functions
--- | --- | --- | ---
FVGPro 1/K | Web edge | Automatic edge detection | 
FVGPro 1/MK | Two web edges with missing web center | Automatic edge detection | Web width measurement
Web width setting
FVGPro 2/MK | Web edge / web center | Automatic web detection and guiding for 1, edge 2, web center (independent from one another) | Web width measurement
Displacement of the center for (half) webs running off-center
Web width setting

Application
Use the BST eltromat actuators in combination with our actuating elements for a variety of web guiding tasks. We offer electric motor powered drives with an actuating force of up to 9,000 N and strokes up to 300 mm in versions with and without position feedback.

The actuating forces of our hydraulic drives reach up to 20,000 N with different strokes.

Application areas
Position correction with the following web materials:
• Paper
• Synthetic materials
• Rubber
• Textiles

Technical data
Actuator type | EMS 18 | EMS 21 | EMS 22 | EMS 23
--- | --- | --- | --- | ---
Nominal actuating force | 420 / 840 N | 840 / 1,680 N | 1,125 / 2,250 N | 9,000 N
Nominal actuating speed | 10 / 20 mm/s | 10 / 20 mm/s | 10 / 20 mm/s | 10 / 20 mm/s
Available stroke | 50 / 100 / 200 mm | 100 / 195 mm | 195 mm | 300 mm

Electric Motor Powered Actuators

Electric motor powered actuators are used in all areas where very fast reactions have to made to changes in the web position. The actuator can be directly connected to the controller.

The ready-for-connection design permits quick and cost-effective assembly, which is also advantageous when retrofitting existing systems.

Special features
• Low-wear DC motors
• Ball screw spindle drives for high service life and minimum play
• Dimensioned for curved-shaped and linear actuating movements
• Different combinations of actuating path, actuating force and actuating speed are possible
• Available with and without position feedback (accurate detection of the current position of the actuating drive) as well as electronic end position switch-off
• Maintenance-free
CONTROLLERS AND INPUT DEVICES

BST eltromat controllers are used to process sensor signals and to control the EMS actuators.

In the most cases, the controllers are working in closed loops. In combination with the guiding systems, the BST eltromat controllers are working in proportional – integral regulation characteristics. The compact design and its easy operation characterize the EKR range of products.

The following models are available:
- ekr 500 digital
- ekrPro Com60
- ekrPro Com50

BST eltromat ProLogic System

The BST eltromat ProLogic top-hat rail module is a higher level logic unit, used for networking several control units and controllers. ProLogic modules can be easily incorporated, thanks to the space-saving housing.

The ProLogic system is made up of the following components:
- BST eltromat Prologic CPU 32x (or BST eltromat ProLogic CPU 32x Compact)
- Diverse logic modules

BST eltromat ProLogic

- Application software tuned to the customer’s needs
- High-performance processor
- Up to 4 separate CAN field buslines
- Can be integrated into Ethernet based networks
- Can be extended with different input and output assemblies

Special features

- Web guide controller
- IP 54 protection
- Compact design
- The system can be configured directly on the device without additional hardware.

Visualization modules and input devices

The following visualization modules and input devices are available for the convenient operation of BST eltromat control systems:
- Commander edition x
- BST eltromat ProTouch
- BST eltromat ProTouch x

CAN-To-Ethernet coupler (C2E)

The CAN-To-Ethernet coupler allows up to four BST eltromat web guide control devices to be remotely controlled by an external control system using an Ethernet interface (e.g. PLC, PC, machine controller, etc.)
- Standard: UDP communication
- Remote control of the ekr 500 digital and ekrPro Com60
- Application software tuned to the customer’s needs

BST eltromat ProTouch / ProTouch x

With the ProTouch visualization module, BST eltromat offers a user interface designed according to the customer’s wishes and requirements.
- Visualization for the application software tuned to the customer’s needs
- Several ProTouch units can be placed at different points on the machine
- Visualization also possible on the customer’s Windows PC (only ProTouch x)

Commander edition x

- Application software tuned to the customer’s needs
- Cost-effective
- High-contrast color display
WEB TENSION MEASURING SYSTEMS

The BTL Load 100-500 cells have been developed for the greatest demands of modern production machines. The unique constructive design guarantees a high service life. BST eltromat web tension measuring systems are available in a variety of designs, depending on the application. A number of different load ranges from 25N to 15,000N and also various installation types are available.

Application
The web tension measuring systems are used in all fields where precise control of the web tension and synchronization of the drives is important. We offer customized web tension measuring system solutions for the high web tensions in cord production and in calenders, but also for low web tensions on winders or in liner control.

Technical features
- Compact, high-quality design
- Stainless steel version available
- Double bending beam principle guarantees a high output signal with minimum sagging
- Compensation of axis expansion, non-aligned axes and sagging
- Different loading directions available
- Typical overload protection 200 - 500 %

Application areas
- Cord production
- Calender
- Winder
- Liner guiding

Special features
- Accurate
- Easy to use
- Robust

LASER MARKER LPS100

The BST eltromat laser marker LPS100 positions up to 4 line lasers at specified linear positions. It is primarily used in tire building machines to visually check the position of automatically positioned semi-finished products or to indicate the correct position to the operator when loading semi-finished products. In addition to a fixed center line, up to 4 laser lines can be positioned parallel to or independent from one another with high accuracy. Absolute measuring systems and high-precision linear guides provide the highest system accuracy. The specification of the laser positions is carried out via data exchange with the machine PLC or ProLogic systems.

Application
The laser marker is primarily used in tire building machines to visually check the position of automatically positioned semi-finished products or to indicate the correct position to the operator when loading semi-finished products. In addition to a fixed center line, up to 4 laser lines can be positioned parallel to or independent from one another with high accuracy. Absolute measuring systems and high-precision linear guides provide the highest system accuracy. The specification of the laser positions is carried out via data exchange with the machine PLC or ProLogic systems.

Technical features
- Precise
- Easy to use
- Robust

Technical data
<table>
<thead>
<tr>
<th>Working width</th>
<th>600 mm … 2,400 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position accuracy</td>
<td>± / - 0.1 mm</td>
</tr>
<tr>
<td>Traversing speed</td>
<td>500 mm / min</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 54</td>
</tr>
<tr>
<td>Working area temperature</td>
<td>0 to 60 °C</td>
</tr>
<tr>
<td>Laser colors</td>
<td>red, blue, green</td>
</tr>
</tbody>
</table>
No matter where you use our technologies, we are here for you, providing dependable BST eltromat service. Our experts are available internationally and will be quick to help you sort out any issues. You can rely on a broad global production and sales network, ensuring first-class service anywhere in the world.

Being partners for top quality: To ensure you achieve maximum value, all our systems are precisely aligned to your specific conditions. You define what you need: project-based cooperation or a full BST eltromat service package. No matter what you choose, we are fully committed to making your products define new benchmarks.

To learn more, please visit www.bst-international.com