

LASER APPLICATIONS



Laser Systems for Automation and Quality Control in Steel Mills

Touches nothing, measures everything ...



LAP Croptimizer

Dimension-measurement and Crop Shears Optimization

This flexible and complex measurement system has been designed for precise measurement of the geometry of plates and strips in hot and cold rolling mills. The system provides:

- Width and shape (sables, necking)
- Over-all length
- Flatness, waviness
- Crop shape at front and rear
- Thickness

Width is measured through two lateral laser triangulation sensors with high resolution. Special laser optics (patented) overcome the problem of vertical material movement. The simple installation of the sensors beside the roller table (lateral to the transportation direction) provides several benefits:

- Needs no heavy support constructions
- Provides easy access to the devices
- Reduces thermal load

The high rate of measured values of each sensor up to 500 Hz shows a precise recording of width and shape.

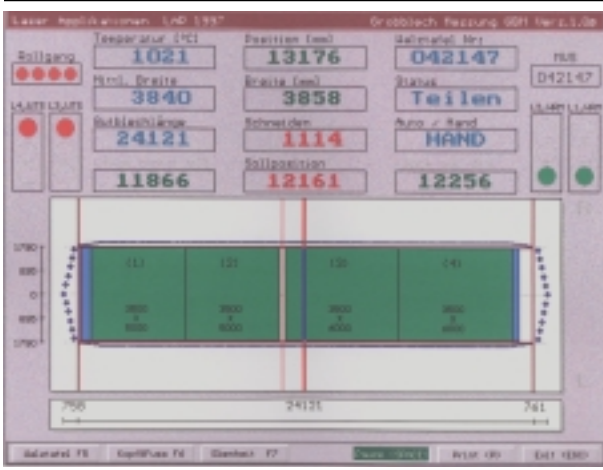
Flatness is controlled by the LMS Shapemeter, a system consisting of 7 to 11 self-contained distance gauges, which incorporate laser triangulation as the principle of operation. High resolution CCD lines are applied as the detector, with Laser diodes or Helium-Neon Lasers being used as light sources. The internal data transmission from the gauges to the computer is done via a fiber cable bus, with a data rate of 2.5 Mb/s. The PC-based computer calculates the flatness and transmits the results to a host computer. On the PC screen, flatness is shown as a line graph and – impressively – as an artificial-colored image. The operator can interpret the levelling result in real-time and can see typical flatness faults, like edge waviness or full center waviness. You can select your display in either mm or i-units. Thickness can be measured by adding gauges

on the bottom side in the same plane, corresponding to the flatness gauges on top. All data measured lengthwise are triggered in 1mm steps. The beginning and end of the plate is detected by specially designed laser light barriers. The LMS Shapemeter gauges are simultaneously used as light barriers for detection of crop shape. The lateral resolution depends on the number of gauges used. Length measurement comes from a laser doppler velocimeter.

In addition to the graphical display of all complete plate/strip dimensional data, relevant numerical data and status informations are displayed. All data can be transmitted via network to a host computer, including product specifications and finished dimensions. In the cut optimizing calculation, the specified finished plate's dimensions plus extra are projected into the raw plate, including test samples, and their position is optimized. The system provides cutting proposals and outputs control signals for the roller table to position the plate for the optimized cuts.

Advantages:

- Complete measurement of all dimensions
- High speed and high accuracy of the sensors
- Real-time display of the results
- Independent of vertical plate/strip movement
- Protected against harsh environment
- Easy to calibrate, almost maintenance free
- Enables feedback control of leveller or rolling stand
- User-friendly graphical display



LAP RDMS

The RDMS hot gauge is designed to measure diameter and ovality with high accuracy in four axes around a rod or bar during the rolling process. Typical installations are:

Hot rolling of rod wire · Hot rolling of bars · Hot rolling of tubes

The basic system consists of four laser scanning micrometers mounted on a mechanical frame around the object to be measured. The high scanning speed and the high repetition rate of these laser gauges make this system the ideal choice for today's high speed mill trains.

