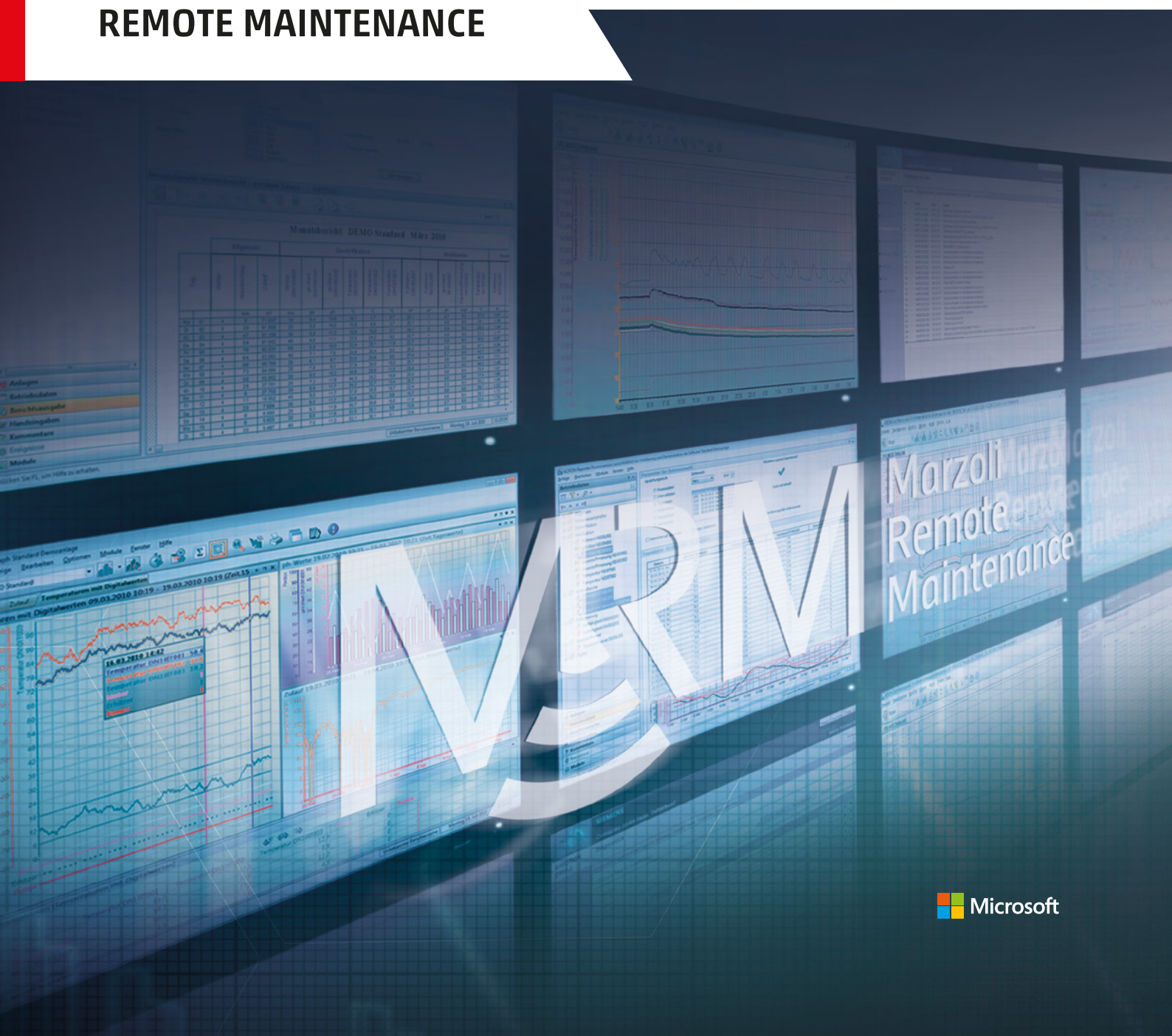


MRM REMOTE MAINTENANCE



SOFTWARE PLATFORM

A whole new maintenance philosophy for the textile sector

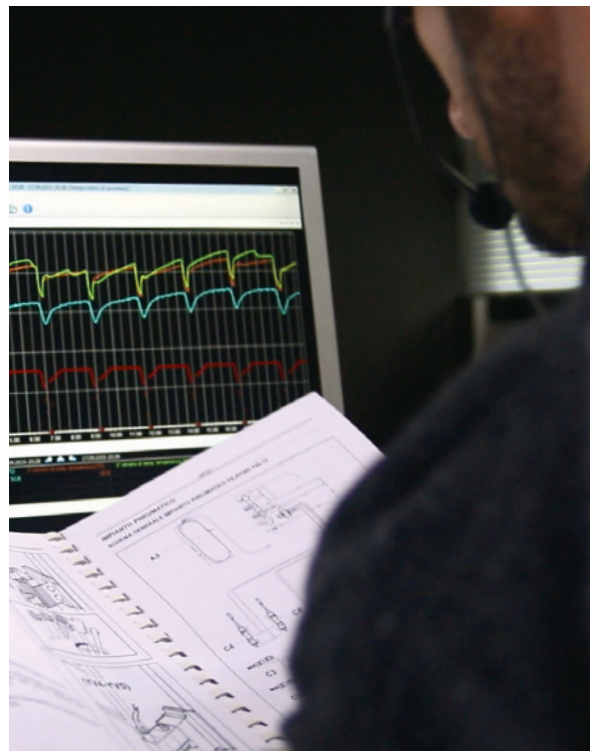
The profitability of a spinning mill relies on the performance of its machines: only if they run smoothly, continuously, efficiently and produce great volumes of high quality yarn, the spinning mill will thrive.

Hence, one of the major risks in a spinning mill is the rise of technical malfunctions which harm the profitability of a spinning mill before and after an eventual machine failure. Before a machine failure there is a sharp increase of energy consumption, temperature and vibrations with a reduction of yarn quality and several problems related to the machine. After the machine failure the problems are even worse: the customer must bear high repair costs and long downtimes, especially if technicians and repair materials are not promptly available.

Therefore, in order to maximize Overall Equipment Effectiveness (OEE) and minimize the Total Cost of Ownership (TCO), it is necessary to invest in reliable equipment and regularly maintain it with on time operations scheduled or guided by a monitoring system before a breakdown or fault occurs. This is the key for a substantial reduction of operational costs and the achievement of a relevant and durable competitive advantage in the spinning industry.

To this aim Marzoli has developed the **Marzoli Remote Maintenance platform**. Through the adoption of specific electronic hardware, embedded sensors, predictive algorithms, developed in the research phase, and by leveraging the latest **paradigm and technologies (IoT, Cyber-Physical Systems, Big Data, cloud computing, M2M, M2H)**, based on an important partnership with Microsoft, it is possible to monitor:

- machines statuses
- pressures/lubrication levels
- temperatures



