

Easy introduction of 24/7 remote condition monitoring

<Vol. 3> Simple, freely scalable remote monitoring systems



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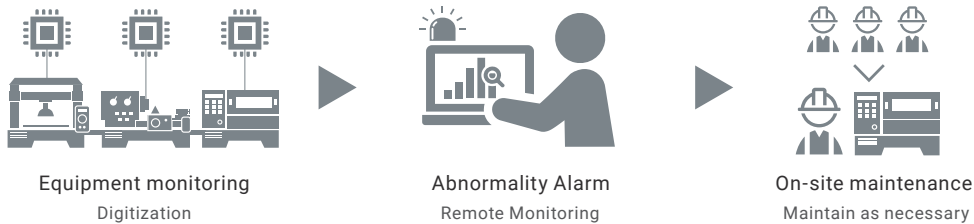


Omron's Predictive Maintenance Solutions

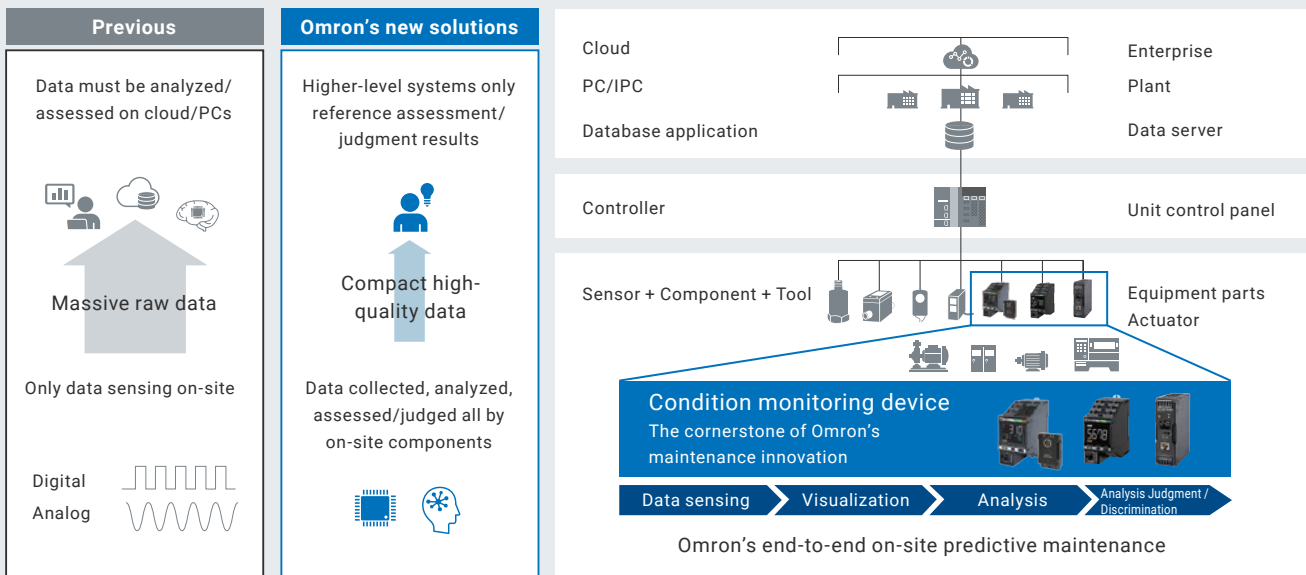
Predictive maintenance is the key to reducing unplanned downtime and operational costs

Due to large shifts in business conditions there is an urgent need to transform the workplace by overcoming the dependence of skilled maintenance personnel and using the latest technology as a primary solution. Overcoming cost and technological barriers can be difficult. Omron's solution monitors and analyzes real data by performing frequent checks.