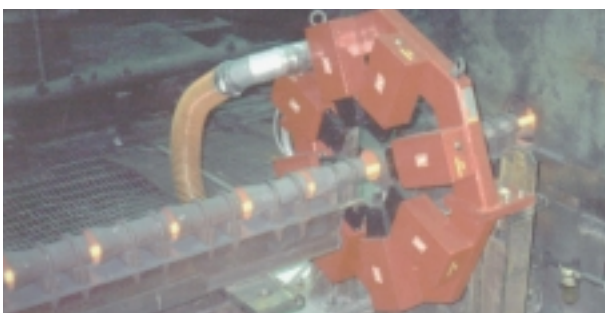
Advantages:

High scanning speed: no errors due to vibrations of the object · High scan rate: suitable for highest rolling speeds of up to 150 m/s · Air knives with independent air supply: ensure trouble-free continuous operation under harshest environmental conditions with water drip, dust and scale · Smallest possible footprint: can be installed almost everywhere in the mill train · Flexible configuration for installation in single or dual strand rod mills, combined bar/rod mills or profile mills · Perfect diagnostics of rolling process: over-/under-fill, ovality, tension/compression, axial roller shift, roller excentricity, roller wear and long term trends

The measuring range is variable from 0.5 to 180 mm, depending on the application needs. The gauge head is equipped with crane lifting eyes and electrical connector for simple installation and for simple change between alternating locations in the mill.

The sensor cooling and pollution prevention is provided through turbo blowers with separate air filters, supplying big amounts of clean, oil free air without loads of costs for supplying, cleaning and drying compressed air. The hollow measuring frame acts as rigid mounting base for the laser sensors, as cable conduit and as air channel for supply of the air knives. The real-time graphical presentation and data evaluation is performed on a PC, presenting the results in 6 different ways:

- Cross-sectional view of the object with the specified tolerance limits, created from the currently measured values of all axes.
- Numerical results are shown on the right top of the screen, with changing colour backgrounds signalling tolerance violations. An analogue meter on the right bottom of the screen displays the grand overall average deviation from nominal size.
- x-t line graph, showing the diameters of all axes along the rod/bar to determine the length of off-size parts on head and tail of the bar as well as influences of tension or compression.



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- Bar-graph average/range diagram of the last 40 rolled billets for simple detection of long term trends.
 - Numerical presentation of the current and the 10 previous rolled billets, with min., average and max. diameters, ovality, standard deviation and number and type of tolerance limit violations.
 - In-line statistical evaluation of the current batch, showing the actual produced total number and "good" number of billets, average diameter and ovality figures, standard deviation and Cp and Cpk values. The evaluation is updated with each completed billet.
- Retrieval of archived data: Any previously completed batch can be reloaded and displayed on the screen while the current batch is being measured uninterrupted in the background. The storage capacity is sufficient to store a summary of each billet for at least a two years production period!

Benefits:

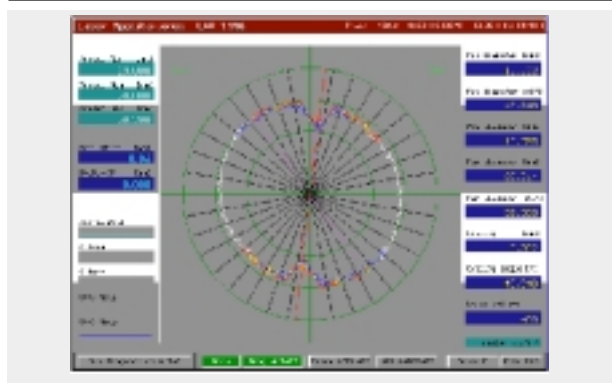
- Drastic reduction of run-in time after size or roller changes
- Maintain tighter tolerance limits
- Easy calibration check
- No wear of moving parts
- Reliable, almost maintenance-free operation
- High accuracy
- Real time display of cross section
- 100 % quality control
- Real time statistical evaluation
- Complete production documentation

LAP RDMS Track

The new hot gauge RDMS track is a joint development with SMS Germany. It is designed to measure simultaneously the true height and width of bars independently of any twist angle and combines the proven principles of the RDMS 4-axes hot gauge with the unique twist detection and twist tracking system (patent pending) of this latest LAP hot gauge – another convincing proof of the technological leadership of LAP. High accuracy and high measurement speed have made possible the revolutionary step towards automatic roll gap regulation of the finishing stands in bar mills. (SMS ASC) Besides fast and precise measurement of height and width for real time feedback control, the operator is supplied with additional information about ovality, twist angle, roller shift and roller wear.

