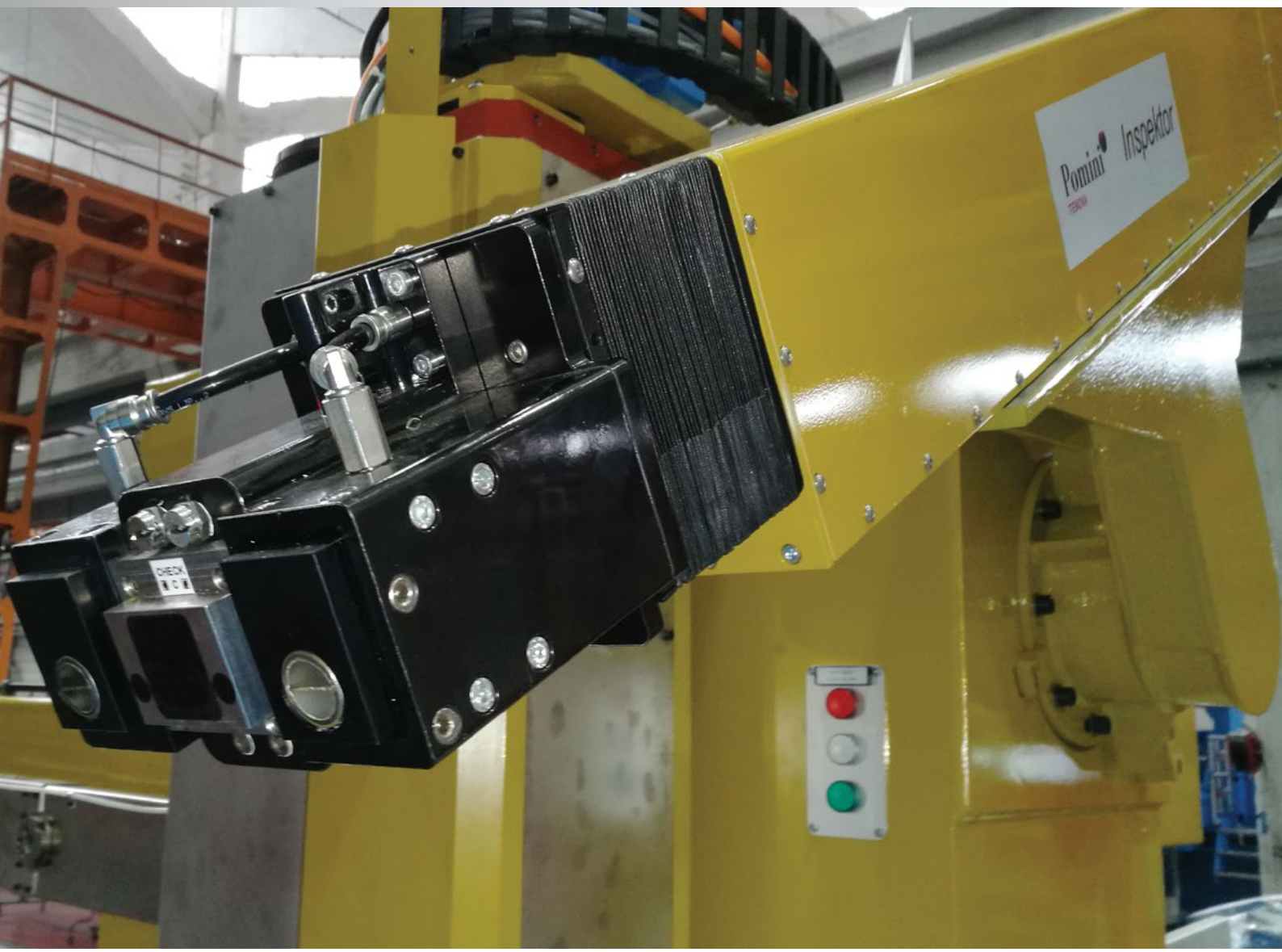
Pomini
TENOVA




# POMINI INSPEKTOR SYSTEM

The complete, state of the art
roll defect detection and vibration analysis system

tenova

Tenova is a worldwide partner for innovative, reliable and sustainable solutions in the metals and mining industries.