Predictive Maintenance- take action when necessary

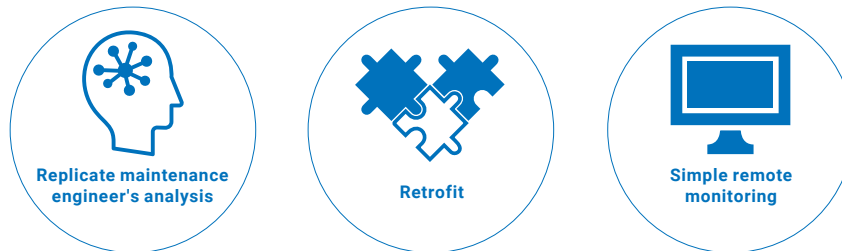


Remote monitoring of critical equipment using condition monitoring devices



Resolve issues through condition monitoring

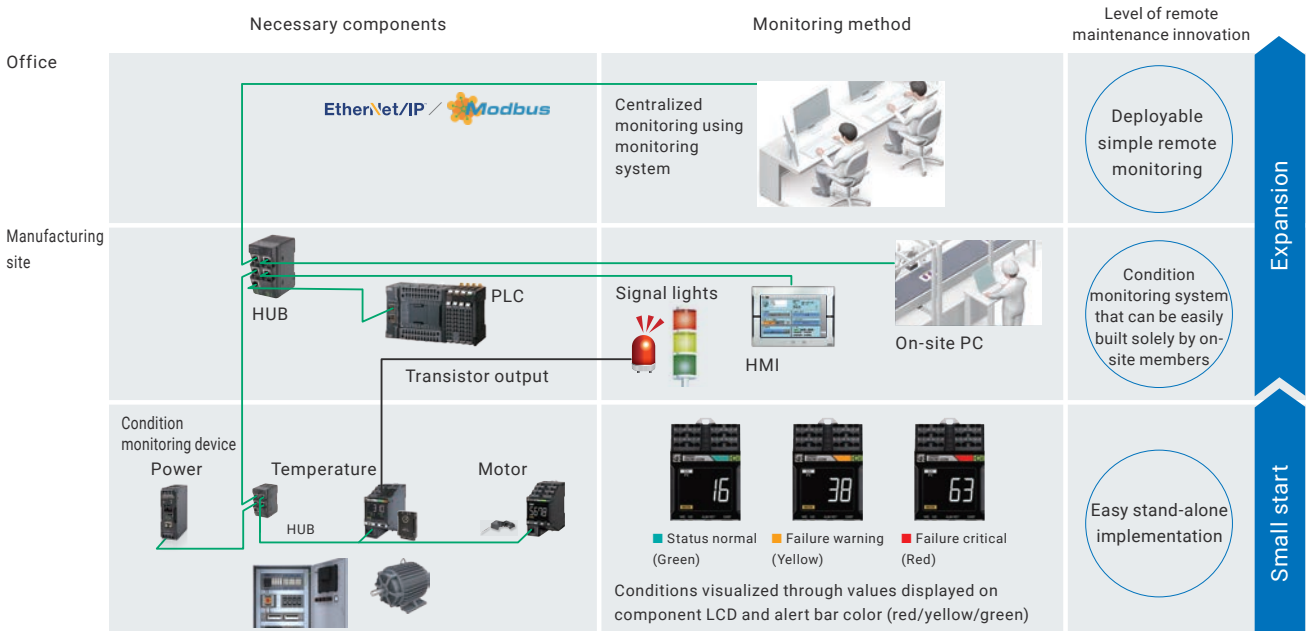
Our predictive maintenance solution is based on replicating skilled maintenance engineer's analysis, retrofitting existing equipment and remote monitoring. The technology simplifies the analysis of equipment by translating measurement data into simple alarms so a maintenance engineer can respond faster to issues.



Three Values of Omron's Condition Monitoring

Enables easy implementation of simple and freely scalable remote monitoring systems

Our condition monitoring devices support EtherNet/IP™ and Modbus TCP, both communication protocols widely used across the globe, through which they communicate the assessment/judgment results garnered from their analysis to higher-level systems. They allow for flexible systems that can cater to a broad range of environments, from predictive maintenance of stand-alone equipment and facilities to that of entire production lines through centralized remote monitoring from office PCs. We also offer monitoring tools, analysis tools, and PLC connection programs necessary for remote monitoring, to enable the optimal implementation according to the level of predictive maintenance improvement/innovation.



Replicating the maintenance skills (five senses) of seasoned engineers

The ability to isolate abnormal facility sounds from other noise, to touch and feel unusual movements in the facility—seasoned engineers harness their senses and knowledge nurtured by years of experience to discern when facility maintenance is needed. At Omron, we replicate these skills by establishing the best sensing methods for each application and packaging them into our condition monitoring devices.

Featured in Vol. 1

Retrofit for a quick and easy start

Modifying existing facilities can be a risky undertaking: the smallest alterations can compromise functionality, and large-scale alterations can have a dramatic impact on production. Omron's condition monitoring devices can be retrofitted to legacy production sites, lowering the hurdle for predictive maintenance implementation.

Featured in Vol. 2

Omron's condition monitoring device features that enable simple remote maintenance