- wearing level of critical components
- alarms
- energy consumption

Marzoli Remote Maintenance continuously informs the client about the state of health of the machines while they are running and identifies the areas where deviations from the nominal operating levels occur. This greatly reduces machine downtimes and the need for a continuous and intensive patrolling and verification of machinery components. It also grants to diagnose technical malfunctions at an early stage and to avoid all the related inefficiencies, costs and losses of productivity. Marzoli, thanks to its longstanding experience in the manufacturing of the complete spinning line and its firm predisposition towards innovation, has been able to interpret the innovative ICT paradigms and launch this new Maintenance philosophy into the textile sector.

KEY POINTS

- CONTINUOUS MONITORING OF CRITICAL PARAMETERS
- IMMEDIATE WARNING IN CASE OF DEVIATIONS FROM STANDARDS
- HIGHER PROFITABILITY OF THE MILL
- LONGER MACHINERY LIFESPAN AND PERFORMANCE DURABILITY
- TROUBLE-FREE SPINNING EXPERIENCE

THE BENEFITS OF MARZOLI REMOTE MAINTENANCE

Thanks to Marzoli Remote Maintenance, the client can draw on a great, relevant and reliable amount of information in order to effectively undertake maintenance operations. Moreover, the advantages of using Marzoli Remote Maintenance increase over time: as the customer learns how long the maintenance cycles of the machines should be, he can better plan maintenance activities, reduce operating costs and always obtain the highest machinery performances. In a nutshell, Marzoli Remote Maintenance discloses the following advantages:

- Higher productivity,
- No machines unplanned downtimes,
- Prevention from major machine failures,
- Longer plant lifespan,
- Higher efficiency,
- Complete reliability,
- Trouble free spinning experience,
- Better maintenance planning.