Building upon decades of experience, Tenova develops solutions that help mining and metals companies reduce costs, save energy, limit environmental impact and improve working conditions for their employees.

Tenova believes in on-the-job passion and actively seeks out professionals who truly love what they do. Their contributions to the business have helped make Tenova the industry-leading company it is today, and their passion is the driver behind the company business approach.

This approach can be summed up in four key pillars:

**Innovation, Reliability, Sustainability and Safety.**

Pomini
TENOVA

Through the Pomini brand, Tenova is worldwide leader in the design and supply of Roll Grinders for flat product rolling mills, as well as of special machines for grinding of heavy components. The product range of Pomini Tenova embraces heavy, medium and light-duty, fully automatic CNC roll grinders, fully automatic CNC roll loaders, chocking and de-chocking machines for all roll types, texturing machines and roll lathes able speed up grinding, handling and maintenance operations on rolls, and to guarantee the level of precision required by the most sophisticated rolling mills.

Pomini Tenova also supplies other ancillaries such as washing machines and tilters for chocks, roll cooling systems, storage racks and other devices used in daily roll shop operations. In addition, it boasts extensive expertise in reconditioning, upgrading and fully automatic revamping of used roll grinders of any brands.

The constant pursuit of innovation in automation and machine integration for the rolling mill process combined with the precision and reliability that have always distinguished Pomini Tenova, provide our Customers with products that represent the state of the art in roll grinding worldwide.

Pomini Tenova range of products include:

**Heavy, Medium and Light-Duty Fully Automatic CNC Roll Grinders**, for superb performance in terms of tolerances and surface finishing, high reliability and internationally patented measuring and control devices.

**Fully Automatic CNC Roll Loaders**, with either two or three controlled axes, combining high handling speeds with outstanding positioning accuracy, for faster roll handling and enhanced grinder productivity.

**Texturing Machines**, the Pomini Digital Texturing process is the clean and safe technology, very efficient with minimal waste. Machines and equipment have modern design features and reduced hardware.

The range of surface textures is very flexible in order to meet a wide variety of the industry's current and future needs, and the ability to produce an optimum combination of surface texture features to provide good service for the producers and excellent sheet surface characteristics for end users.

**Shear Blade grinders and Roll Lathes**, machines that further enhance roll shop product range and amplify maintenance operations capabilities for the mill with high levels of precision and finishing.

**Chocking and Dechocking Machines** for all roll types, to speed up maintenance operations and guarantee the level of precision required by the most sophisticated roll supporting systems.

**Other Ancillaries** such as transfer cars, washing machines and tilters for chocks, roll cooling systems and other devices used in daily roll shop operations.

**Roll Storage Racks and Pads**, to optimize use of the Roll Shop floor in relation to crane and grinder availability, leveraging Pomini Tenova know-how in handling all roll types.

**Roll Shop and Roll Defect Management System (RSMS)**, a complete hardware and software solution developed by Pomini Tenova for full control and analysis of all roll shop operations. RSMS enables analyses from actual grinding process monitoring to collection and processing of production, consumption and requirement data, with minimum outlay of resources.

**Roll Defect Detection and Vibration Analysis Equipment (Pomini Inspektor System)**, in standalone or grinding machine integrated version, a complete system that is the state of the art in technology for Non-Destructive inspection, together with Vibration Analysis features.

## POMINI INSPEKTOR SYSTEM

The Pomini Inspektor System is designed and developed by Pomini Tenova and used in steel and non- ferrous rolling mills throughout the world to detect surface and subsurface defects with Eddy Current and Ultrasound technology. Vibration analysis is an additional enhancing feature.

Structural defects on the surface and in the body of rolls, and cracks and bruises that develop during the rolling process, or as a result of imperfections in the roll casting or forging process, affect the operation of rolling mills. Vibrations from the grinding process also threaten the quality of the rolls surface.