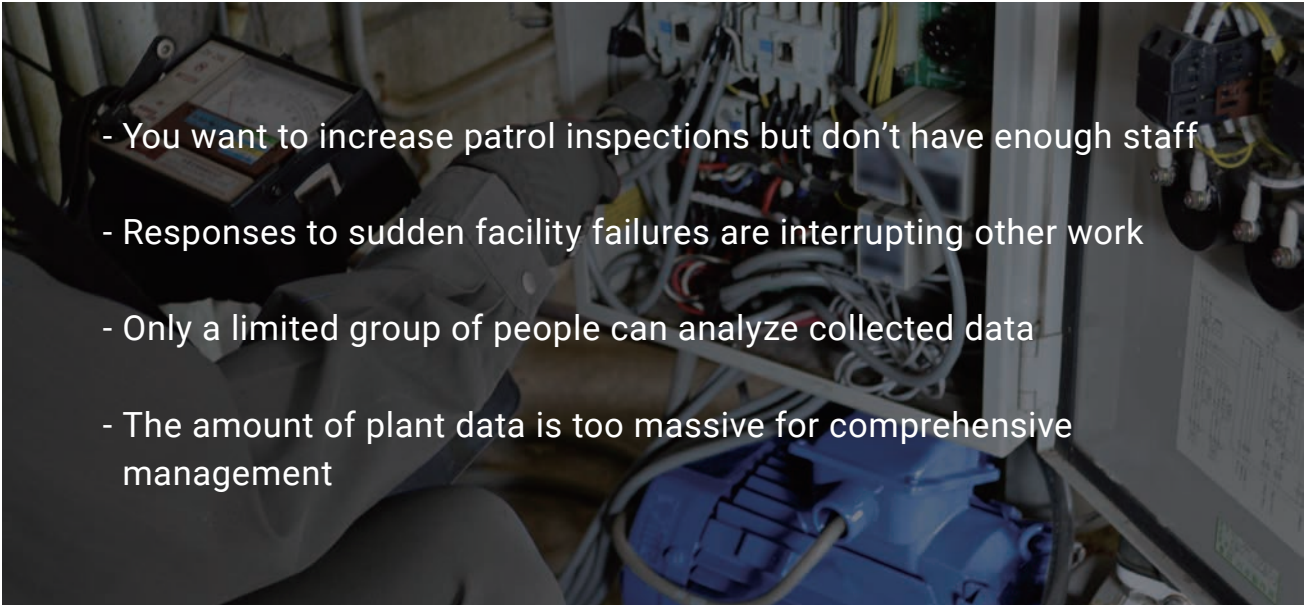


Maintenance innovation driven by remote monitoring systems

Implement your remote monitoring system without the hassle of complicated system design.

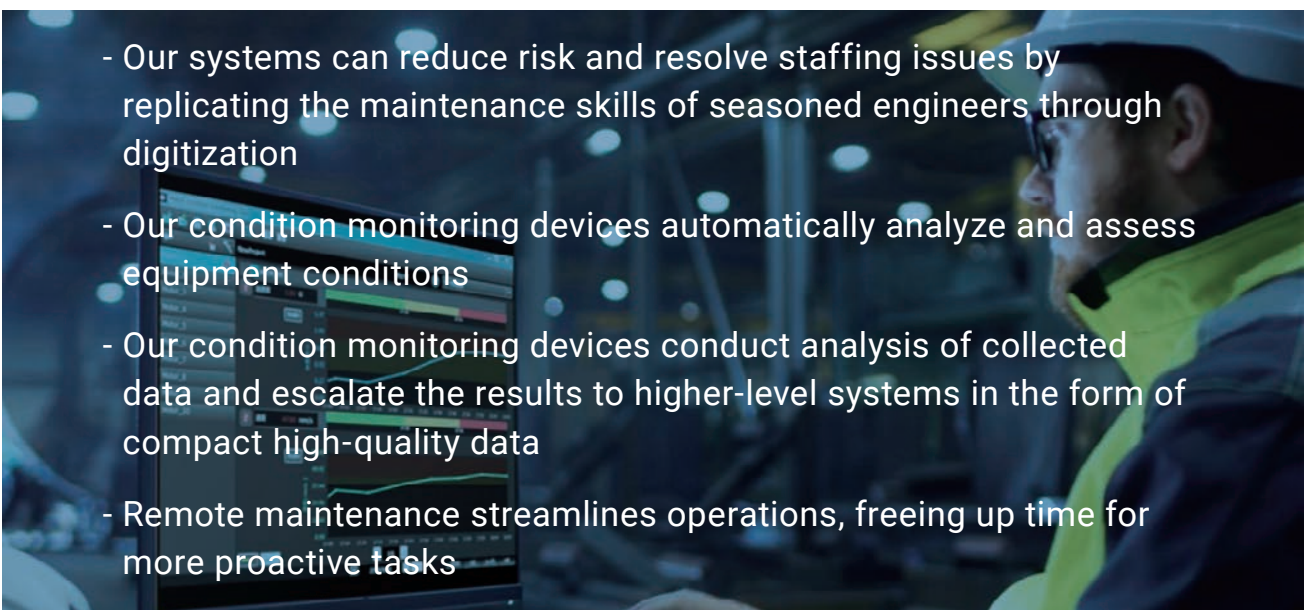
FROM

Do any of the following sound familiar?



TO

Omron's simple remote maintenance solutions can help!



Analysis and assessment by condition monitoring devices allow for equal levels of visualization on-site and at the office

On-site



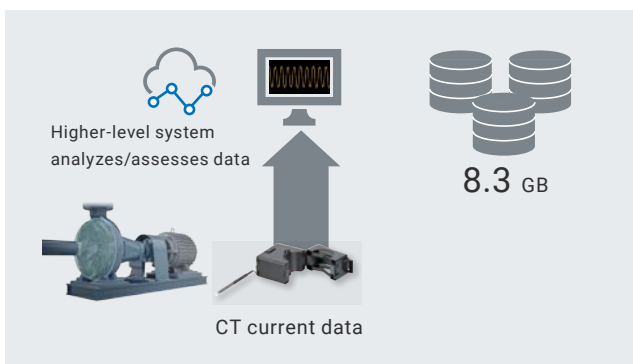
Remote



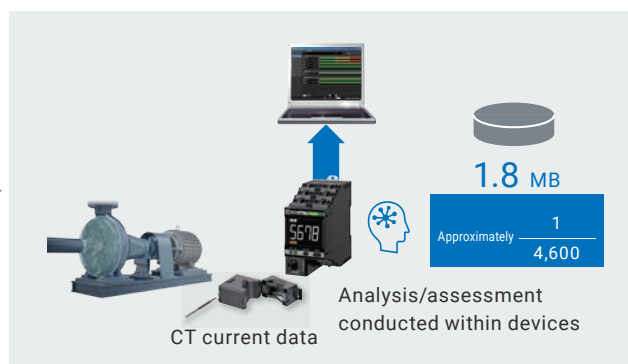
Edge computing allows for centralization of compact, high-quality data to higher-level systems, enabling streamlined IoT application

Example: Per-minute electric current values of motors collected over one-month period