**OPENING SECTION**

- Openers & Cleaners
- Mixers & Blenders
- Card

**COMBING SECTION**

- Draw Frames
- Lap Winder
- Comber
- Lap Transport

**SPINNING SECTION**

- Roving Frame
- Ring Spinning Frame
- Bobbin Transport System

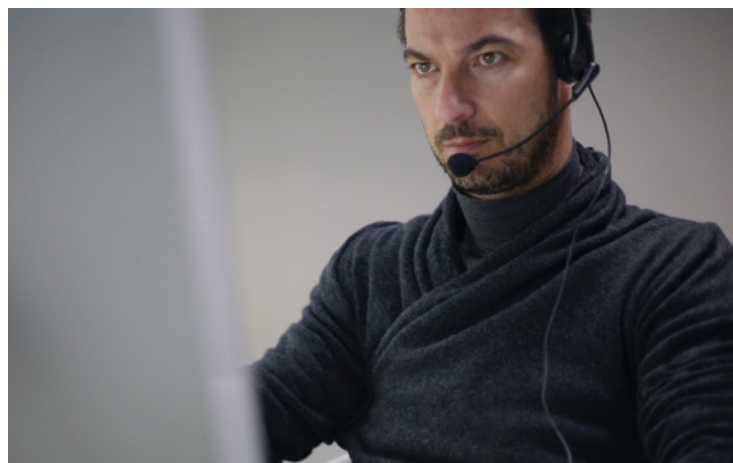


MARZOLI CONTROL ROOM

A whole dedicated senior technical team

Marzoli, in order to secure an outstanding service to its customers and to guarantee all the advantages of preventive and predictive maintenance, has dedicated an entire department of its headquarter to the supervision of the clients' machines through Marzoli Remote Maintenance.

The Control Room operates through a senior technical team, fully trained on Remote Maintenance technology, that has one important mission: to continuously monitor the parameters of every machine of the customers around the world so that if there is a technical malfunction, it contacts the client and provides live technical assistance. Thanks to Marzoli Remote Maintenance, maintenance is no longer based on the experience of few technicians and on standard manuals but on the experience of

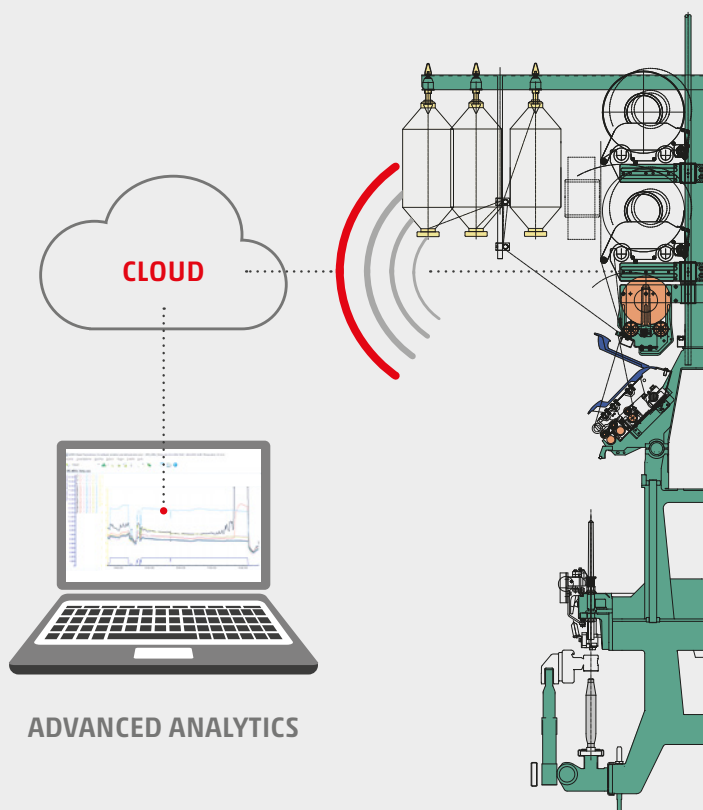


an entire technical department, that **continuously cooperates with the client's technical team**, and on a great amount of relevant, reliable and case-specific information that increases and updates every day. Moreover, the Control room has a direct connection with Marzoli's R&D and Customer service & support departments, thus ensuring a fast and reliable technical assistance with prompt delivery of the needed spare parts and immediate technical support.