Advantages:

Compact · Maintenance free · Rugged · Fast · Reliable





Width Measurement

The width measurement system consists of two LMS 6024 sensors and is designed for use in

- Continuous casting of slabs, blooms and billets
- Width measurement of slabs on a roller table
- Width measurement of hot rolled plates

The LMS 6024 work as independent distance sensors and are connected in master-slave-mode to measure the width independently from the position of the object in the measuring area. The system can output both width and shape information of the measured objects to a PC, PLC or central process computer via serial, parallel or analogue outputs.

Advantages:

- Accurate width results independent from material movements
- Shape and width can be measured simultaneously
- Easy interfacing to process control
- Variable measuring ranges
- Width measurement close behind caster exit possible
- Can be combined with LAP length and thickness gauges
- Sensors are mounted on the sides of, not above hot materials

Each sensor is installed in a cooling housing with individual turbo blower and air filter. Air flow control and temperature sensors in the cooling housing ensure safe operation of the system.

LAP can provide software for data evaluation and presentation on PC's according to customer specifications.

Thickness Measurement

The thickness measurement system consists of two LMS 6034 and is used in

- Hot plate rolling
- Cold plate rolling
- Sheet thickness measurement behind pickling bath
- Continuous casting of slabs and billets

The LMS 6034 is a compact laser distance gauge with high accuracy. The measurement range can be chosen between 300 mm and 2 meters, depending on the application.

Benefits:

- High accuracy, independent from material movements
- High measuring rate to measure in-line at any process speed

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- Various outputs for process integration
 - Temperature protected
 - Variable measuring ranges

Loop Regulation

LAP loop measurement systems are designed for loop control in almost every application in the steel industry. They are used for

- Loop control in strip annealing furnaces
- Loop control in rod and bar mills
- Loop control in strip coating processes

