Predictive Maintenance

Solutions to Transform your Maintenance Strategy

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Agenda

- Industry challenges with plant maintenance

- Overview of predictive maintenance

- Omron predictive maintenance solutions

  - S8VK-X Ethernet/IP Power Supply

  - K6CM Motor Condition Monitor

  - K6PM Thermal Condition Monitor

- Key takeaways

- Questions

Industry challenges

Unplanned downtime

82% of companies experience unplanned downtime.
Downtime may cost up to $260,000/hr

High maintenance costs

Aging equipment can be expensive to maintain and manufacturers spend an average of 19 hours a week on scheduled maintenance

Shortage of maintenance workers

Manufacturers struggle to fill roles in industrial maintenance as experienced workers retire

Unplanned downtime

Top causes of unplanned downtime

1. Aging equipment
2. Operator error
3. Lack of maintenance due to limited resources

Cost of unplanned downtime		
Industry	Cost of downtime (per min.)	Cost of downtime (per hr.)
Automotive – Assembly	$15,000	$900,000
Automotive – Powertrain	$5,000	$300,000
Semi-conductor	$4,167	$250,020
Processed Food Production	$312	$18,720
Bottled Water Production	$50	$3,000

Cost of components (no labor)	
Item	Cost
50 hp. 3-phase motor	$6,000
Transformer	$7,000
Variable Frequency Drive	$10,000
Servo Motor	$2,000
Gearbox	$10,000

What is Predictive Maintenance?

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Predictive maintenance (PdM) is a condition-based maintenance strategy that remotely monitors the condition of equipment using IoT sensor devices. The IoT sensors supply real-time data of equipment and analytics are performed to predict when the equipment requires maintenance.
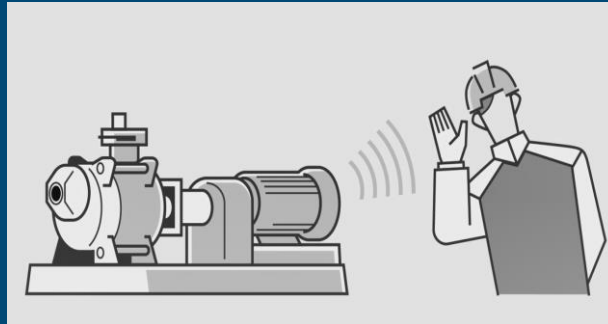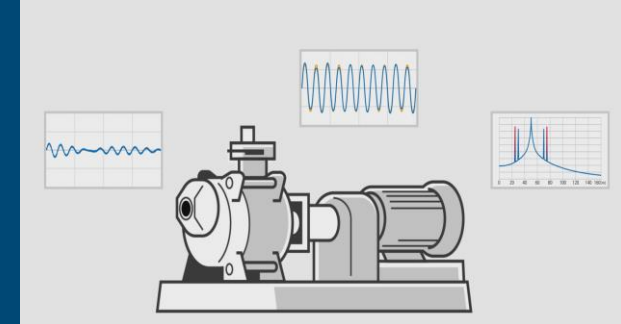
From → To

Reactive Maintenance

(Run to failure)

- Low maintenance costs
- Higher probability of unplanned downtime
- Cost of repairs can be much higher than the cost of preventive maintenance

Preventive Maintenance

(Time based)

- Most common maintenance strategy
- Scheduled maintenance
- Labor intensive
- Time consuming
- Limited monitoring

Predictive Maintenance

(Condition based)

- Continuous monitoring and analyzing of machine conditions
- *Predicts* when equipment needs maintenance and perform maintenance accordingly
- Reduces the need for frequent inspections
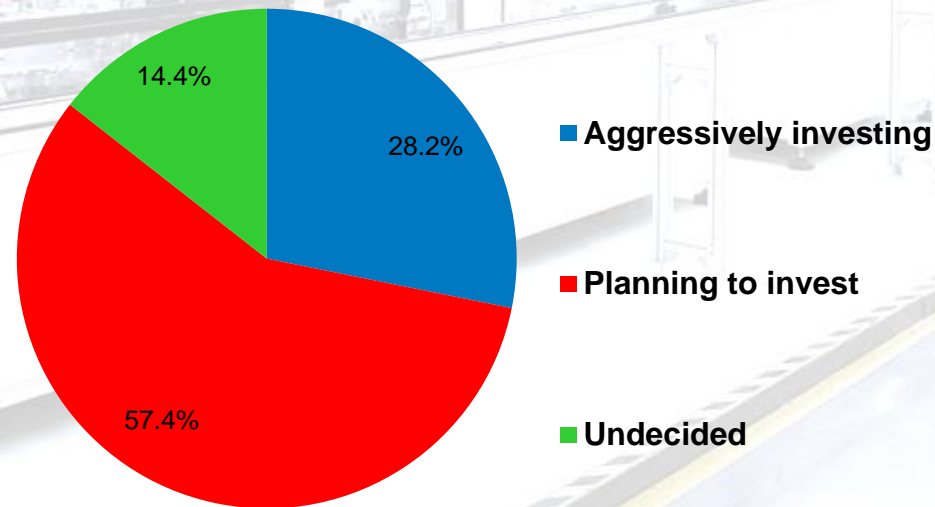- Lower maintenance costs $$ over preventive

