



for a greener tomorrow

SMART CONDITION MONITORING

for Preventive Maintenance



- Reliable online machine monitoring
- Easy installation with intuitive operation
- Flexible and expandable system
- Ideal for monitoring motors, gearboxes, pumps and fans

Smart Condition Monitoring

Manufacturers need to respond to global competition and sourcing. Therefore, there is a need to look for solutions based on reducing cost, eliminating risks, improving system design and helping to manage maintenance to maximise reliable production. Condition monitoring offers a predictive approach to plant maintenance ensuring optimum asset performance, whilst keeping downtime to a minimum.



To optimise maintenance activities it is crucial to have up to date visibility of the status of machinery including primary assets and services such as motors, fans, pumps and gearboxes.

Mitsubishi Electric offers this capability through its integrated solutions collecting live data from advanced measurement sensors for analysis by multiple levels of management systems.

STANDARD MONITORING

Standard monitoring concepts often focus on only classic machine and process parameters such as temperature, pressure or hours of operation.

ADVANCED APPROACH

SmartConditionMonitoring (SCM) with FAG SmartCheck sensors is an independently operating, compact, modular measurement system for the permanent monitoring of machines. The system can monitor both classic parameters and vibration-based parameters.

Mitsubishi Electric, in conjunction with Schaeffler, can provide an integrated approach to monitor the condition of the asset. Information can be automatically transferred over Ethernet networks via the iQ, iQF and L-series MELSEC SmartControllers to multiple information levels.

SCM combines smart sensor intelligence with online monitoring and control. The ability to passively detect variations in machine condition whilst linking to the control system leads to early warning signals and the ability to prevent costly downtime and loss of production.

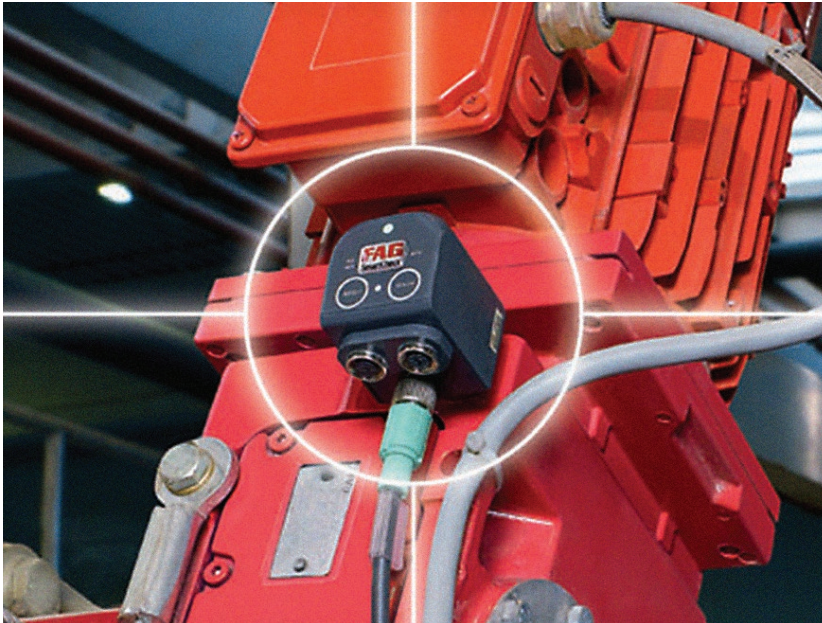
SCM sensors work by detecting the normal vibrations of a machine and look for patterns outside the norm, this leads to a series of alarm conditions that are used to alert the maintenance crew that attention is needed.

A teach function allows the SCM sensor to learn the machine in its normal operating state, it creates a memory map of the vibration readings, all machines

vibrate to one degree or another and using sophisticated analysis techniques the sensor can locally detect abnormal operation. Further advanced methods of vibration analysis are also possible using software tools.

The ability to link multiple SCM sensors back to a single controller leads to a better understanding of the complete area to be monitored. This information can be networked to higher level systems in many ways including wired and wireless methods.

A pre-programmed controller and operator display is used to make the system extremely easy to install and configure, sensors can simply be plugged in and enabled using the touch screen display, within minutes the system is active and monitoring the plant. Real-time alarms give the operator textual graphical information about the type of condition that the alarm relates to. The clear text information includes advice for service and maintenance staff.



