



Measuring Systems in Hot Strip Mills

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Contents

4	Measuring Technology in the Steel Industry
5	Development of new Measuring Systems – Continuity at IMS
	Applications
6	Heavy Plate Mills
8	Hot Strip Mills
10	Continuous Casting Plants
12	Steckel Mills
	System Description
14	Thickness Measurement
15	Profile Measurement Twinset
16	Profile Measurement Three-head
17	Profile Measurement MiniMaster
18	Profile Measurement MultiMaster
19	Width Measurement
20	Flatness Measurement TopPlan
21	Possible uses of Isotope and X-ray Radiation
22	Cooling of the Measuring Systems
23	Automation System MEVInet
24	MEVInet-M
	MEVInet-V
25	Quality Management System – MEVInet-Q
26	Breaking Barriers through Optimisation
27	Our Experience – Your Advantage

Measuring Technology in the Steel Industry



The steel industry is a fascinating world of large material and energy flows, high temperatures, large tonnages and high-speed production plants. The steel industry is quintessentially a 24/7 industry.

Users expect not only excellent processing properties and usage characteristics, but also high lifetime, long-term value and high quality from modern materials. Only technically superior products – steel products of maximum precision – survive the competition in the market.

Thanks to constant improvements in its strength and formability, steel can be produced in ever smaller dimensions – and with ever tighter dimensional tolerances. Finished coatings on steel strip are becoming thinner and more effective with ever more complex layer structures. The strip behaviour and mechanical dimensions are virtually constant along the complete length and width of a rolled steel coil.

To meet these high demands, the steel industry needs innovative, high-precision on-line measuring techniques with intelligent quality management and analysis systems.

The measuring processes and technologies described in this brochure are, together with optimised process models, precision control loops and appropriate regulating elements, the prime pre-requisites for achieving the high level of product quality required from high-speed continuous production processes. Maximum availability and reproducible measuring results ensure the high process stability required for continuous operation.



Development of new Measuring Systems

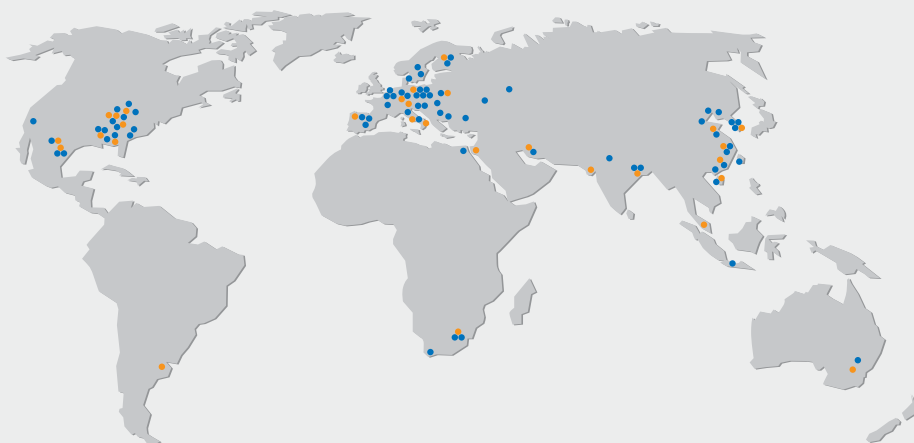
Continuity at IMS

IMS works tirelessly developing measuring systems for the improvement of thickness, profile, width and flatness in rolling mills.

In parallel with technical developments for equipment improvement such as

- hydraulic adjustment
- fast work roll bending systems
- slide rolls in conjunction with mathematical models for roll force, profile and flatness

IMS measuring systems also undergo continuous optimisation in terms of accuracy, resolution and dynamic performance.



Profile and flatness measuring systems from IMS worldwide

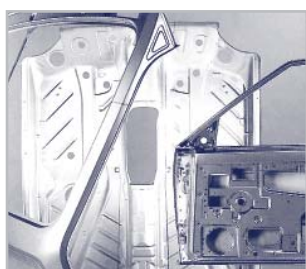
- TopPlan
- Profile measurement

Output and profitability in the production of heavy plate and hot wide strip depends on, among other factors, compliance with the prescribed tolerances for thickness, profile, width and flatness. The ideal is a

product with constant thickness and width, and a constant prescribed profile along the complete length of the coil – a product without flatness errors and with minimised residual stresses.

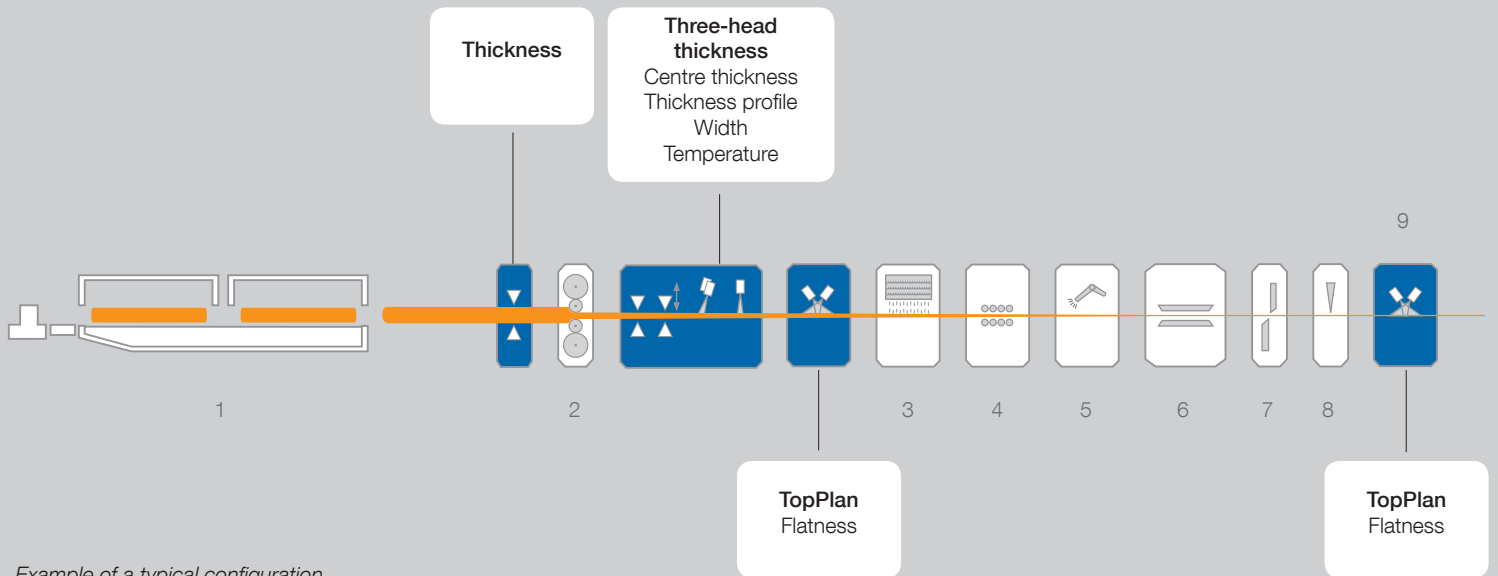
Today IMS can offer multi-function measuring systems for the continuous measurement of the following parameters:

- thickness
- profile, wedge and crown
- height distribution, position, cross and length contour
- flatness and shape
- temperature and temperature profile
- width
- turn-up/turn-down, head and tail shape
- camber
- speed and length

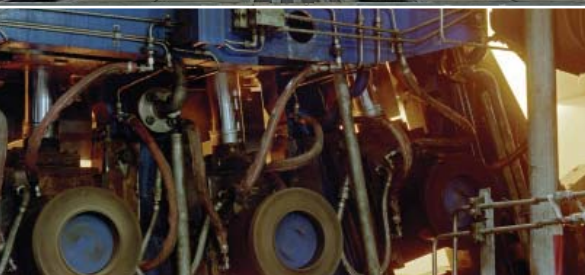




Application Heavy Plate Mills



Example of a typical configuration of a heavy plate mill

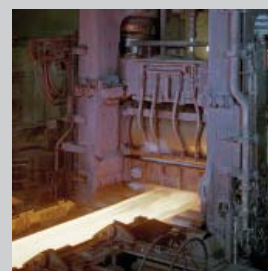


Heavy plate, in the thickness range 3–250 mm, is currently available in virtually all alloyed and non-alloyed steel grades. Highly technical processes such as normalising and thermo-mechanical rolling are used not only to produce sheet steel, with a maximum thickness of 3 mm, but also heavy plate.