FROM Massive data collected on-site escalated to higher-level system

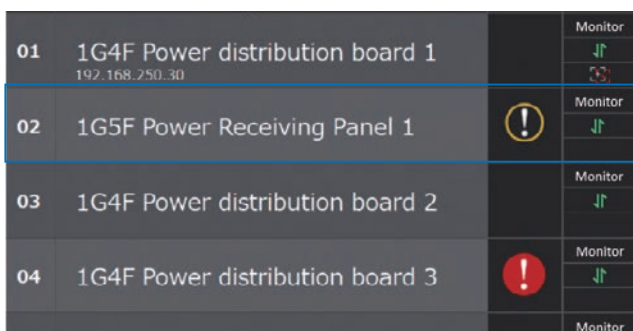


TO Condition monitoring devices analyze raw data and escalate only necessary data

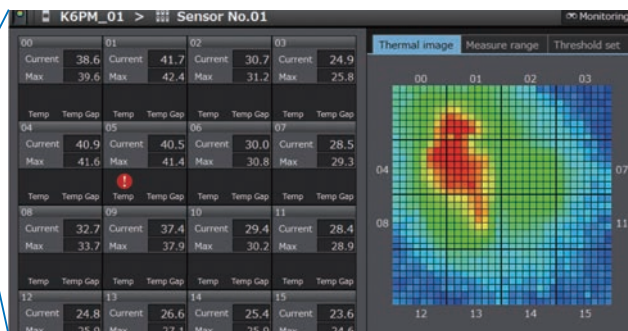


Specialized user-friendly tools allow for smooth transition to remote monitoring

Get an across-the-board view of all facilities



See detailed conditions of each facility with a click of a button



Predictive Maintenance Applications

Remote condition monitoring of hospital infrastructure facilities enables intensive management of chiller pumps and cooling fans

K6CM motor condition monitoring device

Effect: Significant savings in patrol inspection effort

Life-saving hospital infrastructure facilities are too critical to fail. Air conditioning fans and pumps were therefore protected through multiple risk-avoidance measures and inspected several times a day, which required vast amounts of effort. K6CM, which supports Modbus TCP as well as EtherNet/IP™, was included in the building management system for intensive remote monitoring of the vibration and temperatures of chiller pumps and cooling fans. This effectively reduced inspection effort and enabled early anomaly detection, allowing for systematic maintenance. The new system is also more energy-efficient, for continuing to use degraded facilities consumes excessive energy.



FROM

Patrol inspections cannot detect degradations in time

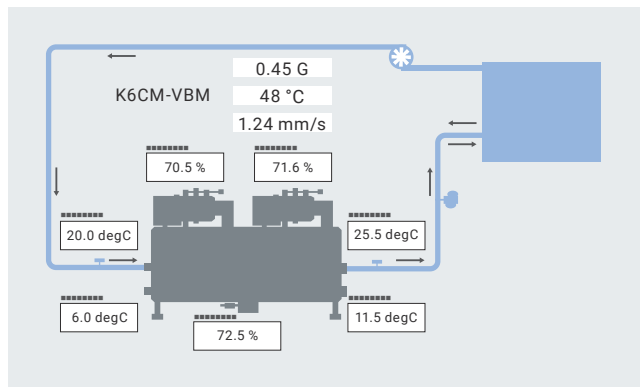
People actually had to go to the site for inspections, which was very effort-consuming.



TO

Constant monitoring by building management system enables systematic maintenance

Conditions of pumps and fans can be constantly and remotely monitored from the intensive monitoring chamber. This allows workers to detect anomalies early and track facility degradation, enabling systematic replacement/maintenance.



Customer Feedback



Hospital A

Facility maintenance technician

Switching from reactive to systematic maintenance enabled streamlining

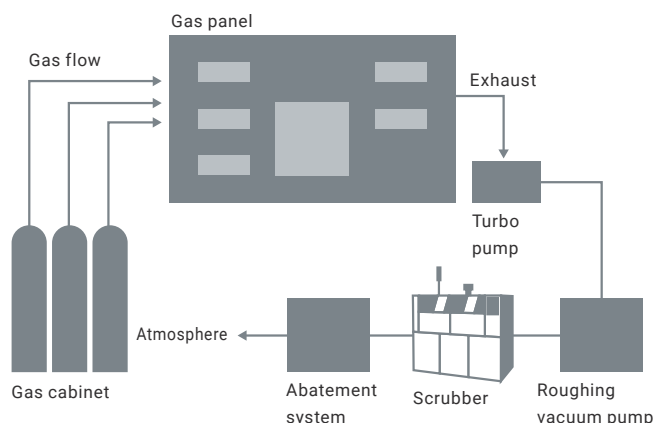
With K6CM built into our building management system, we can now constantly monitor the vibration and temperatures of our pumps and fans from remote locations, which allows us to take corrective measures early on. This makes maintenance and repairs easier and prevents unexpected stoppage in operations, dramatically reducing downtime. The new system also allows us to save energy by keeping damaged equipment from continuing to operate.