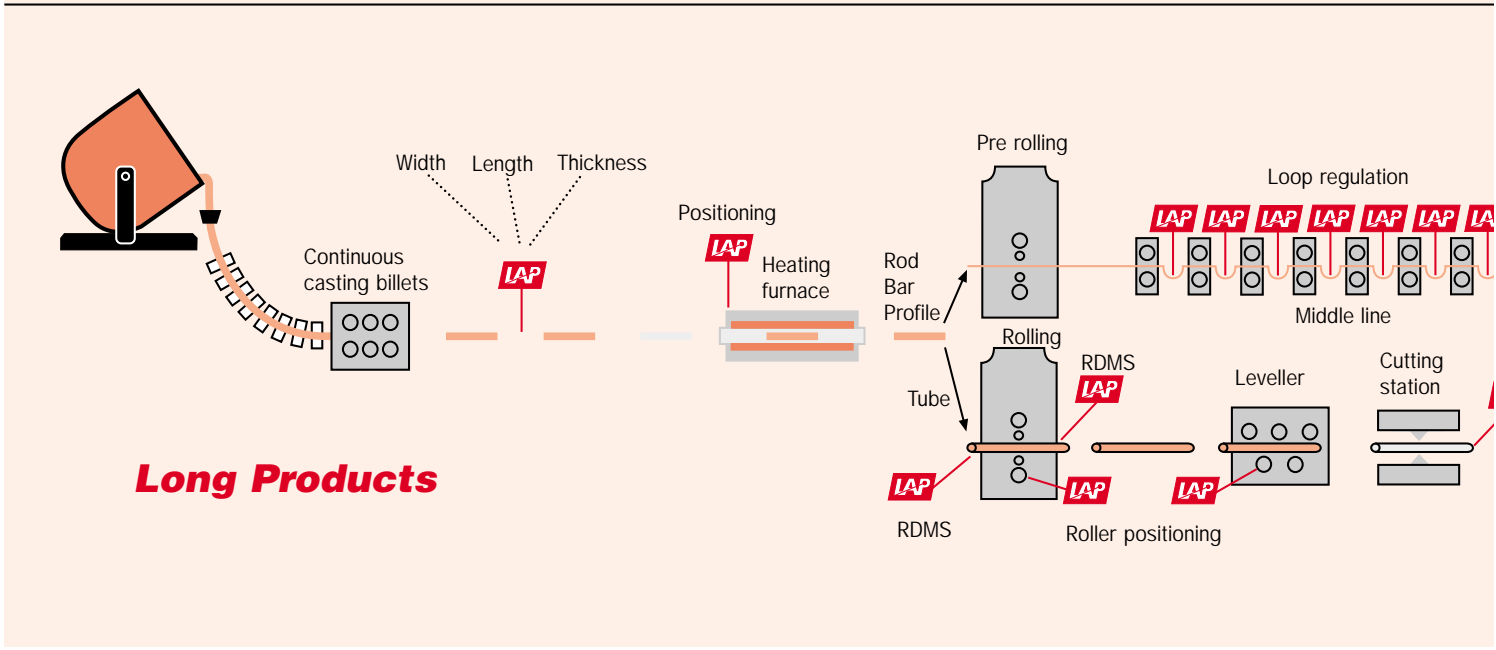
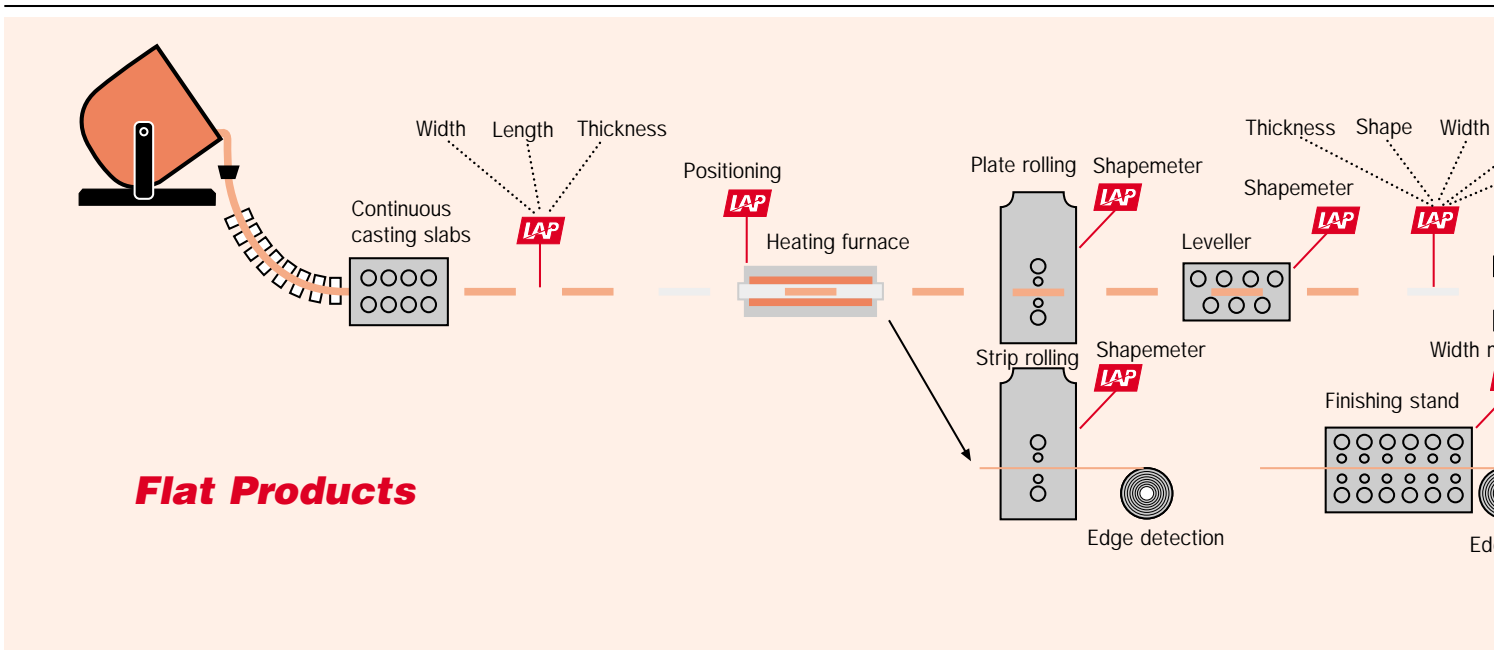
The loop measurement sensors for rod and bar are based on a high resolution CCD camera, using the object radiation as light source. The measurement range can be selected according to the application. The camera outputs a fast analogue signal for feedback process control. The camera controller offers many features like averaging filters, alarm outputs, offset and scaling functions. The camera is built in a protective housing with separate fan and filter system for secure operation under harsh environmental conditions in the rolling mill.