The result is a material whose mechanical-technological characteristics are tailored specifically for later use in the manufacture of oil rigs, pipelines, bridge girders, excavator shovels, pressure tanks and ships.

Heavy plate must pass commensurately strict quality tests before being approved. For all rolled products, the mechanical properties and dimensions must be kept constant to the highest degree over the length and cross section of the product.

- 1 Reheating furnace
- 2 Mill stand
- 3 Cooling section
- 4 Hot leveller
- 5 Marking machine
- 6 Double trimming shears
- 7 Cut-to-length shears
- 8 Laser cutting machine
- 9 Inspection line / Final inspection



*Mill stands
in heavy plate mills*

The following measuring systems are integrated into one overall gauging system in this example of a typical Heavy Plate Mill configuration:

- a thickness measuring system is installed at the entry to the Mill stand
- after the Mill stand a three-head or multi-channel measuring system is installed for the measurement of thickness, profile, wedge and crown, temperature and temperature profile, speed and length
- the optical system TopPlan is installed to measure flatness, camber and turn-up/turn-down, this system can be installed at the entry or exit of the Hot and/ or Cold Leveller
- optical width measurement after the Mill stand, focussed on the end product
- in the Dressing and Straightening Line the cold plate dimensions are re-checked for quality control purposes

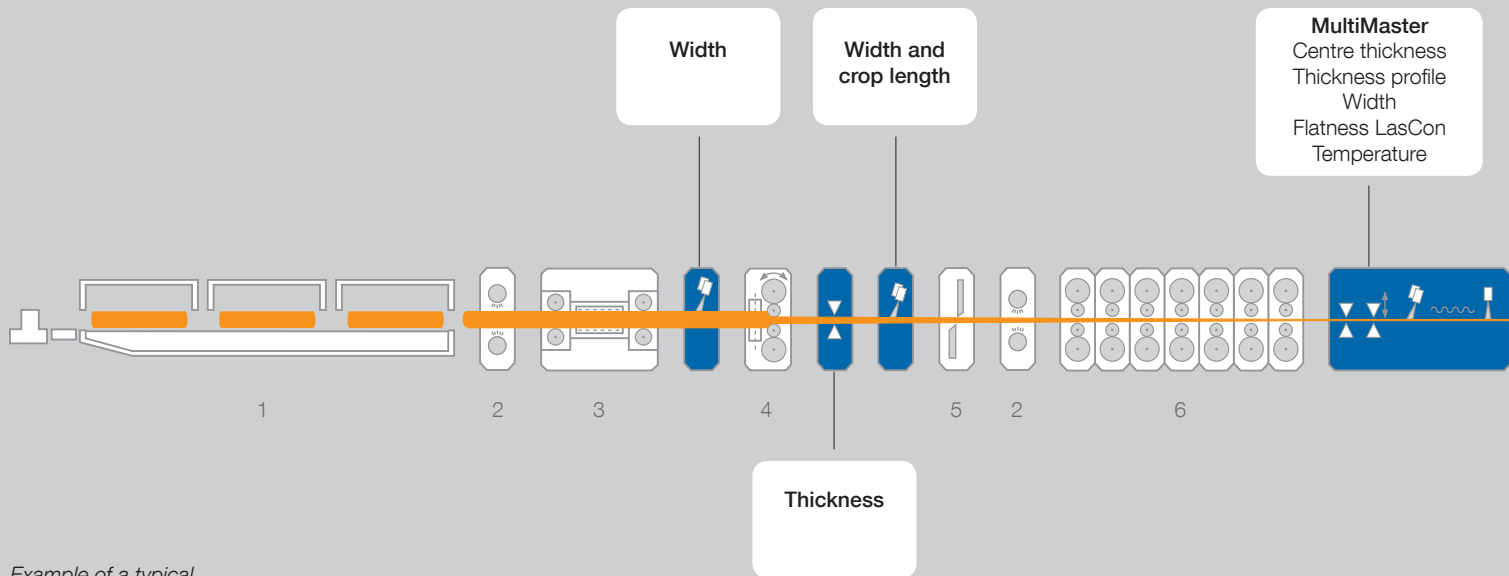
Profile and flatness measuring systems are often installed in combination at the Mill exit. The thickness measuring range is usually 2 to 150 mm at widths of up to 5.5 m and speeds of up to 7 m/s.

Detection method and measured variables

Radiometric	Optical	Laser
Thickness	Height value	Speed
Crown and wedges	Ripple	Length
	Flatness	
	Turn-up/down, head shape	
	Camber	
	Width	
	Temperature	



Application Hot Strip Mills



Example of a typical hot strip mill configuration



IMS has been equipping Hot Strip Mills with strip profile measuring systems for more than 20 years. Modern and revamped Mills are now equipped with fourth generation multi-channel profile measuring systems. X-ray measuring technology is used exclusively for these measurements. In addition, optical systems are used for the measurement of position, width, contour and flatness.

Although X-ray measurement has significant advantages over isotope measurement, it is restricted to a maximum strip thickness: isotope measurement still have their uses. IMS has been using X-ray technology in Hot Strip Mills since 1998.

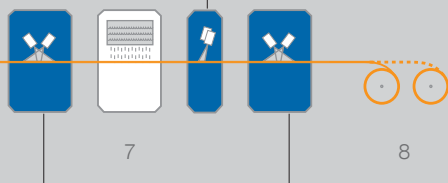
The following IMS measuring systems are integrated into one gauging system in this example of a typical Hot Strip Mill configuration:

- width measurement at the Roughing Mill entry

- isotope profile measurement at the Roughing Mill exit
- width and crop length measurement and optimisation system
- multifunctional measuring system *MultiMaster* for the measurement of centre line thickness, profile, width and flatness at the Finishing Mill exit
- *TopPlan* flatness measurement at the finishing line
- width and flatness measurements at the Coiler
- temperature and temperature profile measurements at the Roughing Mill, Finishing Mill and Coiler

The width of the transfer bar is set at the Roughing Mill. The input variable for width control is the measured width with precise determination of the transfer bar location. For control of the Crop Shear, the head and tail shapes of the transfer bar are measured during the last pass, and the crop lengths calculated.

Width



TopPlan
Flatness

TopPlan
Flatness

- 1 Reaheating furnace
- 2 High-pressure water descaler
- 3 Upsetting press
- 4 Four-high roughing stand
- 5 Cropping shears
- 6 Finishing mill
- 7 Cooling section
- 8 Coiler

Systems for the measurement of width and flatness are based on optical measuring techniques, while thickness and profile are measured radiometrically. Isotope measuring systems are usually located after the Roughing Mill and X-ray measuring systems after the Finishing Mill.

The configuration shown has backup functions for strip flatness, strip thickness and strip width. It is therefore possible to carry out maintenance work while production is running.