Easy mounting of the SmartCheck unit with a screw on top of the motor or gear box

EXAMPLES FOR MONITORING

Monitoring can cover products such as:

- Electric motors
- Geared motors
- Vacuum and fluid pumps
- Ventilators and fans
- Gearboxes
- Compressors
- Spindles and machine tools
- Separators and decanters

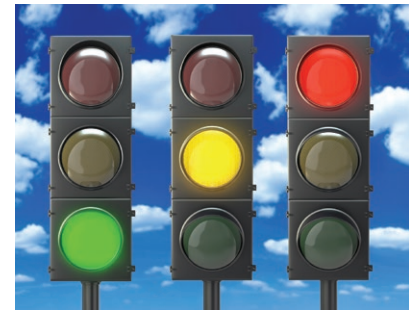
SCM FUNCTIONALITY

SCM provides and supports the following functions:

- Bearing defect detection
- Imbalance detection
- Misalignment
- Temperature measurement
- Cavitation detection¹
- Phase failure recognition¹
- Resonance frequency detection¹
- Data transfer (Bidirectional) via Ethernet to the to the IQ Automation Platform and connected IT Enterprise database applications
- Database web-server integrated with status display as traffic light symbol and detailed information
- Clear text information of status change with advice for maintenance and service

OPERATING BENEFITS

- **Reliable online monitoring on the machine**
Innovative vibration sensor with patented diagnosis technology
- **Intelligent process monitoring**
Recording of different process parameters and correlation with vibration signals
- **Easy installation**
Less wiring and easy integration due to the device's compact size
- **Intuitive operation**
Automatic adjustment of alarm thresholds thanks to self learning mode (plug and play option), LED error indicator
- **Long term storage of history data**
Information is available over a long term. An intelligent thinning-algorithm provides historical data for several years
- **Flexible, expandable system**
Individually adaptable stand-alone system for new and existing applications
- **Full service around machine diagnosis and rolling bearings**
Consulting, commissioning, remote service, maintenance contracts, training courses, rolling bearing solutions etc.



The status of the SmartCheck is displayed like traffic light signs in green, yellow and red for easy recognition. The information will also be sent to the controller and viewed as clear text message offering advice for service and maintenance.

1. Advanced analysis needed

Case Study

Intelligent condition monitoring keeps thermal paper production running

A condition monitoring system installed on a paper coating machine has enabled the Mitsubishi HiTec Paper plant in Bielefeld, Germany to switch from time-based to condition-based monitoring, helping to avoid unnecessary machine shutdowns. Enabling the new system is a Mitsubishi Electric L-series PLC that operates as a bidirectional gateway between the controller and sensors.



Thermal paper gets its characteristics from a special coating. It is typically used for sales receipts and tickets. At the Mitsubishi HiTec Paper plant in Bielefeld, Germany (MPEB), around 300 tonnes of thermal paper goes through one of the coating machines every day.

The four-storey machine has a maximum operating speed of up to 1730m/min. Coating Machine 3 has 26 fan units, each consisting of a supply fan and an exhaust air fan. These ensure contactless drying of the coated paper. The air supply fans blow hot air at up to 250°C into the drying hoods. In the process, the surface of the thermal paper must not be heated above 68°C, otherwise the paper will react and an undesirable discolouration will occur.

Jürgen Heitland, Head of Electronics and Measurement and Control Technology (EMSR) at MPEB, explains: “On Coating Machine 3, we finish the raw paper with a pre-coat and a top coat to give it its thermal characteristics. In order to guarantee the perfect coating, the paper which can be up to 2.9 metres wide must be dried without contact. That critical task is carried out by a total of 13 hot air drying hoods, each with two large radial fans for supply and exhaust air.”

The fans have a diameter of just over 1m and weigh around 100kg, while the exhaust air fans are slightly smaller and lighter. With the fan also rotating at a speed of 1500rpm, there can be a slight imbalance, which over time can prematurely wear the bearings. If that imbalance is not detected and rectified in time, the result will be a production shortfall. If one of the first four hot air drying hoods is affected, production will come to a standstill.

- Early warning of bearing outer ring issue
- Easy installation
- Flexible system expansion

Three years ago, when an imbalance in Coating Machine 3 was not detected in time, it resulted in the complete failure of a fan. Besides the bearing, attachment parts were also heavily damaged. This resulted in a short system shutdown which led to a reduction in the rate of production.