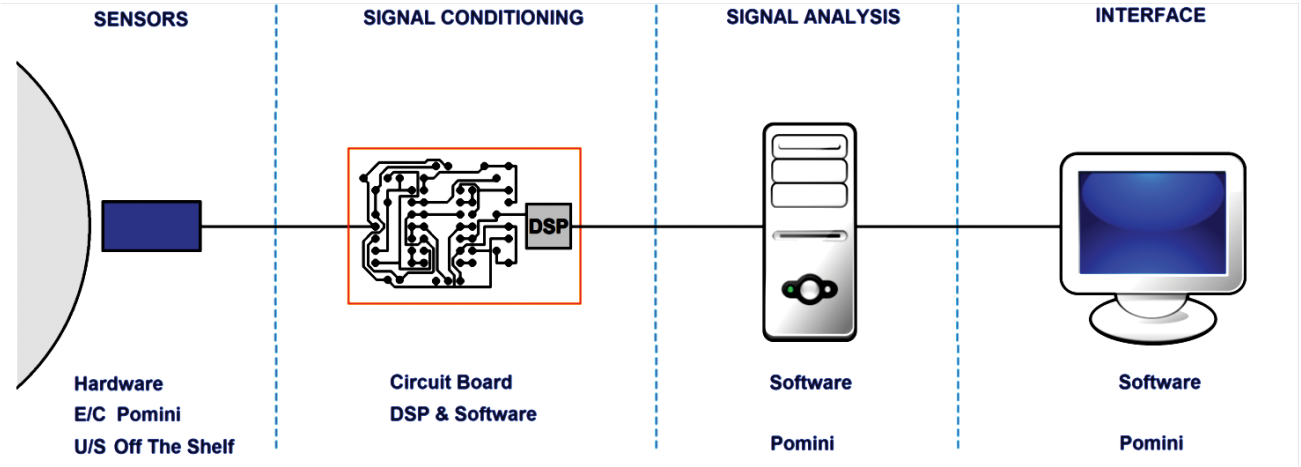
To keep these issues to a minimum, Eddy Current, Ultrasound and Vibration analysis systems are used daily in roll shops to inspect rolls before delivering them to the mill. As mill requirements and roll-shop performance needs become more demanding, inspection systems become more complex.

**The Pomini Inspektor System has been designed to:**

- improve system performance by making sure smaller defects are detected with greater repeatability and reliability, faster and in more positions (e.g. deeper inside the roll)
- reduce hardware complexity and decrease the number of system circuit boards
- use off-the-shelf standard components wherever possible
- improve roll surface quality through real time multi-sensor roll vibration analysis
- offer remote assistance by Pomini Tenova engineers, anywhere in the world
- include future features such as creeping wave analysis, chatter detection

Using the Pomini Inspektor System, each Eddy Current scan can be performed during the grinding cycle, thus saving roll-grinding time and reducing overall costs. As a true, modular system, the Pomini Inspektor System can be enhanced with Ultrasound functionality and Vibration analysis at any time.

Several hundred Pomini Inspektor Systems have been sold worldwide, either as integral components of Pomini Tenova grinding machines or as stand-alone units on competitor machines. In the latter case, the systems may be mounted on the wheel carriage or on an independent guide-way.



## POMINI INSPEKTOR SYSTEM EDDY CURRENT INSPECTION

Eddy Current inspection is carried out during the grinding cycle to detect surface-breaking cracks, bruises and voids caused by thermal and mechanical stress or mill accidents affecting the roll. Roll surface quality is a customer top priority and rolls known to be expensive, the Pomini Inspektor delivers a very high resolution to help operators identify roll surface defects immediately.

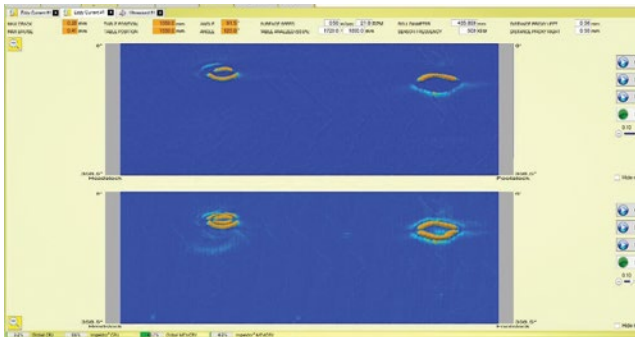
The test head consists of several sensors arranged in a continuous array. This eliminates the possibility of a gap between the area scanned by one sensor and the area scanned by the next one.