Predictive Maintenance

**Customer survey on Plant Maintenance
(443 Omron customers)**

86% of customers surveyed are executing or planning to invest in Predictive Maintenance Solutions

- 28.2% ■ **Aggressively investing**
- 57.4% ■ **Planning to invest**
- 14.4% ■ **Undecided**

Omron's Predictive Maintenance Solutions

Three turnkey IoT condition monitoring products that make it easy to remotely monitor your power supply loads, motor condition and thermal condition of equipment

S8VK-X Power Supply

Monitors:
- DC voltage
- DC current
- Peak current
- Run time
- Replacement time

K6CM Motor Condition Monitor

Monitors Motor:
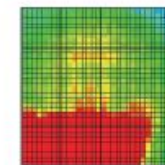- Vibration
- Temperature
- Current
- Insulation Resistance

K6PM Thermal Condition Monitor

Monitors:
- Temperature

EtherNet/IP / Modbus

24/7 Monitoring

What makes Omron unique?

1. Built in LCD display
2. Free PC monitoring software
3. Built-in algorithms provides savings in engineering time

How to integrate Predictive Maintenance devices into existing equipment

OMRON

- Identify critical assets that requires frequent maintenance
- Install devices into existing or new equipment
- Connect devices to monitoring software
- Establish a baseline of acceptable condition limits
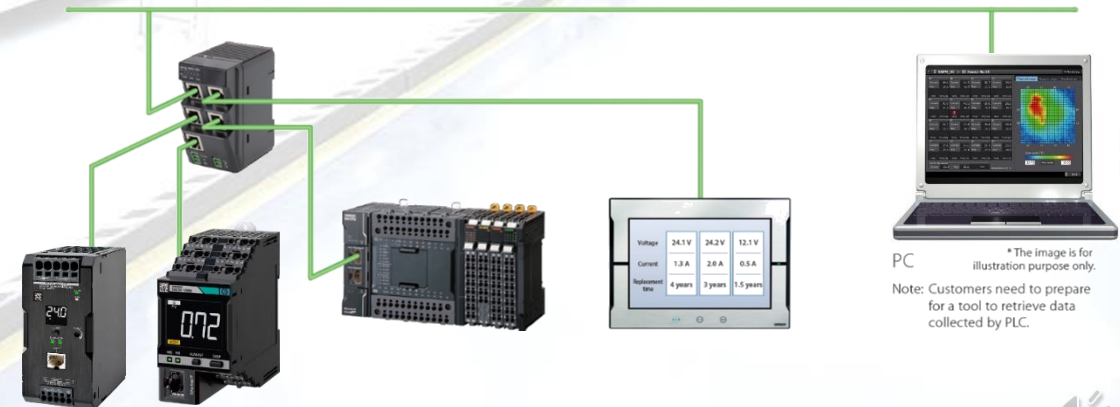- Set warning and alarm thresholds
- Schedule maintenance when condition limit is exceeded

Compatible with **EtherNet/IP** / **Modbus**

System configuration example

PC

* The image is for illustration purpose only.

Note: Customers need to prepare for a tool to retrieve data collected by PLC.