Remote monitoring of exhaust fans, air conditioning fans, and coolant circulation pumps via SCADA*¹ at semiconductor production facility

K6CM motor condition monitoring device

Effect: High-accuracy condition monitoring enabled by synchronization of monitoring data and other measurement data

Previously, workers went to the manufacturing site on a daily basis for inspections and record-taking, but would sometimes miss anomalies, which would eventually cause the facility to fail, forcing operations to halt. With the construction of a new building, an automatic monitoring system was installed to mainly monitor facilities that impact product quality, such as the exhaust fans of scrubbers, coolant circulation pumps, and air conditioning fans. Because vibration indicator values and current waveforms can fluctuate simply due to changes in operating conditions, it is difficult to distinguish by motor condition monitoring alone whether a perceived anomaly is actually a sign of degradation. Connecting K6CM to SCADA software allows monitoring data to be synchronized with other measurement data. The results of this synchronization is then visualized, enabling users to correctly interpret changes in sensor data and properly identify degradation trends.

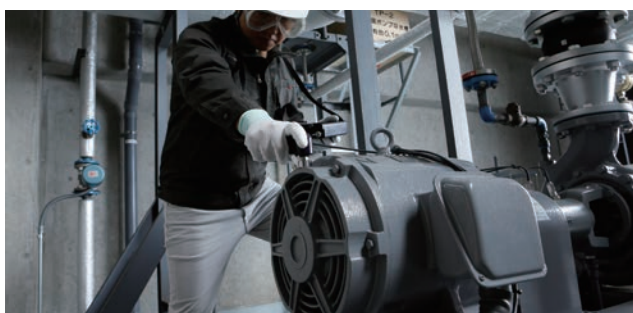


*1. SCADA: System that collects information from equipment/facilities via the network to a single location, monitors this information, and controls the equipment/facilities as needed

FROM

Multiple measurement data could not be viewed simultaneously, making it difficult to distinguish between normal and abnormal operation

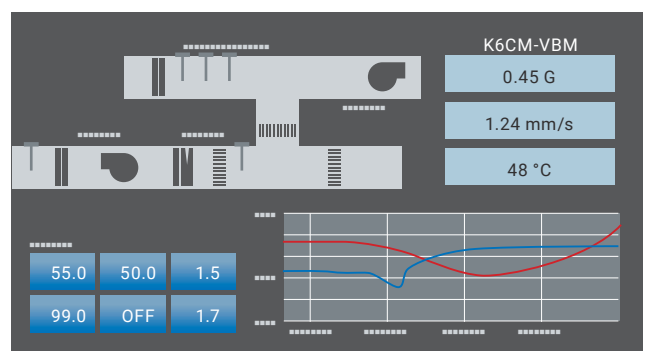
Patrol inspection data was recorded separately for each facility, making it difficult to see the correlation between data for different facilities and thus to correctly identify anomalies, increasing the risk of unexpected stoppage.



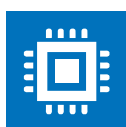
TO

K6CM connected to SCADA software to clarify correlation between data and facility operation conditions

Trends can be monitored based on motor condition monitoring data from specific time points. The correlation between this motor condition data and data from different facilities can be clarified, enabling accurate data analysis and timely maintenance.



Customer Feedback



Semiconductor manufacturer Company A

Facility maintenance manager

All monitoring data can be collected to SCADA system for comprehensive facility monitoring

Our initial plan was to install a separate PC for monitoring motor conditions, but we decided to go with K6CM because it supported Modbus TCP and so could be incorporated into our SCADA system. We can now see how the monitoring data correlates with all other measurement data and cross-reference different data to make the right decision.

Predictive Maintenance Applications

Constant remote monitoring for signs of air duct overheating in coating and drying process

Thermal condition monitoring device (K6PM-TH)

Effect: Better worker safety, reduced risk of hot air leaks

Coating and drying is one of the more dangerous processes in car manufacturing. In the drying oven, air heated to 400°C in the combustion chamber travels through the air duct for use in drying. These air ducts degrade over time, sometimes allowing air hotter than 100°C to leak, which can lead to burn injuries during patrol inspection. Hot air may also cause coating components accumulated on the interior of the duct to overheat. Such incidents can result not only in unexpected stoppage in production but also actual human injury or even death. The air ducts wind through spaces above the ceiling, underground, and other places that are hard to physically access, making the mere task of checking their conditions difficult. In addition to preventing overheating incidents and ensuring occupational health, streamlining the workflow is also a major issue in coating line maintenance.



FROM

Dangerous sites must be inspected in person despite accident risks

Hot air leaks from air ducts can cause burns or other injuries during on-site inspections. These leaks are also hard to predict; they may not be discovered in time with regular inspections conducted only a few times a year, leading to delays in initial action.



TO

Remote monitoring eliminates the need for dangerous inspections

Temperatures surrounding air ducts are remotely monitored by K6PM, allowing users to detect hot air leaks from office environments. This not only reduces dangerous patrol inspection work but enables early initial action against overheating as well.



Customer Feedback



Car manufacturer
Company A

Manufacturing department manager

K6PM improves worker safety and streamlines the workflow

In-person air duct inspections are dangerous; workers can get burned by hot air. We were trying to find some way to inspect our facilities without compromising the safety of our maintenance workers. K6PM allows us to do just that, by enabling remote air duct monitoring.

Manufacturing department technician

Streamlining frees up time to try new things

Air ducts are installed in the ceiling and other places that are hard to reach, so checking their conditions required extra effort, like climbing on ladders just to get access. K6PM allows us to monitor our air ducts from the comfort of our office and provides several other features for streamlining, giving us more time to try new things.