The sensors have been designed and positioned to scan a wide contiguous strip. The system also measures absolute probe phase changes as well as amplitude changes, improving differentiation between different defect types.

Different frequencies can be selected via software to improve defect detection in different roll materials.

A very small sensor array head, with two integrated distance proximity sensors, is used to reduce mechanical interference with chocks and enable 100% scanning of the roll table surface.

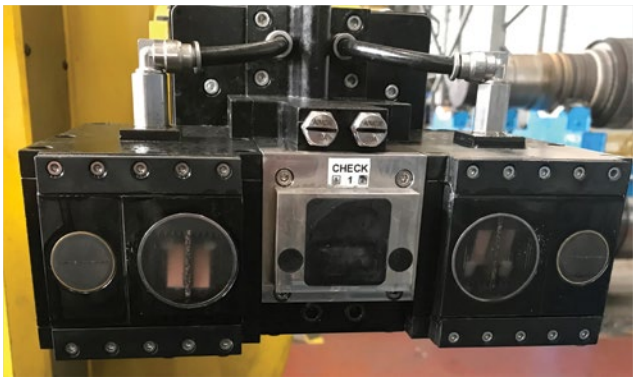
▶ Pomini Inspektor System EC 2D screen shot



▶ Pomini Inspektor System EC 3D map screen shot

## EDDY CURRENT FEATURES

- Multiple probes, covering a contiguous strip of 20 mm for every roll revolution
- Signal resolution is 2.5 mm across the roll table and 1.5° along the circumference
- Software selectable frequencies to match all roll materials available on the market
- Adjustable hardware components have been removed, allowing remote assistance activities to be performed using dedicated Pomini software




▶ Close-up of typical Inspektor Head with probes

## POMINI INSPEKTOR SYSTEM ULTRASOUND (0°) INSPECTION

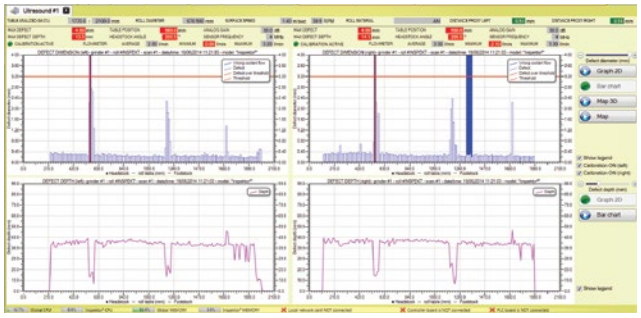
Roll defects with potentially dangerous consequences are not limited to surface-breaking cracks. Maximum rolling stresses are located below the barrel surface and double-pour casting creates an interface between the roll core and shell that must be checked periodically.

The Pomini Inspektor System can drive different ultrasound sensors simultaneously, each one focusing at a different depth inside the roll, to allow the system to detect defects closer to the roll surface and defects deeper inside the roll.

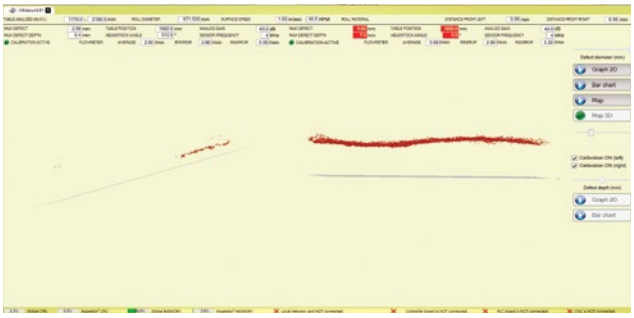
The sensors can work with different frequencies to scan different roll materials with different scatter properties.