Voltage	24.1 V	24.2 V	12.1 V
Current	1.3 A	2.6 A	0.5 A
Replacement time	4 years	3 years	1.5 years

S8VK-X Power Supply
An advanced IoT power supply that remotely monitors DC loads

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Specifications

- Single Phase

- Power Rating: 30W-480W models

- Input Voltage: 100-240 VAC/90-350VDC

- Output Voltage: 5, 12, 24VDC

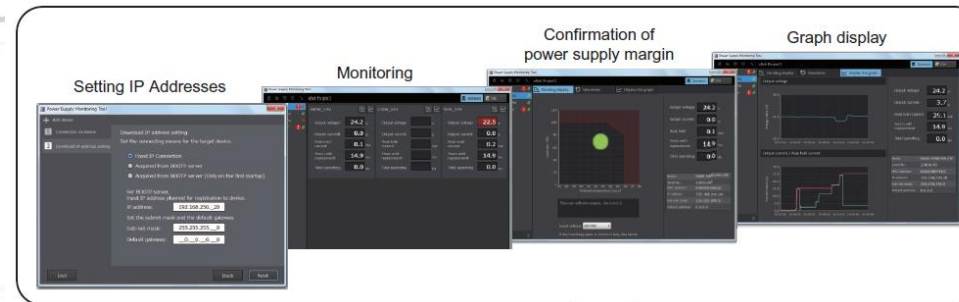- Operating range = - 40°C to 70°C

- Class 2 rated (30W/60/90W only)

Key features

- Ethernet/IP & Modbus TCP communication

- Monitors output voltage, current, peak current, run time, and life expectancy

- Optional display

- Alerts for low/high voltage & current conditions

- Free monitoring software

- 5 year warranty

EtherNet/IP / Modbus

Output voltage	24.0	V
Output current	3.0	A
Peak hold current	6.3	Apk
Years until replacement	14.7	Yrs
Total run time	0.0	kH

Setting IP Addresses
Monitoring
Confirmation of power supply margin
Graph display

S8VK-X
Power Supply Monitoring Tool

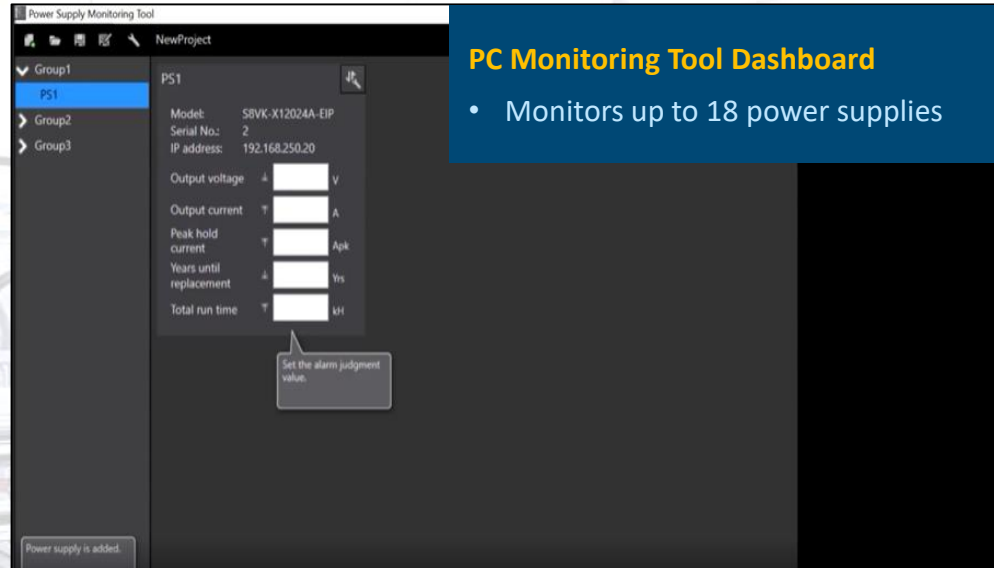Calculates remaining life by monitoring capacitor temperature & run time