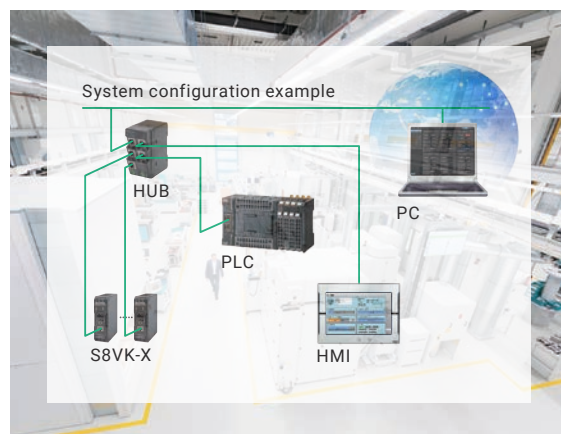
Remote monitoring of voltage/current conditions in overseas manufacturing facilities for early incident resolution

S8VK-X IoT power supply

Effect: Data from overseas plant sites can be analyzed at mother plant, enabling remote support for failure recovery

With the expansion of markets for digital devices and electric vehicles, markets for electronic parts for controlling autofocus and other cameras are growing rapidly as well.

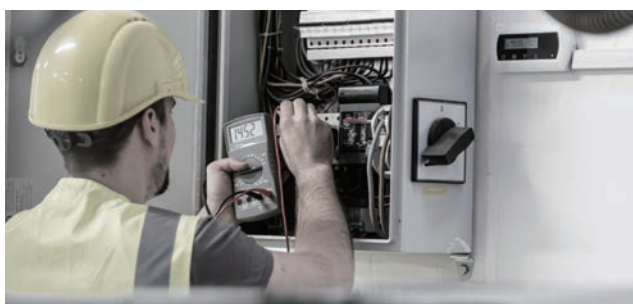
The rise in demand has driven a boost in production, making takt time and defect rate reduction critical issues which veteran engineers are working to improve every day. Maintenance workers at newly erected overseas production plants, however, have yet to gain experience and may not be able to promptly identify and resolve incidents. With the COVID-19 pandemic barring veteran maintenance workers from traveling to these plants, the customer needed a system that they could use to provide remote assistance to enable fast recovery. Fully accomplishing this goal would require cross-referencing a wide range of indicators, but as an introductory step, they built a monitoring system that uses S8VK-X to monitor the voltage and current conditions of power supplies, the lifeline of their equipment.



FROM

Inexperienced maintenance workers cannot quickly resolve issues on their own

Takt time and quality was being managed but no data for investigating incident causes, such as those on changes in current or voltage, was being collected. The time required for failure recovery therefore varied according to the experience level of the worker on duty.



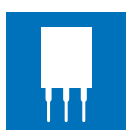
TO

Constant monitoring of current/voltage conditions and data collection allow skilled engineers to provide remote support for recovery

System for monitoring voltage and current conditions enables skilled engineers to provide remote incident support to on-site workers; accumulated data allows for easy maintenance planning.



Customer Feedback



Electronic parts manufacturer

Maintenance department manager (mother plant)

Sharing data with remote locations allows for faster communication

With this new system, on-site workers at the overseas plant can monitor for changes anytime using the touch panel interface, making anomaly detection easier. Skilled engineers at the mother plant, on the other hand, can use accumulated data to provide remote support to these workers, reducing the need for them to actually go to the site.

Maintenance department technician (overseas plant)

New system enables cause investigation and early recovery

Because S8VK-X supports EtherNet/IP™, it allows us to monitor operating conditions such as current, voltage, and replacement time. Data accumulated on the PLC and office servers can be used for incident cause investigation, early recovery, and root cause analysis.

TOPICS

Insulation resistance monitoring device K7GE

New release

Identifying trends in insulation resistance degradation is crucial in preventing facility downtime and electrocution incidents. With the shortage of veteran maintenance workers at the production site, however, it may be difficult to use their time for manual measurement. In previous systems, regular on-site measurements of insulation resistance were a must; with K7GE, which applies the same principle as insulation resistance meters, measurements can be made automatically using trigger signal input, enabling systematic maintenance.

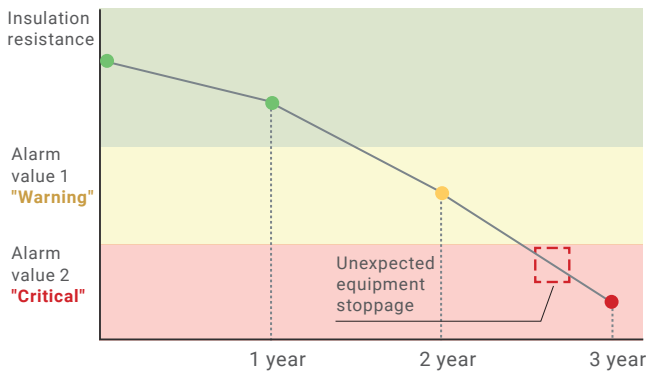
Measurements can be made more frequently for accurate identification of the slightest facility anomalies

Measuring a facility's insulation resistance can cause significant impact. For example, they require that the facility be powered off, forcing production adjustments; resources must also be secured for the actual task of making the measurements. Because of this impact, measurements could not be made very frequently, sometimes allowing insulation degradation to go undetected until it finally caused sudden downtime. K7GE can measure insulation resistance quickly and automatically, even during a 10-minute break. This minimizes the impact on the production schedule, allowing for measurements to be made as frequently as needed.