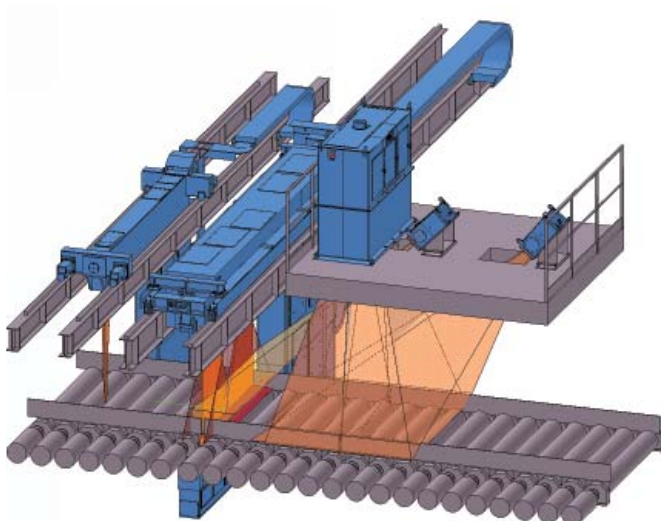
Roughing mill



Roller table



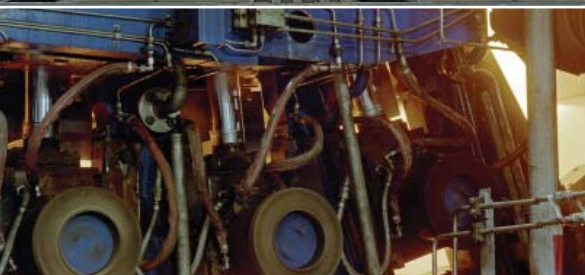
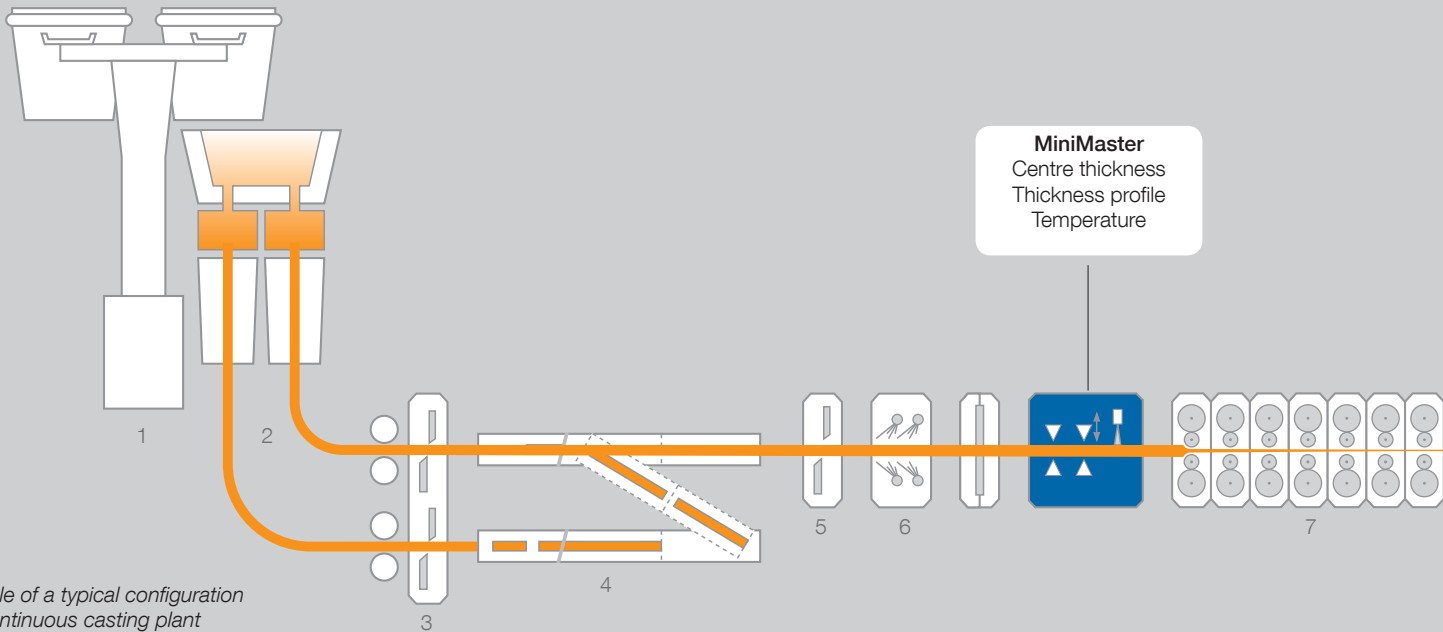
Finishing Mill



Profile and TopPlan flatness measurements



Application Continuous Casting Plants



The introduction of continuous casting technology in 1989 laid the foundation for a fundamental change in the production of hot strip worldwide. This technology won acceptance by the market in the early 90s.

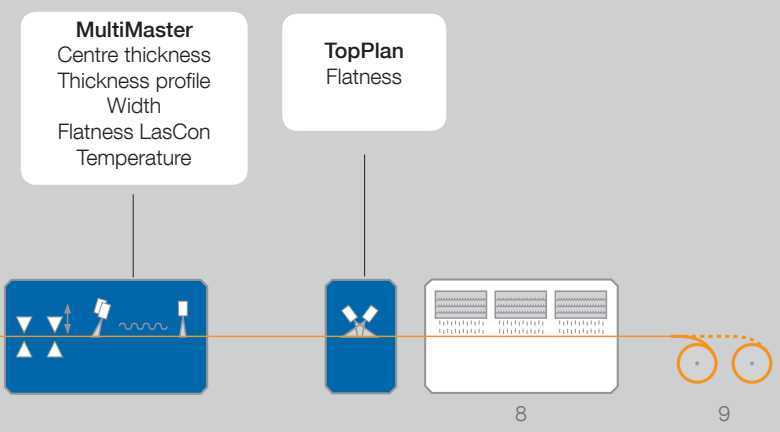
IMS has accompanied this technology from the start and contributed significantly to improving product quality. The measuring methods known from conventional Hot Strip Mills are also used in Continuous Casting plants. Due to the thin dimensions at high rolling speeds, the measuring systems have been adapted to this technology.

Additional thermal stresses on the measuring systems caused by semi-continuous rolling have been

eliminated by suitable measures. These days, the thickness tolerances achieved in hot strip measurement today are comparable with those achieved in the cold rolling sector.

This decrease in hot strip thickness has made it necessary for the flatness to be improved radically in the production process. The measuring system *MiniMaster* was developed for installation at the entry section to the Finishing Mill. The systems used in hot strip applications are used for fast level 1 control loops and for supporting mathematical models for crown, width, contour and flatness.

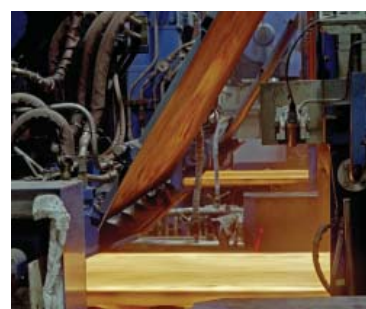
In future, these values will be measured and assessed directly on the thin slab during casting.



- 1 Ladle turret
- 2 Casting machine
- 3 Shears
- 4 Continuous furnace with swivel table
- 5 Emergency shears
- 6 Water descaler
- 7 Finishing mill with interstand cooling
- 8 Cooling section
- 9 Coiler

In this example of a Continuous Casting plant operation, possible locations for the different measuring systems are shown:

- profile measuring system *Multi-Master* for the measurement of centre line thickness, profile, width, flatness and temperature at the exit of the Finishing Mill
- *TopPlan* flatness measurement at the entry to the Cooling Section
- profile measuring system *Mini-Master* for the measurement of centre line thickness, profile and temperature at the entry to the Finishing Mill