Years until replacement
3.0 Yrs

Percentage until replacement
20.0 %

S8VK-X Monitoring Software

Remotely monitor multiple power supply loads in one software

PC Monitoring Tool Dashboard

- Monitors up to 18 power supplies

Simulation mode
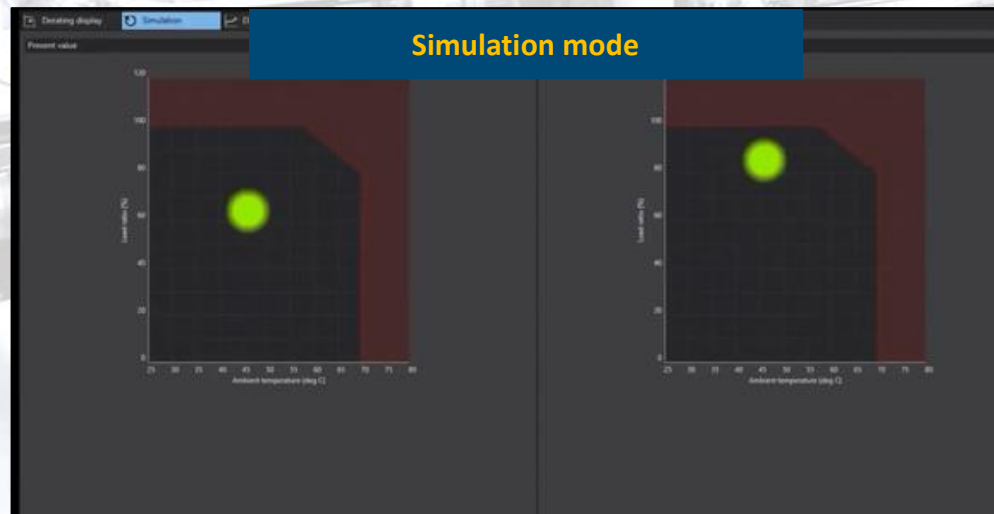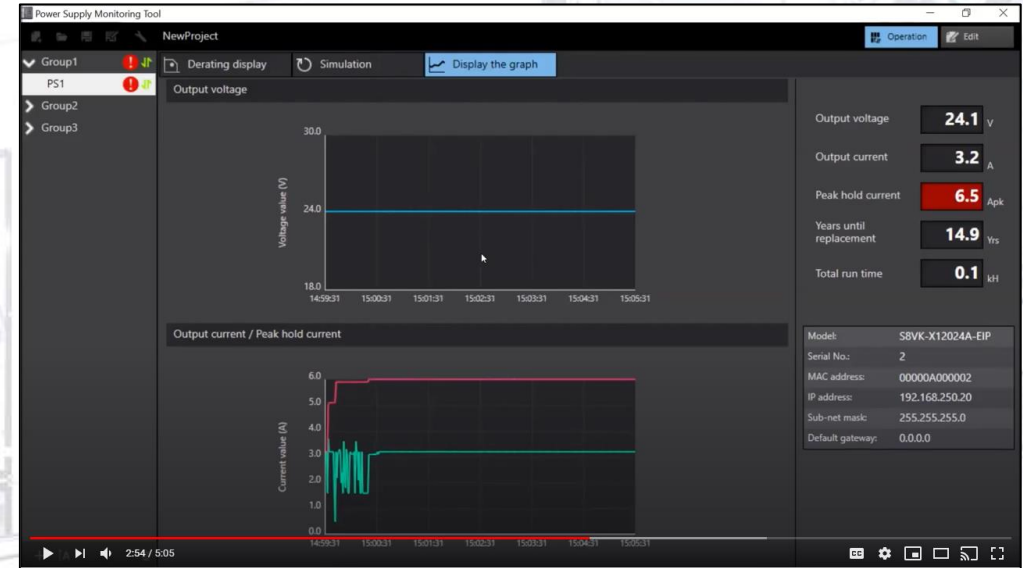
Trending Graph

- Output voltage

- Output current

- Peak current

S8VK-X Power Supply Benefits

24/7 remote monitoring of power supply loads and life expectancy

From

Preventive Maintenance

- Time consuming panel inspections with multi-meters to check for abnormal circuit issues
- Time based power supply replacements

To

Predictive Maintenance with the S8VK-X

- Remote monitoring of power supply DC loads
- Reduced maintenance costs with panel inspections
- Maximize power supply life vs. replacing it early based on a schedule

S8VK-X

Return on Investment

- Average cost of one panel inspection $300 USD
- Cost of 1 hr. of unplanned downtime in Automotive Manufacturing $765,000 USD (based on internal study)
- Average payback period for investing in one S8VK-X power supply is 1-2 years.