SYSTEM ARCHITECTURE

Solid system architecture for a thorough plant analysis

A distributed online system uses a remote data acquisition device to collect physical signals from the machines and transmit them back to a cloud service powered by Microsoft for online monitoring and analysis. The results from data analysis, physical-mathematical models application, deep dive on incidents and critical cases are returned to Maintenance Engineers and Operators by means of Reports, Web Application and Dashboard. This architecture allows to accumulate large amounts of information and data which can then be processed in order to identify and analyze historical trends of the operating parameters and investigate correlation functionalities and prediction algorithms.



MONITORING OF MACHINERY COMPONENTS

Inside the machines there are measuring sensors that monitor the most significant physical parameters so that rotating components, transmission systems and electric motors are constantly under control. In addition to that, the integrated electronic automation system allows to collect all the data related to the working conditions of the machines: power consumption, speed, machine status and machine alarms, temperature of drive and electric cabinet. Due to the huge amount of rotating components installed on spinning machines, big attention is paid to the bearings. Thanks to special procedures, a complete and detailed picture of the mechanical/ electrical behavior of a machine can be taken at regular interval of times, at specified running conditions and without material, in order to exclude the influence of any external variable. This process can be repeated for the whole life of the machinery in order to easily detect any deviation or premature aging of the components.

AUTOMATIC REPORTING

Marzoli Remote Maintenance automatically generates reports that are sent to the client on a regular basis. In these reports the customer can find all the information concerning the trends of the monitored parameters with possible suggestions by Marzoli customer service team to optimize machines performances.

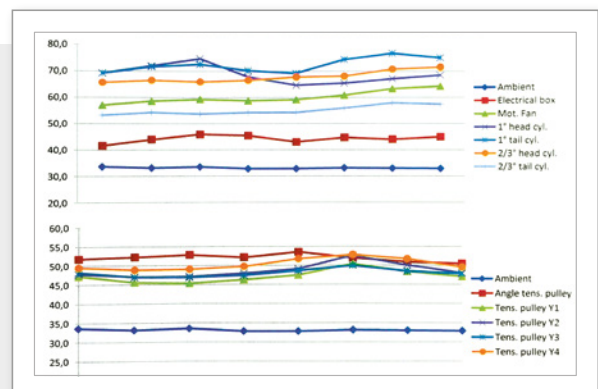
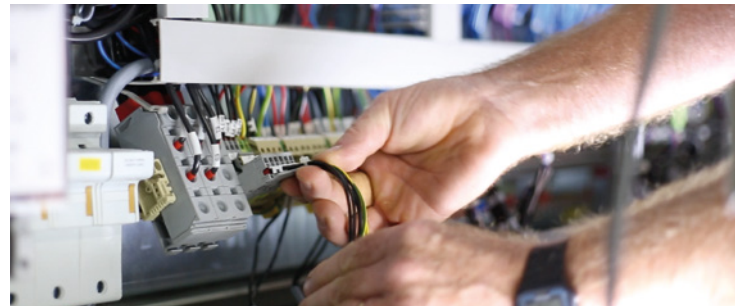
MARZOLI ENGINEERING SERVICE AND PROCESS

In Marzoli every solution is unique: the plants that Marzoli designs, creates, installs and maintains are tailored to the client's requests. Marzoli Remote Maintenance fully embraces this business philosophy as its implementation follows a highly tailored engineering process that is articulated in the following steps:

1. Analysis of the plant and collection of requirements, specifications, maintenance procedures and maintenance problems.

RETROFITTING OR INSTALLATION ON THIRD PARTY MACHINERY

Beside being available for all new Marzoli machines, Marzoli Remote Maintenance can be installed on older Marzoli and on third parties' machines through Marzoli's retrofitting & revamping service. On these types of machines Marzoli Remote Maintenance benefits can be very important in terms of higher productivity and efficiency: on older machines real time diagnostic helps localize components that must be substituted and gives valuable guidance for a more effective maintenance of the machine.



2. MRM customization to the Customer plant and equipment.
3. Installation of hardware, software, sensors, communication infrastructure and HMI.
4. Performance verification and validation: SAT and assessment of the installed platform according to defined KPI.

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666REM00523 06/2023



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