Casting machine

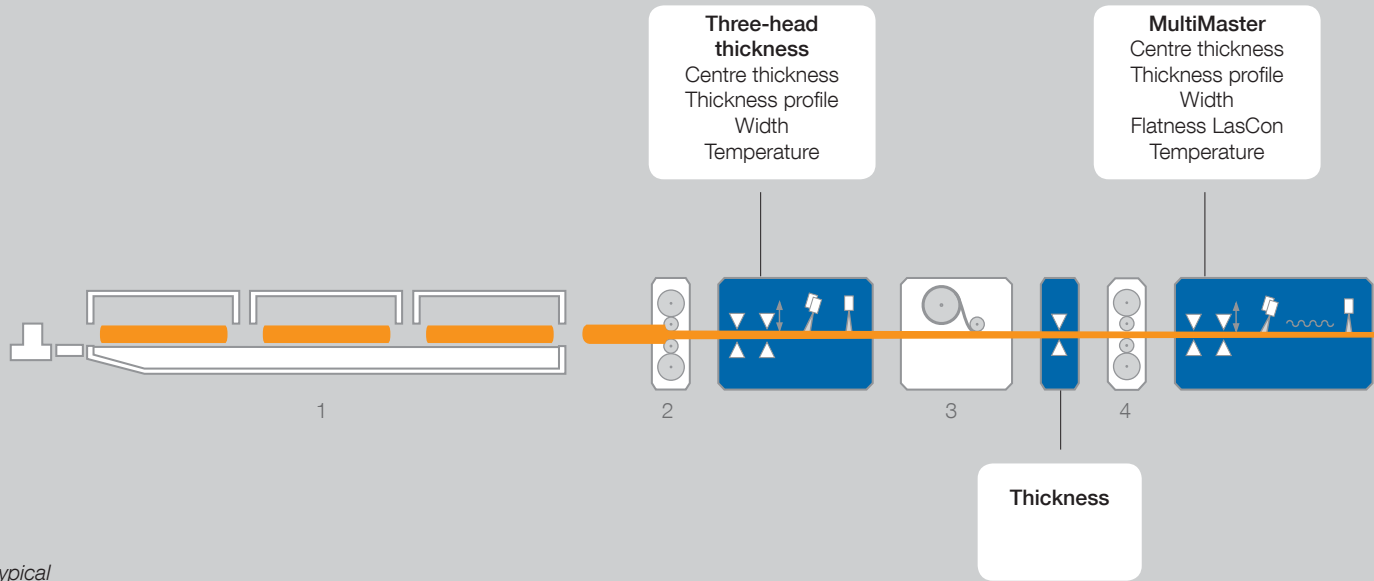


Twin-stand slab casting machine





Application Steckel Mills



Example of a typical steckel mill configuration



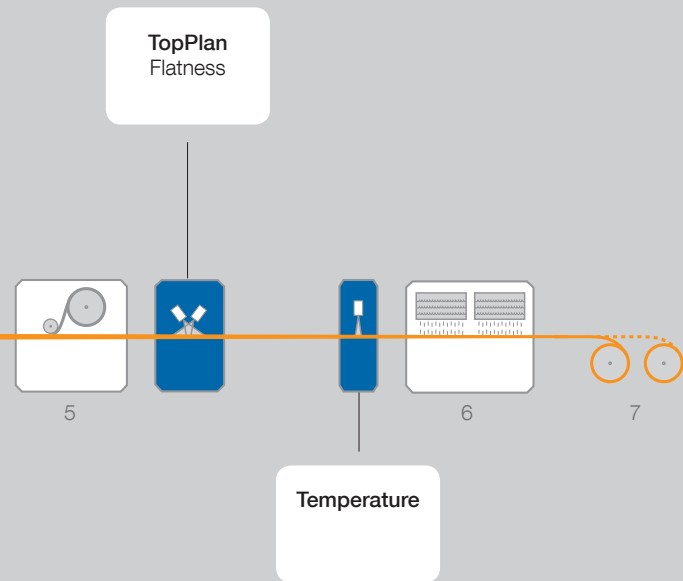
A complete Steckel Mill plant usually consists a four-high Roughing stand, a Reversing Mill stand, and two Coil Boxes (mostly gas-heated) in which the strip temperature is maintained during the rolling process.

Both heavy plate and hot strip products with manufacturing thicknesses similar to those of a wide Hot Strip Mill are often rolled in a Steckel Mill.

In spite of the confined space, due to the close proximity of the Coil Boxes

to the Mill stand, IMS has successfully installed specially adapted multi-channel profile measuring systems in various Steckel Mills.

These measuring systems are incorporated within one overall gauging system providing simultaneous measurement of thickness, profile, width, temperature and flatness directly at the exit of the stand.



- 1 Reaheating furnace
- 2 Roughing mill
- 3 Coil box 1
- 4 Steckel mill
- 5 Coil box 2
- 6 Cooling section
- 7 Coiler

The following IMS measuring systems are integrated into one gauging system in the above example of a Steckel Mill:

- three-head isotope profile measurement, after the Roughing Mill
 - isotope or X-ray thickness measurement between Coil Box 1 and the Steckel Mill
 - multifunctional measuring system *MultiMaster* for the measurement of thickness, profile, width and flatness between the Steckel Mill and Coil Box 2
- *TopPlan* flatness measurement at the exit of the Steckel Mill, before the Cooling Section
 - temperature and temperature profile measurements can be installed at every measuring location



Roughing mill



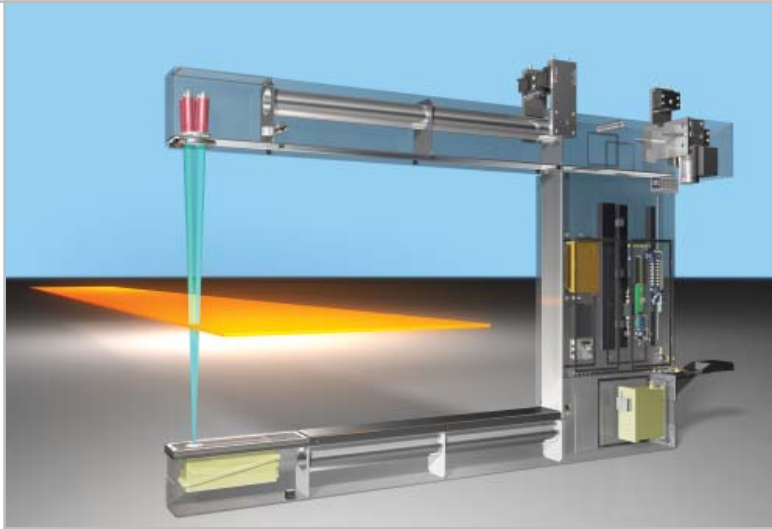
Coilbox



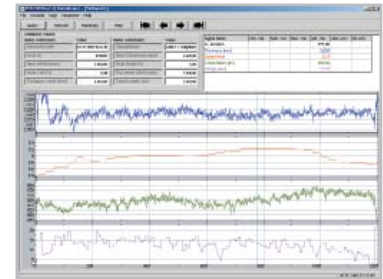
Cooling section

System Description

Thickness Measurement



Profile measurement



The thickness measurement provides precise measurement of strip thickness at the centre line position. The measured thickness is transmitted to the master AGC control system for thickness control along the length of the coil.

The thickness measurement can also be designed to provide cross-strip profile data. In this case the C-frame is made to scan the strip width continually.

For precision measurement of the profile, it is necessary to take into consideration the centre line thickness variation along the length of the coil. Since it is not possible to measure the centre line thickness and the profile at the same time, either the strip must remain stationary during profile measurement, or the

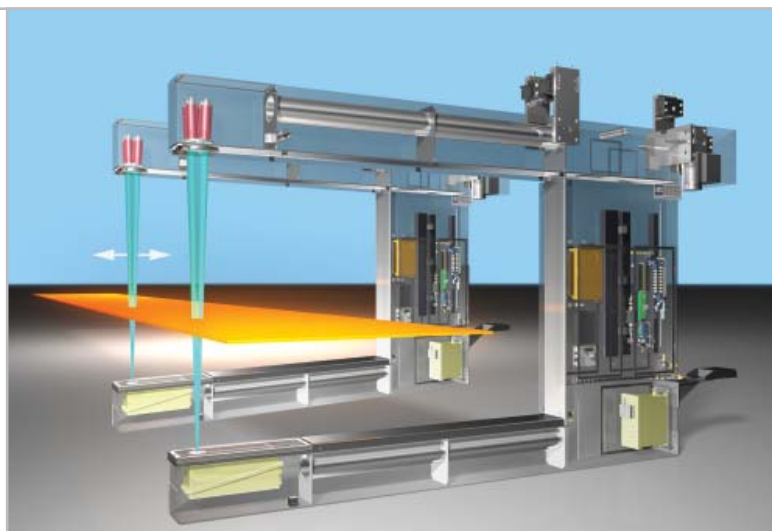
thickness variation along the length of the coil must be negligibly small.

Isotope or X-ray radiation may be used as the source of radiation, depending on the measuring range. If there is a free choice, X-ray sources are preferred because they contribute to higher accuracy measurement.

If X-ray sources are used, the thickness measurement can ideally be equipped with a strip position angle compensation function. In this case the strip thickness is measured accurately, even without strip tension, when the strip may be oriented at various angles and passline positions within the C-frame measuring gap.

System Description

Profile Measurement Twinset



Profile measurement Twinset

The Twinset profile measurement consists of two separate C-frames. At the entry side of the Mill, one C-frame measures the centre line thickness of the strip. A second, scanning C-frame located at the exit side of the Mill provides cross strip profile data as it scans backwards and forwards across the strip.

This C-frame can also provide a measurement of strip centre line thickness, if it is positioned permanently at the centre of the strip.