S8VK-X Applications

The S8VK-X power supply can be used in control panels for various industries and applications
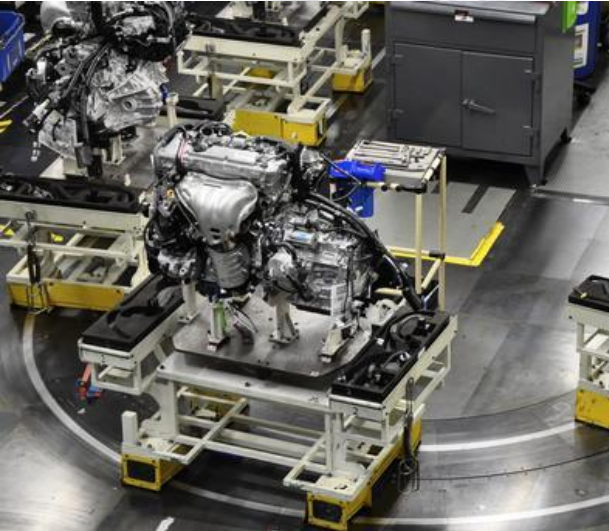
Automotive Industry

- Paint stations
- Parts manufacturing
- Stamping press
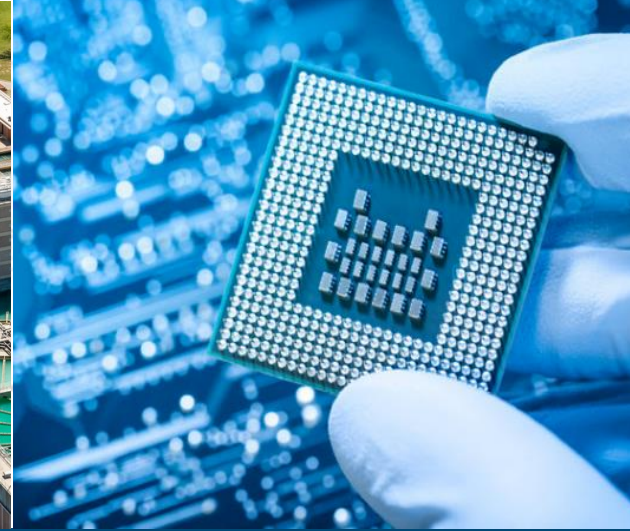- Casting equipment
- Conveyors

Food and Beverage Industry

- Filling and packaging process
- Heat sealing process
- Spray dryer equipment
- Storage tank mixers

Infrastructure Industry

- Water and waste water equipment
- HVAC equipment
- Hydraulic equipment
- Conveyors
- Warehousing equipment

Digital Industry

- Semi-conductor deposition
- Molding stations
- Winding stations
- Parts transportation
- Material pretreatment

S8VK-X Success Story

Automotive manufacturer improves predictive maintenance by switching to the S8VK-X power supply

Challenge:

A global auto manufacturer experienced multiple power supply failures using a competitor's power supply. The failed power supply caused significant unplanned downtime in their plastic forming station.

Solution: The customer learned about the S8VK-X's monitoring features and found it beneficial in preventing unexpected failures. They also had experience with Omron's S8VS power supply and found it to have excellent reliability.

Results : The customer switched to the S8VK-X as the global power supply and started to upgrade all of their equipment panels throughout the various plants.

Success story

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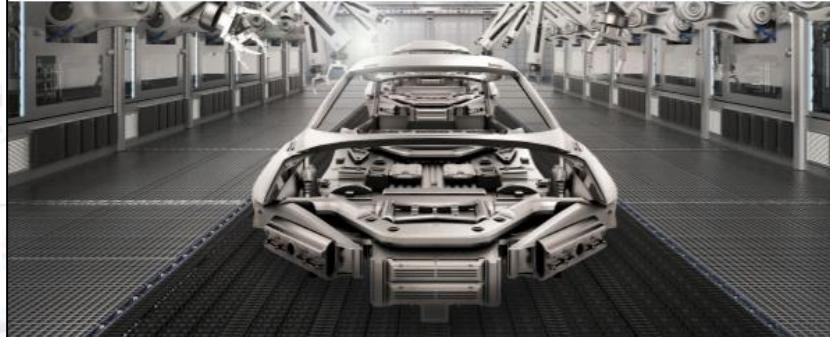
Large automotive manufacturer dramatically improves predictive maintenance by switching to Omron power supply

An automotive plant in the Midwest that manufacturers SUVs was experiencing unexpected power supply failures in the plastic forming department. This issue was in turn causing unplanned equipment downtime that significantly impacted the production of vehicles being assembled at the plant.

The automotive plant learned about Omron's strong predictive maintenance offering through the Omron Strategic Account Team. Not wanting to take the chance of having the line shut down again due to a power supply failure, the plant did a thorough analysis of all options and selected Omron based on the quality of its S8VS-A Series switch mode power supply (an older technology now replaced by the S8VK-X).