As loop sensor for flat products the LMS 6035S is used. This triangulation sensor with fixed measuring range of 2.000 mm outputs an analogue signal for process control. The analogue output can be scaled to represent any part of the full measurement range.

Benefits:

- High accuracy
- High speed analogue control signal
- Simple installation
- Rugged protective housings
- Reliable and stable process control
- Versatile setup options





Strip Edge Control / Strip Centerline Control

The LMS 6500 CCD camera is used for strip edge control, either with background light for cold materials or stand alone when measuring through radiation of hot objects. Strip position control is needed in

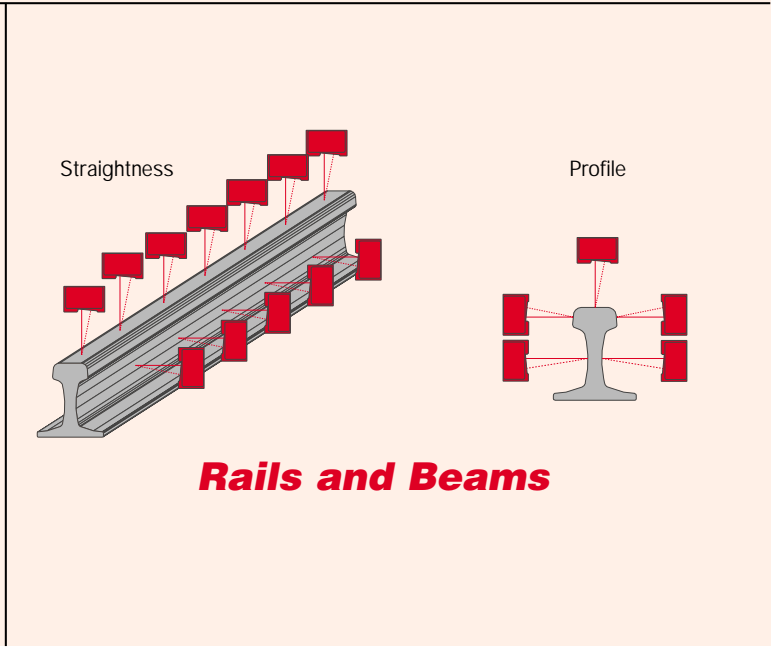
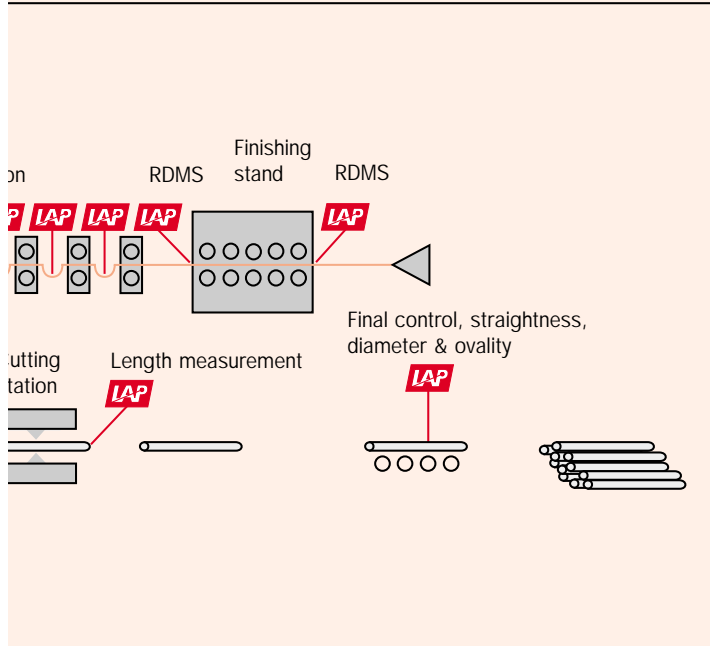
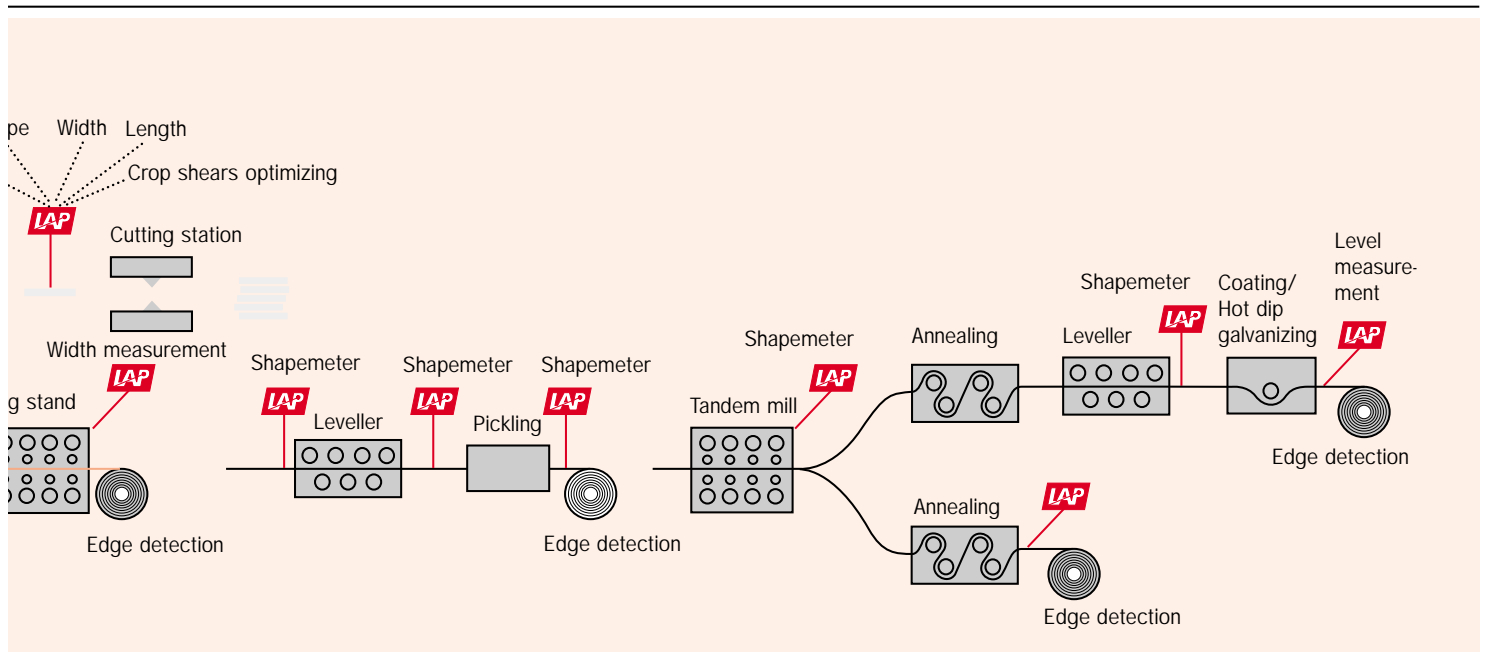
- Temper mills during strip rolling
- Electrolytic tinplate production
- Strip coiling
- Slitting processes

The fast and accurate measurement allows a precise and stable strip position regulation during production. Up to four LMS 6500

cameras can be connected to one controller. Each camera can output an analogue control signal if required. The resolution is 1/5000 of the chosen measurement range. A built-in LED bar display shows the actual strip or edge position and makes installation and adjustment easy.