The measuring system measures the following parameters:

- centre line thickness
- strip centre line temperature
- profile, wedge and crown
- temperature profile

The profile is calculated from the difference between the strip centre line thickness at the Mill entry and the strip profile at the Mill exit. The distance between the entry C-frame and the exit C-frame is taken into consideration.

The Twinset profile measurement provides an inexpensive method of measuring correct strip profile provided that the strip remains flat on the roll table (i.e. at the correct passline). Any degree of non-flatness in the strip during scanning will lead to incorrect profile measurement.

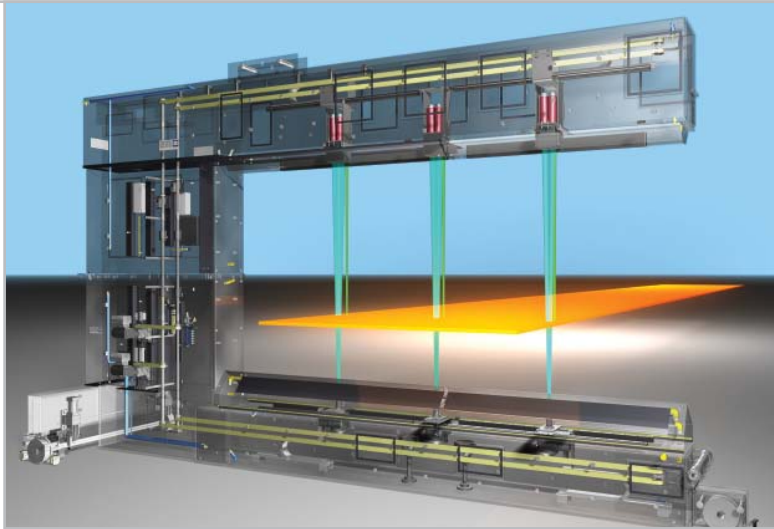
Furthermore, the number of cross profile scans is limited to between one and five depending on the length of the coil (or transfer bar), and the transport speed. Due to the

relatively long control loop response time, on-line profile control is not feasible. And, under certain circumstances, it is possible that changes in the profile – and therefore changes in the wedge and crown over the coil length – will not be measured accurately.

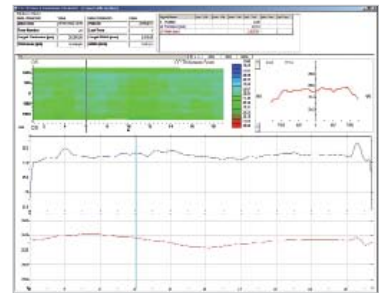
Depending on the radiation beam geometry, one or two detectors are arranged in the strip length direction in order to achieve the required measuring resolution, i.e. the smallest measured width in the cross strip direction. The higher statistical noise obtained with a small number of detectors is disregarded.

System Description

Profile Measurement Three-head



Three-head profile measurement



The three-head profile measuring system is the standard IMS measurement for Heavy Plate Mill applications and measures the following parameters:

- centre line thickness, edge thickness, wedge and crown
- profile
- width
- temperature
- length

The three measuring heads are built into one C-frame – one centre head and two edge heads. The two edge heads are able to scan the plate width, but normally remain in their respective edge positions. The centre head remains stationary at all times. Each measuring head is equipped with a temperature pyrometer.

The edge measuring heads are also equipped with CCD cameras for the measurement of plate edge position. The outputs from these cameras are used for the measurement of plate width. At plate temperatures above 750°C, the CCD camera in each edge head measures the plate position by detecting the infrared radiation from the plate. At temperatures below 750°C light from a backlight situated under the roll table is used as the light source.

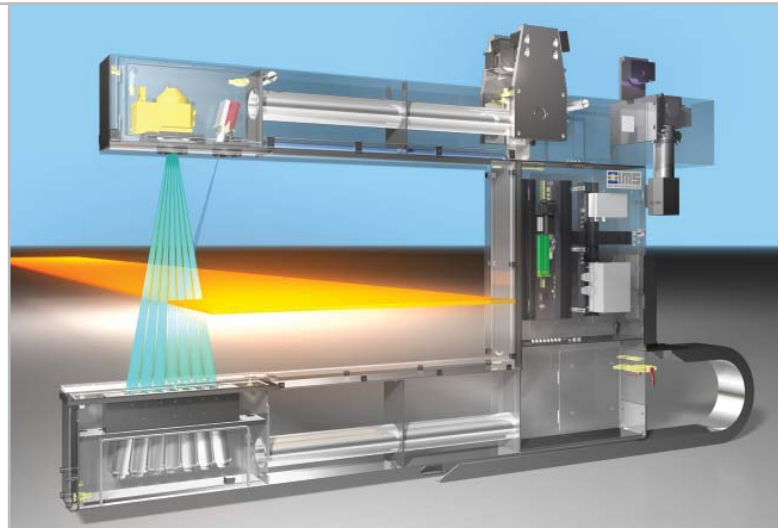
An adaptive laser device mounted in the upper section of the C-frame provides a constant measurement of plate length. With the plate length value it is possible to locate the thickness, width and temperature values in their correct positions along the length of the plate.

In normal operation the edge heads are positioned at prescribed fixed distances from the plate edges. Due to horizontal plate movements, camber formation and/ or changes in the plate width, it is necessary to readjust the edge head positions to their prescribed nominal positions. In order to achieve this, the positions of both plate edges are measured continually by the CCD cameras and the edge heads repositioned as necessary. The plate width is calculated from the difference between edge head positions and the distance between the edge heads.

Usually, the plate speed and the relatively small plate lengths make it impossible to carry out a complete cross profile scan during a single pass. Therefore cross profile is only measured on stationary plates.

System Description

Profile Measurement MiniMaster



Profile measurement MiniMaster

The *MiniMaster* measuring system offers an inexpensive solution to the measurement of strip profile in Continuous Casting plants and provides the following measurements:

- centre line thickness
- profile, wedge and crown
- width
- temperature

The top arm of the C-frame is equipped with an isotope radiation source, while the bottom arm contains up to 13 ionisation chamber detectors.

The measurement is located at the entry to the Finishing Mill and provides feed forward information to the Finishing Mill control computer. In the Continuous Casting plant defects from the casting section are

identified immediately, especially wedge and profile problems in the incoming bar. These errors, which originate in the Roughing Mill, are also detected in conventional Hot Strip Mills.

A special feature of the *MiniMaster* measurement is the scanning C-frame, which enables simultaneous measurement of centre line thickness and cross profile. Furthermore, the scanning periods – and therefore the cycle times of the profile measurement – are reduced by virtue of the multiple detector arrangement in the C-frame.

The C-frame is driven by a rack and pinion device mounted on a drive beam. The supports for this beam are located outside the roll table. The complete drive system, includ-

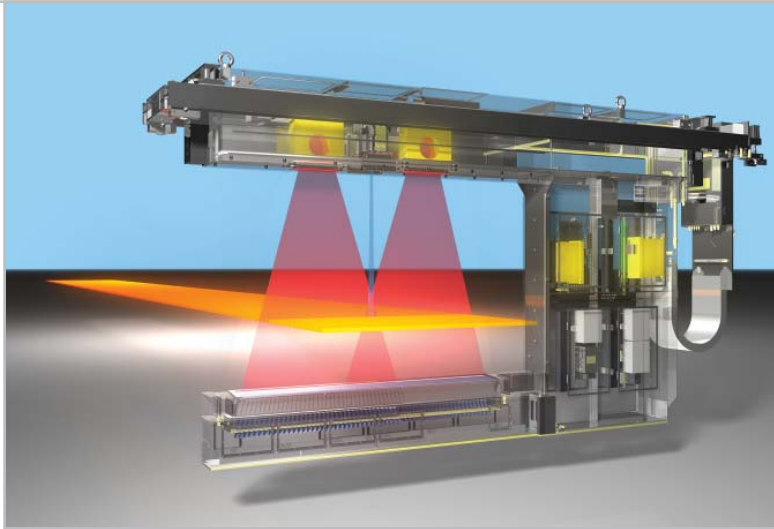
ing the drive unit, is located in a protected area and is not exposed to the harsh environmental conditions at the measuring position.