The plant's team also placed great value on the option to see how the power supply is functioning from a remote location and to make changes remotely without needing to open up the panel. Both of these capabilities are offered by Omron's predictive maintenance solutions and are known to be a great time-saver from a productivity standpoint.

Business need

An automotive customer was experiencing unexpected power supply failures in its plastic forming department, which in turn caused equipment downtime that significantly impacted vehicle production.

Unique solution

The customer replaced its power supply with the Omron S8VK-X, which provides 24/7 remote monitoring of power supply health via EtherNet/IP to help identify abnormal DC circuit issues.

Customer benefits

The problems with unplanned equipment stoppages have been resolved, and the customer now has peace of mind thanks to remote power supply monitoring and the ability to respond to issues more quickly.

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The solution

Predictive maintenance with the S8VK-X

The need

The plant had previously been using a power supply from an Omron competitor to power critical components in its plastic forming equipment. Since the competitor's power supply lacked remote monitoring capabilities, the customer was unable to identify abnormal issues in a timely manner and troubleshoot accordingly. After realizing that Omron offered remote monitoring, the customer sought approval to change the plant spec over to an Omron power supply.

With the help of a local system integrator, the customer retrofitted and updated its current panels to implement the Omron S8VK-X Series switch mode power supply. The process took about ten minutes per unit.

The technology

The new solution is designed to let the customer to monitor real-time power supply status in order to prevent unexpected failures. Omron's S8VK-X is an advanced DIN rail-mountable device that provides 24/7 remote monitoring of power supply health via EtherNet/IP, including important data like voltage, current and peak current to help identify abnormal DC circuit issues.

The S8VK-X also comes with a power supply life monitoring software that can remotely monitor the conditions of multiple power supplies. This advanced solution dramatically improves predictive maintenance on industrial equipment and helps customers respond more quickly to critical electrical issues on their equipment.

The outcome

By replacing the competitor's power supply spec with the Omron S8VK-X in the plastic forming equipment, the automotive plant was able to resolve the previous issues with unplanned equipment stoppages. The new solution gave the customer peace of mind thanks to the ability to understand how the unit is performing and get ahead of any issues before they result in costly downtime.

The customer is also seeing a significant time-saving benefit of the new system. Power supplies are typically overlooked until they fail, so it's important to have predictive maintenance capabilities on a product that normally doesn't have this functionality. The customer is very happy with Omron's high level of product dependability since downtime is an unaffordable expense.

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Omron Automation | 800.556.6766 | automation.omron.com

Industrial 3-phase motors

Common motors voltage ratings

- 208V, 240V, 480V, 600V (Canada)

Common motor applications

1. Material Processing
2. Pumps
3. Material Handling
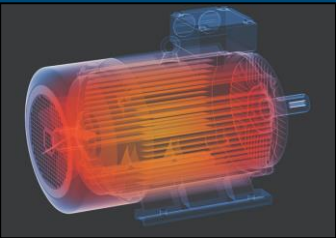4. Fans
5. Compressors

Top causes of motor failure

1. **Bearing wear** – caused by lack of lubrication

2. **Insulation breakdown** –caused by dust, fluids, heat

3. **Overload** – caused by exceeding motor load capacity or misaligned drive systems

Size Range	Number	Average Hours of Operation per Year	Total Energy Use, Million kWh/year	% of Total Motor Energy Use
1 to 5 hp	7,306,080	2,745	27,807	4.8
6 to 20 hp	3,288,035	3,391	60,122	10.4
21 to 50 hp	1,129,527	4,067	73,111	12.7
51 to 100 hp	363,940	5,329	72,924	12.6
101 to 200 hp	220,908	5,200	83,099	14.4
210 to 500 hp	86,836	6,132	90,819	15.8
501 to 1,000 hp	28,047	7,186	77,238	13.4
1,000+ hp	10,958	7,436	90,307	15.7
Totals:	12,434,330	5,083	575,400	

K6CM Motor Condition Monitor
24/7 Remote Motor Condition monitoring for 3-phase motor failures