Straightness Measurement

The LAP straightness gauges are used in flat, round and profile steel production. The measuring principle is to measure the bow height in relation to a fixed reference plane. Each system can be configured to measure in 3, 5 or more points. All measurements are



taken simultaneously to assure a correct reading during transportation. The straightness measurement systems can be combined with other gauges for additional dimensional control, if required. These systems are used in:

- Strip production
- Tube production
- Profile production
- Slitting lines
- Belt production

BRERAK is a combined width and straightness gauge for strip steel. It measures the width with a laser scanning micrometer or a CCD camera and the edge straightness with two additional CCD cameras. Straightness is measured in three points as a distance between the strip edge and a reference straight line, with subsequent

mathematical compensation of angular deviations of the object with respect to the reference straight line. Data presentation is made on a PC system through a special software. The system allows to create batch protocols, shift reports and product classifications. The PC screen shows straightness and width in real time, both as numerical figures and as graphical presentation. The actual tolerance limits will be shown in the graphics as well. Actual workload of the PC, date and time together with the batch ID, the strip ID and the selected class complete the user information. The main benefit of the BRERAK system is the real time information about width and straightness of steel strips during production.

Quality Control of Rails

High speed railways are very demanding upon the flatness and dimensional accuracy of rail profile. LAP has developed a laser system to check and document all relevant dimensions of rails during the final stages of quality control. This non-contact measuring system is installed behind the rail straightener and measures the following data "on the fly":

- Vertical flatness
- Horizontal flatness
- Height of rail and web thickness
- Width of rail head and rail base

Centering rollers guide the rails on the roller table through the measuring station. The laser gauges are installed on a rugged support frame. There are two laser scan micrometers to measure the base width; five laser distance gauges to determine the flatness of the rail head top; seven laser gauges to check the flatness of the rail head side and eight laser gauges for the control of important cross sectional dimensions. Laser precision photocells control the measuring sequence. The computer samples, analyses, displays and stores the measurement data and provides printed reports.

Advantages:

- Simultaneous measurement of flatness and cross section of rails
- Non-contact measurement, in-line
- Continuous control in production speed
- 100 % quality documentation