Profile measurement MiniMaster

System Description

Profile Measurement MultiMaster



Profile measurement MultiMaster

The profile measuring system *MultiMaster* is the most inclusive of the multi-channel profile measurements, providing a truly multi-function capability. The earlier stereoscopic arrangement of radiation sources and detectors has been replaced by a laser-contour system (*LasCon*) consisting of two laser lines projected on to the strip/plate surface, and a CCD matrix camera. The profile measuring system measures the following parameters:

- centre line thickness
- profile, wedge and crown
- width
- flatness
- strip position and strip contour in the cross and longitudinal (rolling) directions
- temperature, and optionally, temperature profile
- optionally, speed and length

The upper arm of the C-frame contains two X-ray sources and two laser systems. The bottom arm contains ionisation chamber detectors arranged in a single line along the length of the C-frame, thereby rendering it unnecessary to install an apron plate between the two rolls either side of the C-frame.

Further advantages of this system are:

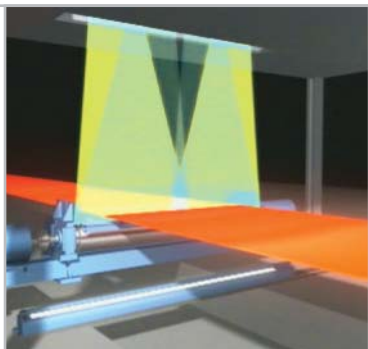
- precise determination of strip position and strip contour in the strip longitudinal and cross directions
- determination of the strip width and side shift taking into account the cross contour of the strip
- compensation for the effects of cross *and* length angles of the strip – the only system in the world that measures and compensates for the effects of variations in strip length (pass) angle

These profile measuring systems are used in modern Hot Strip and Steckel Mills where exacting demands are placed on product quality.

MultiMasters in isotope version are used in heavy plate mills and roughing stands of hot wide strip mills.

System Description

Width Measurement



Width measurement with scanning cameras

Optical measuring systems have a long tradition at IMS. We manufacture single and multi-camera systems to measure the width, position and diameter of hot and cold rolled products. The measuring methods applied depend on the application. CCD cameras are used as detectors. They are either integrated in a fixed position housing or mounted on a linear drive beam unit enabling variable positioning.

For hot strip (> 750 °C), the infrared radiation from the strip provides the light source for the detectors. For lower strip temperatures (< 750 °C), the light source is provided by a backlight. In other optical measuring systems, lasers are used for highlighting the contours of the measuring object.

Thanks to the use of high-performance cameras, modern computer

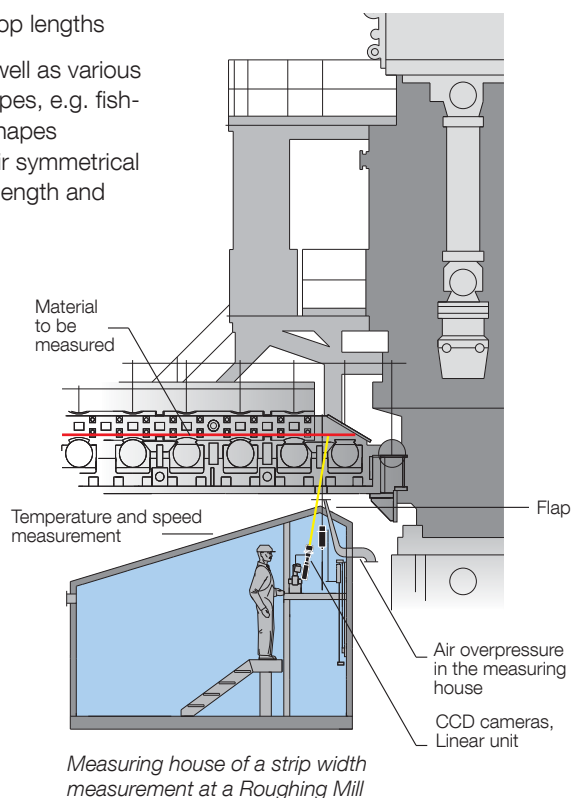
technology paired with high transmission speeds, as well as laser light sources, the following additional functions can be integrated into the complete system:

- detection of pin holes and edge cracks
- 3D measurement of the strip position in the measuring gap
- measurement of slab edge contours
- detection of plate and transfer bar head and tail shapes for the determination of crop lengths

Numerous parameters are taken into account for the calculation of crop length:

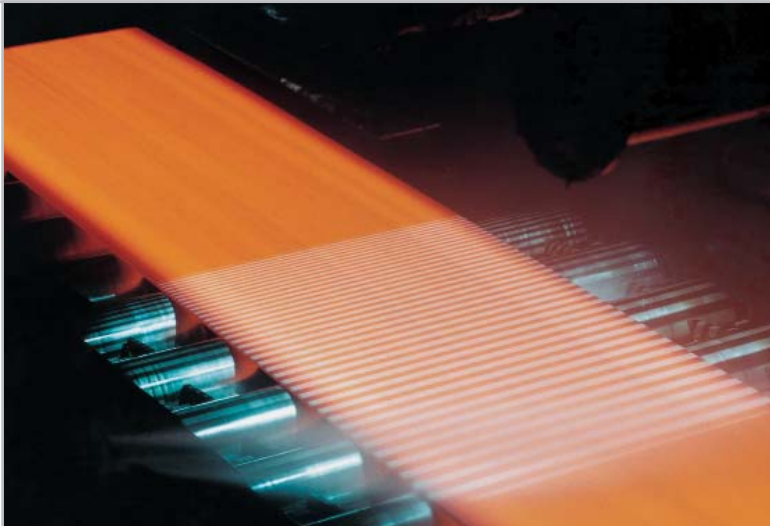
- safety margins and allowances for samples
- min. and max. crop lengths
- width profile, as well as various head and tail shapes, e.g. fish-tail and tongue shapes together with their symmetrical properties in the length and width directions

Optical measuring systems are designed and engineered for use in extreme environmental conditions. The cameras work at extremely high scanning rates so that water, steam and scale have negligible influence on the final measurements. Statistical analyses are applied for further checks of measured data plausibility.

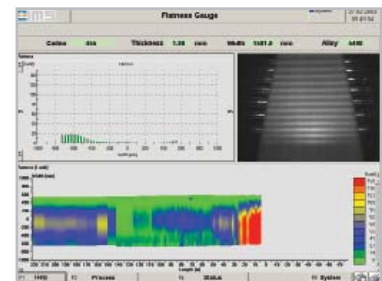


System Description

Flatness Measurement TopPlan

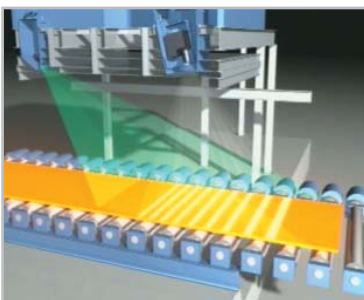


Flatness measurement TopPlan



For flatness measurement, IMS provides an optical measuring system which works on the principle of the “projected fringe” technique. The measuring system is referred to as TopPlan topometric flatness measurement.

In Hot Strip and Continuous Casting plants flatness is measured after the Finishing Mill and the measured data transmitted to the profile and flatness control system. There is only a short time available for



Flatness measurement TopPlan

measurement before the Coiler tension comes into effect. The flatness measured value must therefore be available in a highly accurate form, immediately after the strip head enters the measuring gap, so that the control system can react quickly. Up to 60 software “fibres” are produced across the width of the strip. This compares to typically 9 points of measurement across the strip width with conventional laser systems.

In Heavy Plate Mills high demands are placed not only on the flatness, but also on the straightness of the plate. The aim is to achieve a flat-parallel plate without crown, ripple, turn-up/turn-down or twisting.

Typical applications for flatness measurements are:

- after the Reversing Mill
- after the Hot Leveller
- after the Cold Leveller
- in Dressing and Straightening Mills
- at the Inspection stage

Very high demands are placed on the accuracy of plate surface height distribution measurement in Dressing and Straightening Lines and at the plate inspection stages, as the end product is manipulated and verified according to prevailing standards.

Possible uses of Isotope and X-ray Radiation

Isotope sources and X-ray tubes are used as radiation sources.

Isotope sources emit monochromatic radiation. X-ray tubes, by contrast, emit an energy spectrum that depends largely on the high-voltage applied to the tube. The maximum thickness of steel that can be measured using X-ray radiation is 50 mm. The use of X-ray technology for the measurement of higher thicknesses is uneconomical.