Pomini Inspektor System enhances inspection repeatability, reliability and the capability to find small defects. To reduce installation and maintenance costs, user-adjustable components have been removed from the hardware,

The Pomini Inspektor System is designed for fail-proof defect detection, allowing longer roll life and increased performance in the mill.



▶ Pomini Inspektor System UT 2D screen shot



▶ Pomini Inspektor System UT 3D map screen shot

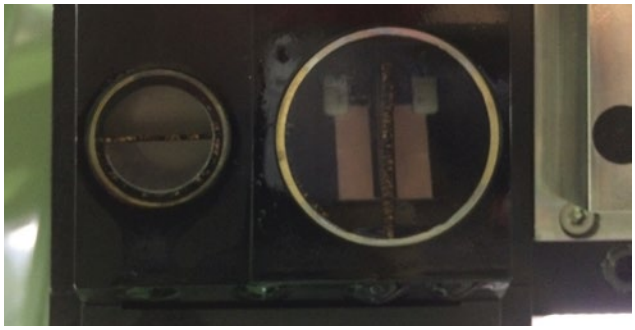
## ULTRASOUND (0°) FEATURES

- Two probes may be used simultaneously and be directly connected to the same electronic board
- Probe may cover depths from 2 to 350 mm
- According to different roll materials the customer can select different probe frequencies to match best performance; hardware is designed for use of all probe frequencies
- Defects up to 2.5 mm diameter may be detected
- Signal resolution is 10 mm across the roll table and 1.5° along the circumference
- Adjustable hardware components have been removed, allowing remote assistance activities to be performed using dedicated Pomini software

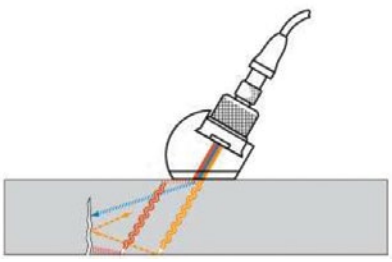
## POMINI INSPEKTOR SYSTEM CREEPING WAVE FEATURES

Creeping Wave (CW) inspection is the complementary technology used together with eddy current and ultrasound 0° with high-angle ultrasonic longitudinal waves which propagate just under the surface of the roll. The signals are very sensitive to near to surface-breaking cracks and unaffected by surface conditions. With CW, Inspektor System may identify defects on roll surface and sub-surface with follow features:

- Depth of scan: 0 mm to 3 mm
- Minimum defect length parallel to roll axis: 1 – 2 mm
- Minimum defect length perpendicular to roll axis: 0.5 mm



▶ Left Side is the US (0°) degree probe while on right side the Ultrasound Creeping Wave



▶ Creeping Wave beam, just under the surface (illustration for information only)

## POMINI INSPEKTOR SYSTEM STRUCTURE ANALISYS

During this Inspektor analysis, the system locates different homogeneity and hardness on the structure material. The structure variation is due to the Mill force applied on the roll which may be different from roll side ( part no involved in the mill process ) and its center.

All analyses are saved in a database associated to the roll number (this applies to ultrasonic and eddy current scans too).

The graph shown the two measures made by the sensors 1 and 8 (the external ones on the head).

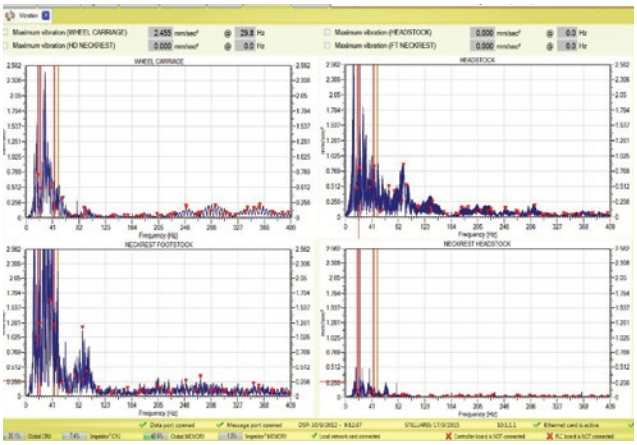
▶ Example of Structure Analysis, data format provided by Pomini Inspektor3 System

## POMINI INSPEKTOR SYSTEM VIBRATION ANALYSIS

Vibration is a major problem in grinding operation. Accuracy and performance of the grinder may be affected due to vibration. The Pomini Inspektor System Vibration Analysis module primary function is to warn of the presence of chatter and other abnormal vibrations while grinding.