“That fan failure was the catalyst for our decision to look for a way to switch from time-based to condition-oriented maintenance,” says Heitland.

“We wanted to be able to detect imbalances or damage to roller bearings early before they became apparent through noise or an increase in temperature – by the time the temperature rises in the bearing, it is usually too late for a scheduled component replacement. Replacement parts are often not immediately available, meaning that the failure of the fan goes on for even longer.”

To counteract this problem, 26 SmartCheck sensors from Schaeffler now monitor those fans by carrying out vibration measurements. A SmartController - based on a Mitsubishi Electric PLC from the MELSEC L-series - operates as a bidirectional gateway between the controller and sensors. As a result, unscheduled machine shutdowns can be avoided.

Condition monitoring aims to indicate in good time when limit values will be exceeded. SmartCheck systems have a status indicator based on a traffic light system: if the status changes from green to yellow (preliminary-alarm status), a predefined limit value has been exceeded. However, the machine can still continue to operate for the time being. A red alarm indicates an urgent need for action.

The operator can access each individual sensor via an integrated web server and display detailed information. As the system can issue an initial warning via the yellow preliminary alarm up to three months in advance, that leaves sufficient time to schedule a system shutdown and order replacement parts, thus avoiding bearing damage in the process. As a result, machine availability and process reliability have improved.

Applications



Waste Water Plant

APPLICATION

- Three Archimedes-Screw pumps with gear box, redundant, SCM with FAG SmartCheck sensors, iQ Automation Platform, analog values, telemetric access and access point for SCADA
- Break down of the gear box in a time frame of 1-3 years

DETECTED FAILURE

- Four months after installation gear wheel defect detected

COSTS

- Overhaul of gear box: £800
- New gear box: £4400
- Saving £3600
- SCM solution cost:
 - Hardware: £3760
 - Installation: £800

INSTALLATION

- By Mitsubishi automation partner



Sugar Factory

APPLICATION

- Four gear boxes at a sugar beet washing machine, SCM Kit-1 COMPACT with four SmartCheck sensors
- Buffer time during stop is 10 minutes

COSTS

- 1 hour stoppage £48000 (During normal operation)
- 1 hour stoppage £800 (Scheduled maintenance)
- SCM solution cost:
 - Hardware: £4000
 - Installation: £2400

INSTALLATION

- By System Integrator supported by Mitsubishi automation partner



Theme Park

APPLICATION

- Passenger elevator in a theme park. High temperature and many people. Two stations with SmartController and total 18 SCM sensors to control the two idler pulleys and the rope
- Min. 2.5 hours stop to evacuate the people during failure

COSTS

- Image damage and money back refunds: Immeasurable
- SCM solution cost:
 - Hardware: £12000
 - Installation: £4000

INSTALLATION

- By System Integrator supported by Mitsubishi automation partner

The Smart Condition Monitoring Kit-1 COMPACT

Simple decision. The SCM Kit-1 COMPACT offers outstanding value and reduces costly downtime. It is a completely preconfigured condition monitoring solution with a vibration sensor and is optionally expandable with up to six sensors.



SCM Kit-1 COMPACT	Part no.
Compact control cabinet H x W x D: 30 x 30 x 21 cm 1 x SmartCheck sensor with 10 m Ethernet connecting cable, expandable with up to six sensors. Mounting with M6 screw connection Integral programmable SmartCheck sensor controller for data processing and external signal handling Integral 4.3" operating display for visualisation and parameter adjustment PoE switch for data signals and sensor power supply	290578
Optional for expansion:	
SmartConditionMonitoring Kit-Extension-10 m consisting of 1 x Ethernet cable, 10 m, and one SmartCheck sensor	283166
SmartCheck- Kit pre-configured sensor #2	298547
SmartCheck- Kit pre-configured sensor #3	298548
SmartCheck- Kit pre-configured sensor #4	298549
SmartCheck- Kit pre-configured sensor #5	298550
SmartCheck- Kit pre-configured sensor #6	298551
Ethernet cable 10 Metre for SCM Kit sensor	271188
Ethernet cable 20 Metre for SCM Kit sensor	271189
Ethernet cable 30 Metre for SCM Kit sensor	298545
Ethernet cable 50 Metre for SCM Kit sensor	297286

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