In Hot Strip Mills, isotope measuring systems are used at the Roughing Mill stage, and X-ray systems at the Finishing Mill and Coiler locations.

X-ray systems from IMS are operated at a fixed high voltage for the following reasons:

- maximum X-ray tube lifetime by maintaining the tube under constant load
- low load on the X-ray tubes through low operating parameters; nominal values: 3 kW, 225 kV, 10 mA; typical actual values: 0.4 kW, 155 kV, 2.5 mA
- no drifting of the tubes due to temperature changes on adjustment of the high voltage

Isotope and X-ray radiation can be detected using different technologies, e.g. with scintillation counters, semiconductors and ionisation chambers.

IMS uses only ionisation chambers because they offer the following major advantages:

- very high sensitivity and therefore high signal yield across a wide range of radiation energies – from ca. 5 keV to 1 MeV
- insensitivity to environmental influences including temperature variations
- long operating life – they are not subject to wear and tear
- not affected by exposure to maximum and direct radiation; the radiation intensity does not have to be attenuated by additional absorbers in order to protect the ionisation chambers
- design, chamber volume, gas type, gas pressure, etc. can be adapted to the measuring task



X-ray tube



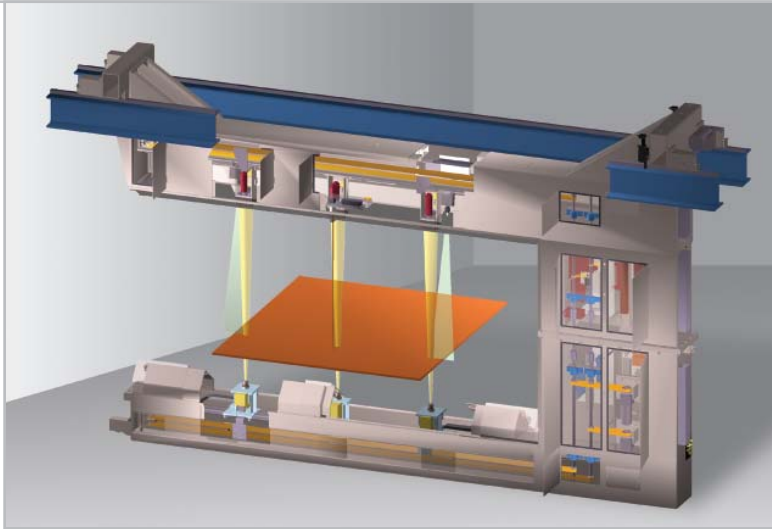
Ionisation chamber



Source holder

Radiation source	X-ray tube	Isotope
Radiation energy	20–130 keV	662 keV
Max. thickness (steel)	0–50 mm	0–150 mm
Time constant	1–5 ms	25 ms
Measuring point	2 mm	25 mm

Cooling of the Measuring Systems



Three-head thickness measurement

Due to the high radiant heat from the strip/plate during the rolling process in Hot Strip and Heavy Plate Mills, it is necessary to cool the measuring systems. To withstand the high thermal stresses reliably for many years of operation, IMS uses water-cooled, double-walled C-frames and protective enclosures made usually of stainless steel.

The use of X-ray technology in measuring systems makes additional cooling of the X-ray tubes necessary because they operate at very high temperatures.

Gauges and X-ray tubes are cooled by cooling water flowing in closed secondary cooling water circuits installed in supply cubicles developed and manufactured by IMS. Each secondary circuit is designed for the

separate cooling of the C-frame, X-ray tube and other components. The accumulated heat is removed by the customer's primary water as it flows through a stainless steel plate heat exchanger in the primary cooling water circuit. The necessary cooling flow rates are controlled thermostatically. Temperature, pressure and flow are monitored.

Thermocouples measure the actual operating temperatures in the C-frame and protective enclosures. Alarms and fault conditions are transmitted to the main control system when limit values are exceeded.



Supply cubicle

Automation System MEVInet

MEVInet is a standardised system developed by IMS for use in the fields of measurement and control, data display and quality management in automation systems in rolling mills.

The hardware consists of industrial PCs and field bus and Ethernet technology. MEVInet consists of the subsystems MEVInet-M, MEVInet-V and MEVInet-Q depending on the particular tasks required of the gauging system.

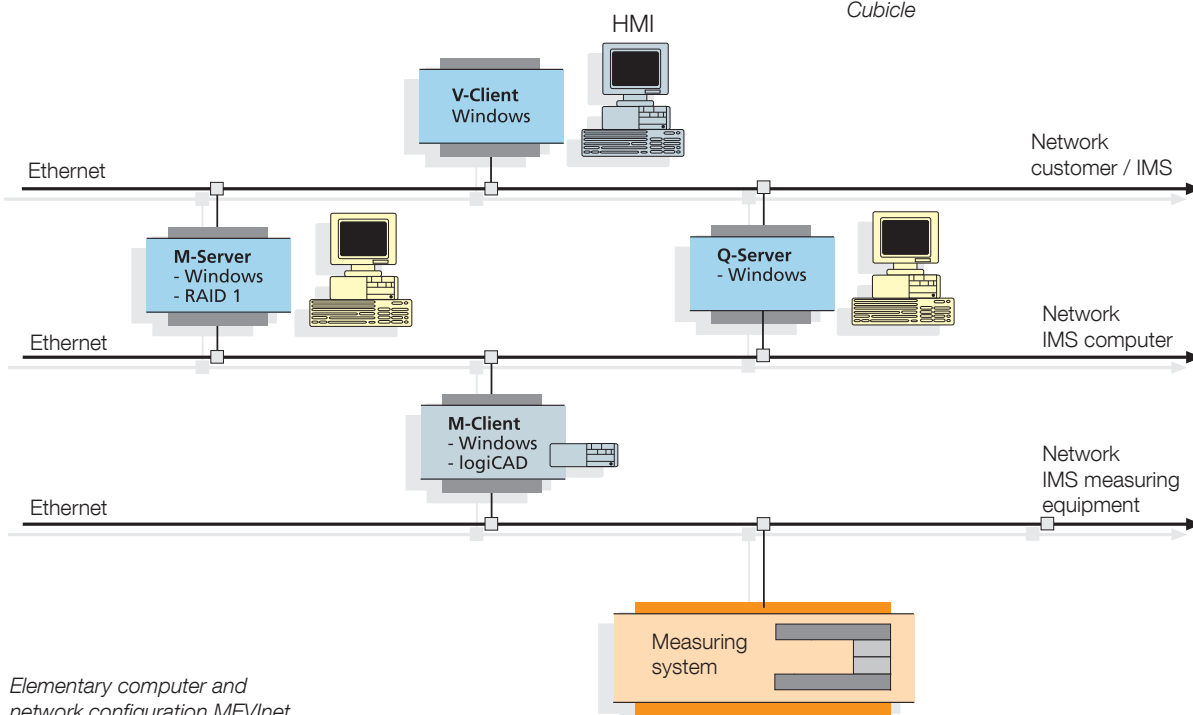
The main criteria taken into account in the development of the systems were:

- greatest possible hardware and software transparency (modular and scalable design, multiprocessor system)

- use of desktop, server and real time operating systems from Microsoft
- graphic configuration and documentation of the measurement and control functions to EN 61131-3
- diagnostics via online test and oscilloscope function
- standardised communication between the subsystems and external systems (Ethernet, UDP and Fieldbus)
- process-compliant reaction times of the individual tasks
- remote diagnostics and maintenance

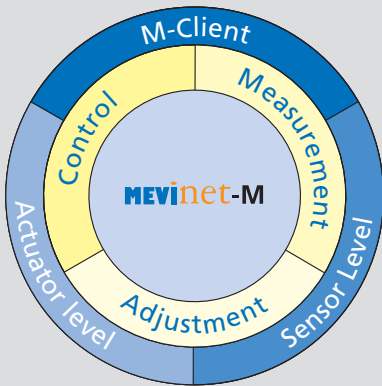


Cubicle



Elementary computer and network configuration MEVInet

MEVInet-M / MEVInet-V



The measuring systems used in rolling mills represent high-tech solutions to the problems of high precision measurement. Individual measuring systems for the acquisition of measured values and processing & quality control are usually combined to provide one complete measuring solution. Real time tasks involving the processing of extremely high quantities of data are performed by **MEVInet-M**.