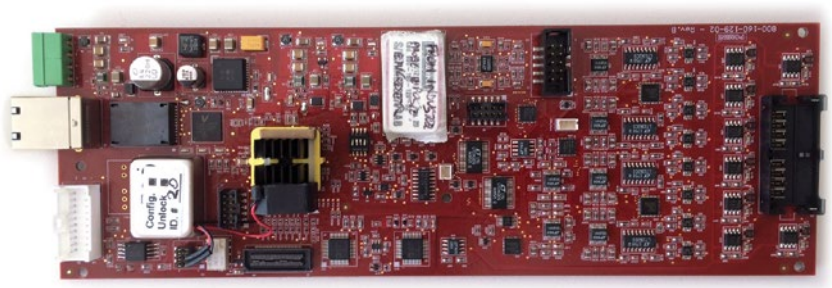
The vibration module can handle many accelerometers at the same time so that the system can monitor grinder vibrations in different places, showing the results in real time, during machining and in no-load working conditions.

The Pomini Inspektor System is designed for fail-proof defect detection, allowing longer roll life and increased performance in the mill.



▶ Pomini Inspektor System VA screen shot


▶ Inspektor Vibration Box



▶ Heavy Duty Solid State Electronics

## POMINI INSPEKTOR SYSTEM HARDWARE OVERVIEW

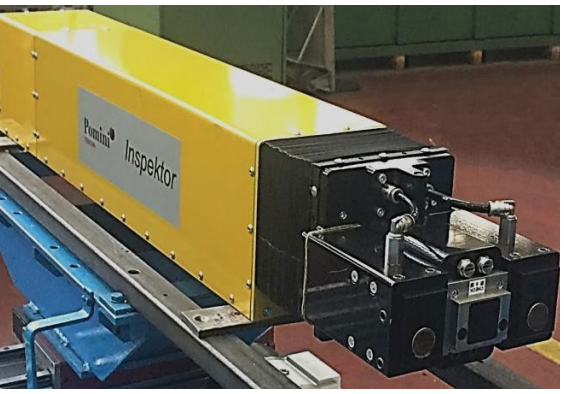
The Pomini Inspektor System hardware architecture implements a very simple structure. There is no dedicated hardware inside the PC to process data coming from Eddy Current sensors, Ultrasound sensors and Vibration/Wheel balancer accelerometers: all data reaches the PC via a standard Ethernet network. All that is needed inside the PC is a standard Ethernet network card available off-the-shelf.

The only hardware developed by Pomini Tenova is the sensors head and one independent hardware board for each separate Inspektor feature.

The fact that the Pomini Inspektor System uses only one board designed and built by Pomini Tenova for each module (Eddy Current, Ultrasound, Vibration/ Wheel Balancer) delivers true customer benefits:

- easy system maintenance
- minimum spare parts requirement at customer site
- easier, quicker operator training
- industry 4.0 ready

The result is a modular system where any feature can be added independently from the others at any time and without modifying the system already installed.