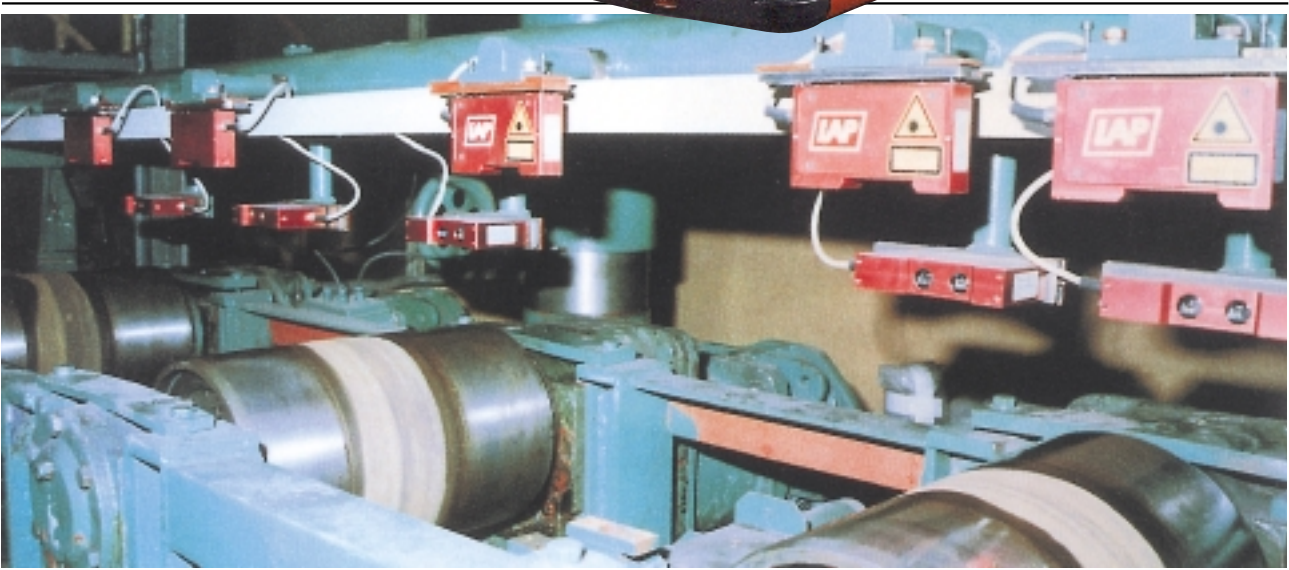
Positioning and Length Measurement

The LMS 6024, LMS 6034 and LMS 6035S distance sensors can be used as stand-alone gauges in several applications and locations of steel mills. LMS 6024 und LMS 6034 are specially suited to measure on hot materials of up to 1.300 °C. Typical applications are:

- Positioning of slabs and billets on the furnace charging side
- Length and width measurement of slabs, billets and rods
- Coil positioning and diameter measurement
- Measurement of coil side profiles
- Positioning of rollers during the rolling process

These measurement systems have serial and parallel outputs as standard. Analogue outputs are available as option. The 5000 pixel CCD array of these sensors provides high resolution and accuracy. The measurement ranges can be set according to the application needs. Following accessories are available:

- Heat/dirt protective housings with turbo blowers
- Versatile brackets for simple, yet accurate adjustment
- Hot object filter kit
- Automatic laser shutter



Touches nothing,
measures everything:
distance, thickness,
length, width, diameter,
velocity ...

Measures all dimensions!



Company Profile

LAP has been supplying laser systems for alignment, positioning and non-contact measurement since 1984.

We work jointly with our customers to develop solutions to meet their specific working conditions. This is our strength.



We design, manufacture and install optical systems, electronic circuitries, mechanical constructions and application software.



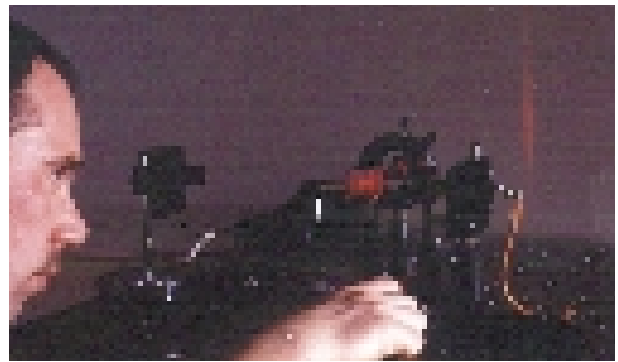
Steel Industry References

AB SANDVIK STEEL • ALCAN • ARBED • A.S.T. (Italy) • AVESTA SHEFFIELD • BHP (Australia) • BRITISH STEEL • CSC (Taiwan) • DALIAN (China) • DILLINGER HÜTTENWERKE • EBG • ERASTEEL • FAGERSTA STAINLESS • FUNDIA • HSW • KRUPP-HOESCH • MANNESMANN • NEDSTAAL • OVAKO • PREUSSAG • RAUTARUKKI • SIDBEC (Canada) • SMS • SSAB • THYSSEN • VOEST ALPINE • WISCO (China)



Our highly qualified, motivated team, supported by local suppliers and international partners, provide us with the capacity to supply long lasting, reliable systems to customers throughout the world. Our strict quality control procedures have received ISO 9001 accreditation.

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