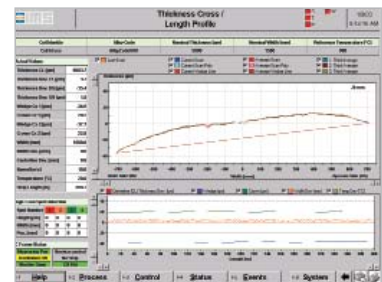
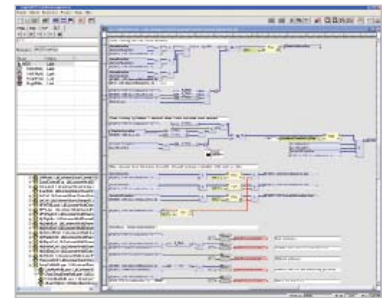
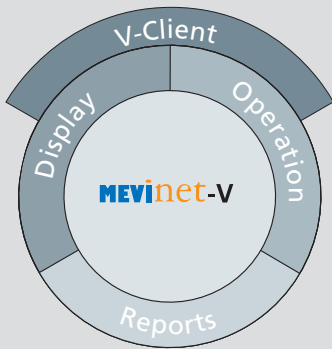
MEVInet-M consists of the individual systems, M-Server and M-Client.

The **M-Server** is the communication centre between the real time computers (M-Client), HMI (*MEVInet-V*) and quality management system (*MEVInet-Q*).

M-Clients are real time systems for measurement and control.

MEVInet-V provides the HMI and displays production data, operating parameters and system faults.

Information for display is assembled by selecting and configuring display modules with the integrated editor. In this way customised user screens can be created easily without the need for programming skills.



MEVInet-Q
MEVInet-M-Server
MEVInet-M-Client
MEVInet-V-Client

Quality Management System MEVInet-Q

IMS developed the automation system *MEVInet-Q* as a necessary addition to conventional measuring systems.

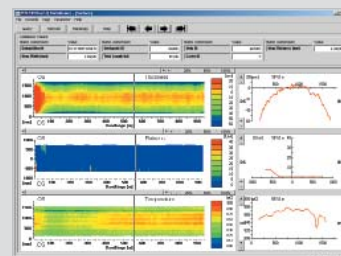
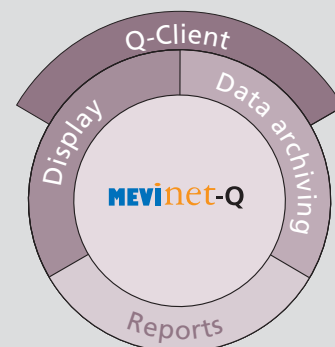
MEVInet-Q is the quality management system in the *MEVInet* product family. It was developed specifically for analysis and archiving of production data from rolling mills and allows the data store to be managed both at individual workplaces and on a company-wide network.

The central component of the *MEVInet-Q* system consists of one or more decentralised database servers. The servers are set up at different production plants and receive their data from IMS systems and/or third-party systems. Data requests from individual workstations are passed on to the basic systems through the data switching service DCL (Data Connection Layer). A decentralised information structure can be built by using multiple DCLs. Data from various production plants can then be displayed and edited.

The IMS DataViewer – for data presentation – provides immediate access to archived data for production and quality personal. It can present single measured values and data series (length, cross and error profiles) on freely configurable pages that are managed centrally on a server or locally at a user's own workplace. These pages can also be published on a company intranet, where they are shown in a web browser.

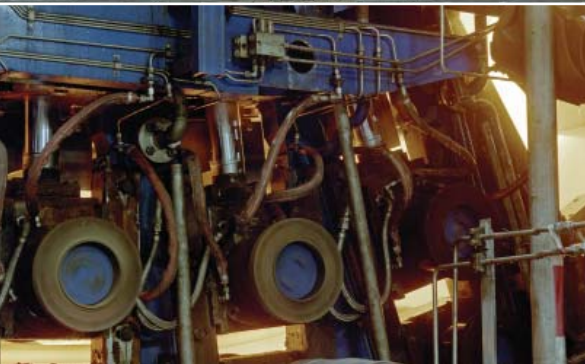
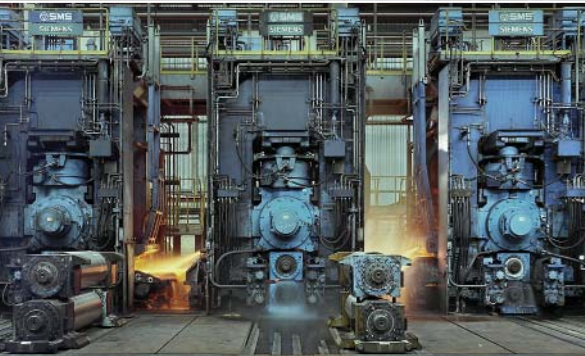
Performance features:

- quality management with data archiving, data analysis and data logging
- maintenance and service support
- production tracking, monitoring, preview and documentation
- recording of other, third-party signals and data
- complaint assessment
- display of data via web browser on a company intranet



Definition of the subsystems

- Quality management system
- Communication centre
- Real time computer
- HMI (Human Machine Interface)



Breaking Barriers through Optimisation

IMS measuring systems are used in rolling mills in the harshest of environmental conditions and are renowned for their very high availability.

By using modern X-ray technology and fast, high-precision detectors, IMS measuring systems achieve extremely high measuring accuracies at very low measuring time constants, establishing their rightful place in the range of high-tech systems used in industrial metrology.

Together with optimised process models and precision control technology, the measuring methods and technologies described are essential pre-requisites in the attainment

of the high level product quality required in high-speed continuous production processes. An inter-plant quality management system enables inter-process optimisation.

New goals are achieved through permanent ongoing development. What is technically feasible today may be accepted as everyday practice tomorrow, and possibly replaced completely by new technologies the day after.

You profit from our experience!

“Satisfied customers
around the world
testify to our **expertise.**”

*Walking beam furnace, Slab at pusher furnace,
Coil box, Roughing stands, Finishing mill,
Continuous casting plant (from top to bottom)*

Our Experience Your Advantage



SERVICE is a subject close to our heart.

All service jobs worldwide are coordinated centrally in Heiligenhaus so that we can react quickly and effectively to all requests.

Service is supported by remote maintenance from our different locations (remote access). In this way, faults are identified quickly and eliminated efficiently by our qualified service personnel. This helps to save costs. Our efficient service ensures your measuring systems remain stable and reliable in operation.

For IMS, trustworthy cooperation with our customers is the basis for long-lasting good relations. Our long experience in providing support for our measuring equipment benefits every new development.

Consultation and training

Service near you

Maintenance and service

Cyclical maintenance

Remote maintenance

- early detection of faults
- speedy correction of faults
- minimisation of costs

Central service centre worldwide

- hotline
- quick reaction by qualified experts

Spare parts

- central management of stocks
- quick delivery through local stocks of spare parts

Direct input of experience into the further development of our products

Modernisation and optimisation of measuring systems

Regular communication

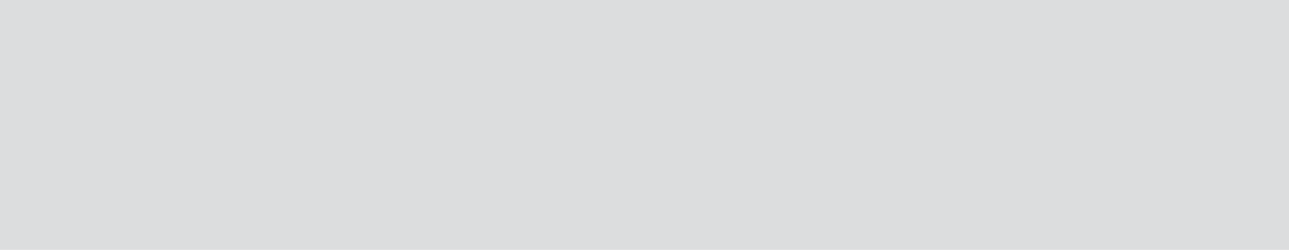
IMS ↔ Customer

Early detection

of the need for modernisation

Constant continuing development

of products, especially software



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