▶ Inspektor Arm & Sensor Head

▶ Inspektor Electrical Cabinet

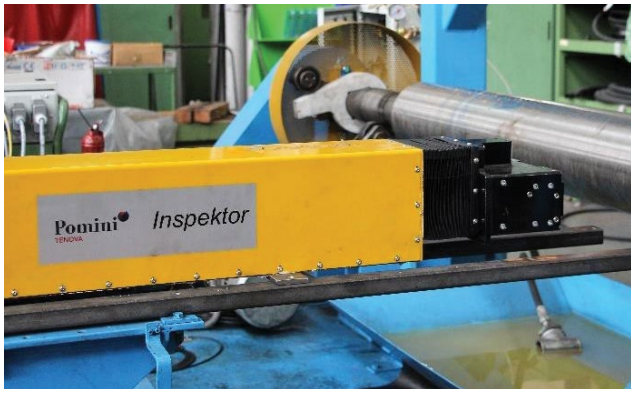
▶ Inspektor Air & Water Supply

▶ Inspektor Panel PC

## POMINI INSPEKTOR SYSTEM MECHANICS

The Pomini Inspektor System can be mounted either on the independent calliper of Pomini Roll Grinders or as a stand-alone system on any other grinder and may also be installed on a suitable bench and used as an offline inspection system.

Pomini Tenova widely used independent measuring calliper allows operators to perform Eddy Current scans during the grinding cycle since the calliper is placed on the opposite side to the wheel carriage; the CNC selects the best travelling speed to match the headstock speed, for 100% scanning of the roll surface. As a stand-alone unit, the Inspektor can be fitted either on a frame on the wheel carriage or on a separate frame on an independent guide-way (this configuration is patented by Pomini Tenova).




▶ Inspektor Stand Alone Mount


▶ Inspektor Caliper Mount

## POMINI INSPEKTOR SYSTEM REMOTE ASSISTANCE

The Pomini Inspektor System is totally digital and may be linked directly to Pomini Tenova offices where Pomini Tenova highly specialized personnel will immediately address any operation issues. All system information is stored and may be traced for easy and immediate analysis.

The remote service feature enables Pomini Tenova engineers to connect directly to the grinder fitting the Pomini Inspektor System and analyze the operating environment in real time, without the need to dispatch a technician to the customer site.

The solution is often just a phone call away, saving precious time and money.

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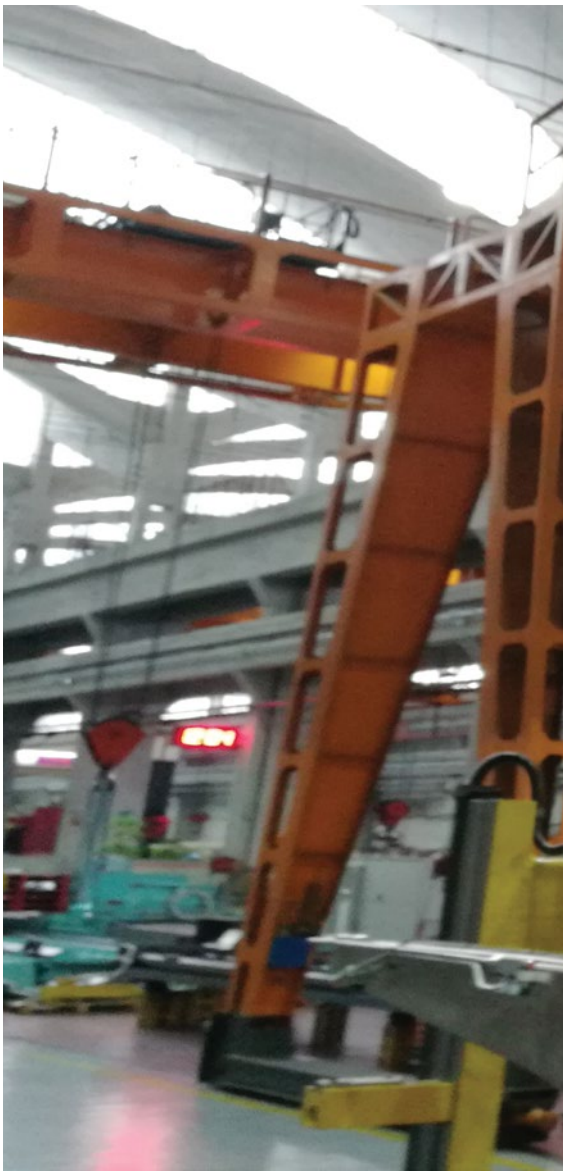

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