FROM Manual measurement using megohmmeters

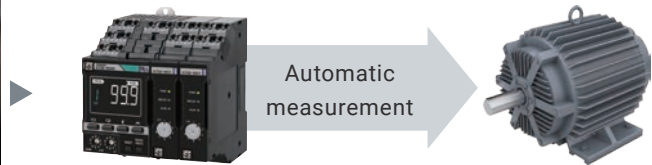


Measurement using megohmmeters (once/year)

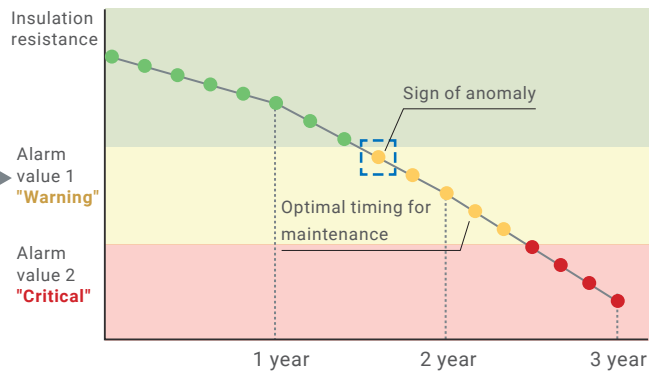


Unexpected stoppage because the once-a-year inspection failed to discover the anomaly

TO Automatic measurement by K7GE



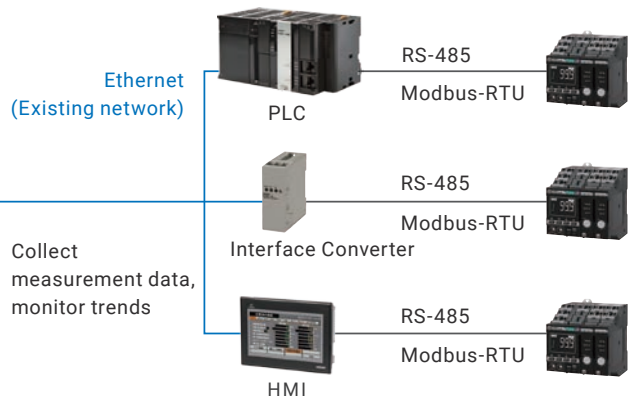
K7GE



Anomaly identified before a sudden stoppage due to periodic trend monitoring

Insulation resistance data collected via communication is visualized in remote locations for systematic maintenance

Measurement results can be both viewed on-site on the K7GE unit and monitored remotely at office sites using touch panel screens and PLCs connected to the unit by network communication via interface converters.



Application examples

Monitoring insulation degradation of metal parts processing machine

NC machine tools and machining centers use cutting oil to process metal parts. This oil vaporizes and seeps into built-in motors, causing insulation to degrade faster. Insulation resistance cannot be measured very often, for measurements must be taken from motors inside the facility, which requires production downtime. K7GE automatically takes measurements when a facility powers off, making the process much easier and thus allowing for better degradation trend monitoring. Up to a total of eight probe units can be installed to enable monitoring of processing machines with multi axis motor control systems.



Monitoring insulation degradation of exhaust fans for coating process

In the coating process, air containing vaporized coating material passes through exhaust fans; components of this material can seep into the fans to cause insulation degradation. Facilities that need insulation resistance measurement are often located in high places, forcing workers to work at dangerous heights. With K7GE, measurements can be made automatically and therefore safely and efficiently.



Special Feature Maintenance tips

Here are some case studies for facility maintenance streamlining.

Power supplies

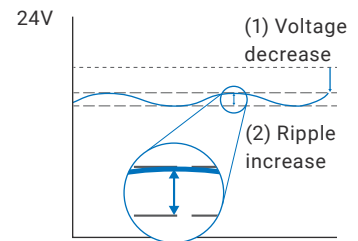
Issue Facilities that were operating normally yesterday are not starting this morning when powered on. Investigation revealed that 24 VDC power is not being supplied from the power supply.



Cause The power supply may have reached its end of life due to electrolytic capacitor degradation.

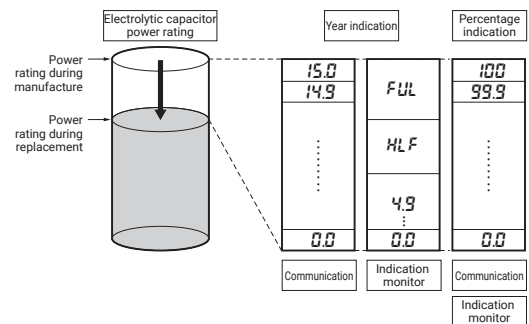
Power supplies do “age” over time, so we recommend that they be replaced on a regular basis. Power supplies have electrolytic capacitors which degrade when used over long periods of time and impact their performance, such as their ability to start under low temperatures. Power supplies are by nature less able to start under lower temperatures; the lower the temperature, the more difficult it is for them to start. This difficulty is exacerbated as their electrolytic capacitors degrade, until they finally become unable to start at all. In this case, the power supply’s electrolytic capacitor, which is thought to be quite degraded, is likely to have cooled while the facility power was turned off, rendering the power supply unable start. Other issues caused by electrolytic capacitor degradation include diminished power output ((1) on Figure 1 at right) and increased ripple noise ((2) on Figure 1). For example, degradation of the electrolytic capacitor of a power supply with an output of 24 VDC upon implementation may reduce its output to about 22 VDC or cause severe fluctuations in its output voltage. Although such symptoms, if noted, can inform users that the product is nearing its end of life, they can be easy to miss, for they usually have little impact on the operation of 24 VDC devices.

Figure 1



Solution You can reduce the risk of unexpected stoppage by using power supplies that can visualize when they should be replaced.

At Omron, we provide a feature that lets you see how much life is left in our power supplies by constantly calculating the level of electrolytic capacitor degradation based on use conditions (ambient temperature, load factor, etc.). The results of this calculation are displayed as the percentage of time (number of years) left to replacement, set at 100% upon shipping and decreased by increments of 0.1%, which users can reference to determine when to replace their power supply.



Relationship between electrolytic capacitor power rating and indicator

Recommended Omron product

Switch Mode Power Supply S8VK-X

The S8VK-X power supply allows you to easily monitor the degradation of its electrolytic capacitor and product replacement time from your PC (With models with 7 segment LED displays, you can view this information on the product itself as well).

Power Supply Monitoring Tool



Enables real-time monitoring of electrolytic capacitor degradation, product replacement time, output current, and output voltage

How to better store your power supplies

Electrolytic capacitors degrade even if they are not energized or used for a long time. When storing a power supply over long periods of time, if possible, store it under normal temperatures ($\leq 30^{\circ}\text{C}$) and a relative humidity of 25%-70%. Before using a power supply that has been under storage for one year or more, apply voltage to the power supply with zero load current for at least 30 minutes.

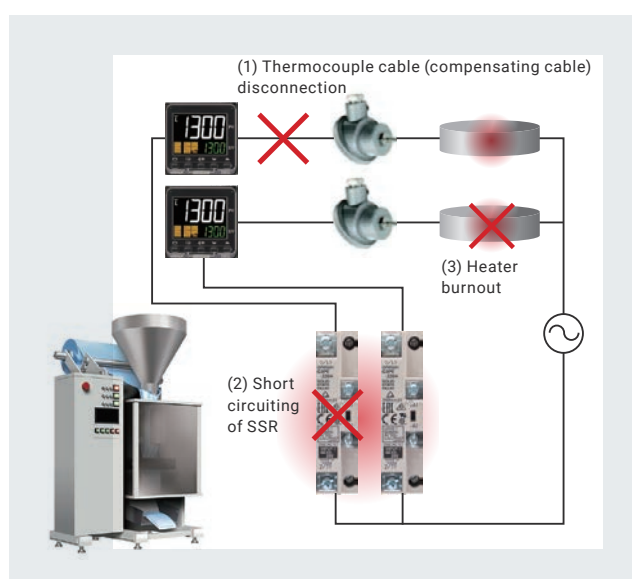
Temperature controller and related equipment

Issue Peripheral devices for temperature control frequently fail in packaging machines and other equipment with moving heaters. Even if these devices are replaced, their replacements also fail not long after installation.

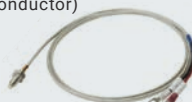




Cause The devices being used may not be equipped to withstand the operating conditions.

Temperature control is achieved by a coordinated system of temperature controllers and peripheral devices: thermocouples for measuring temperature, heaters for heating workpieces, and solid state relays (SSRs) for controlling heater operation. A typical example of a machine equipped with such a system is the packaging machine (figure at right), in which multiple SSRs are used to control the current fed to heaters with thermocouples that repeat the same movements over and over. Temperature control issues are actually more likely to occur not because of problems in temperature controllers but those in peripheral devices, which may burn out or become disconnected due to mechanical (bending) or thermal factors, or short circuit due to thermal factors. You can extend your system's service life through proper use and by replacing its peripherals with more durable alternatives, and this requires that you sufficiently understand how it works. The chart below provides basic functional information on key components and describes proactive measures you can take to prolong their service lives.



Solution Reduce failure incidents by mitigating equipment degradation and preventing rapid heating.

Peripheral device	Failure example	Solution
Thermocouple (Compensating Conductor) 	(1) Thermocouple cable (compensating cable) disconnection Thermocouple cables degrade faster when installed along parts that bend frequently, until they finally break.	Use thermocouples that use cables with high bendability (10x typical products). - Thermocouple (Special models for Packaging Machines) Omron E52-□ S2 (bend-resistant, heat-resistant model) - Compensating Conductor Omron WCAG-40 (silicone sheath, high bendability)
SSR 	(2) Short circuiting of SSR SSRs themselves emit heat, which means that when multiple SSRs are installed in close proximity to each other, their degradation is accelerated by the heat they produce until they finally stop working.	Typical SSRs can be used at their rated current (25A) only when they are installed with sufficient space around them in ambient temperatures no more than 40°C. Up to three of our G3PJ SSRs can be installed in close proximity and still work at their rated current of 25A.
Heater 	(3) Heater burnout Rapid and repeated heating causes heater components to expand and contract, accelerating degradation and ultimately resulting in burnout.	Our temperature controllers (E5□C, E5□D, E5□N-H) are equipped with the SP Ramp feature, which allows heaters to heat up more slowly to prevent rapid expansion.

Omron's Predictive Maintenance Solutions

If you have any requests or questions, please ask our sales person.

Motor Condition Monitoring Device K6CM



Thermal Condition Monitoring Device K6PM-TH



Motor Condition Monitoring Devices
K6CM series
Application Guide

Cat. No. N223-E1

IoT Power Supply S8VK-X



Insulation resistance monitoring device K7GE



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