K6CM Controller

EtherNet/IP™ / Modbus

Key features

- DIN-rail mount controller with LCD display and alarm bar
- Ethernet/IP & Modbus TCP communication
- 3 sensor options for monitoring various type of motor failures
- Transistor outputs for external alarms
- Free PC monitoring software
- Built-in algorithms for analyzing motor conditions
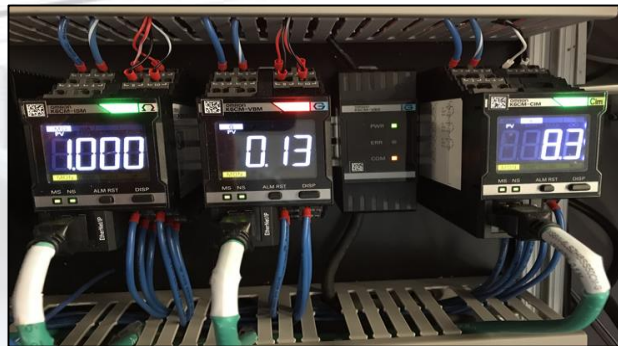
K6CM Sensor Options

Current transformer (CT)
K6CM-CI2M model

Monitors motor current and analyzes current sine wave for **abnormal load conditions.**

Vibration/temperature
K6CM-VBM model

Monitors motor vibration and temperature for detecting **bearing wear**

Zero current transformers
K6CM-ISM model

Monitors insulation resistance to detect **insulation breakdown** from dust or chemical intrusion
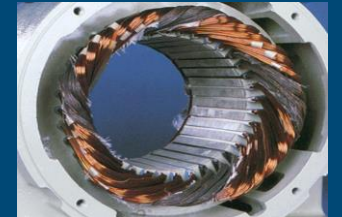
K6CM-CI2M Current Analysis Model

Detecting abnormal motor load conditions

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Highlights

- Measures motor current up to 600 A and analyzes AC sine waves for load abnormalities
- Displays Amperage and Degradation level
- UL/CSA
- Rated up to 600V 3-phase motors

Ideal for:

- Detecting abnormal load conditions such as pump cavitation, over load, foreign debris in a mixer
- Inverter applications or motors with variable speed
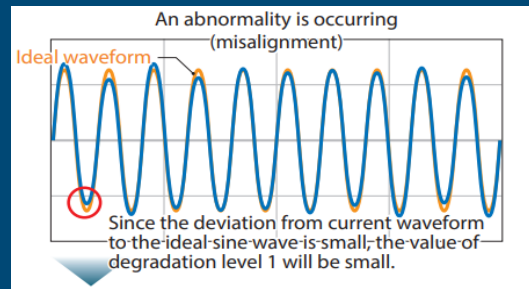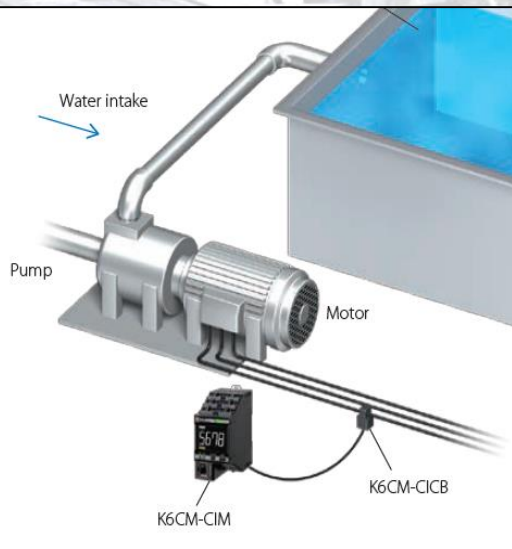
Current Analysis

Built-in algorithms analyzes motor current sine waves for deviations from the uniform sine wave. The K6CM provides a degradation level to determine how critical the deviation is.

Detects abnormal loads like pump cavitation by performing a current analysis on the motor. Quick detection of abnormal conditions can prevent catastrophic damages from happening.

Current Transformer Input ranges

- 5A , 25 A, 100 A, 200 A, 400 A, 600A

Degradation level 1 under normal conditions is about 13-16,
Vibration (acceleration) is about 0.05-0.06G.

K6CM VBM – Vibration/Temperature Model

Detecting bearing wear conditions

Highlights

- Measures velocity, acceleration, temperature, Δ temperature
- Vibration detection frequency : 10 Hz to 10 kHz
- Rated up to 600V 3-phase motors

Ideal for:

- Detecting bearing wear conditions on motors and drive systems
- Constant speed motor applications

Vibration/Temperature sensor
IP67G rating

Pre-amplifier

(built-in ambient temperature sensor)

Acceleration (G)

Detects earlier bearing wear conditions
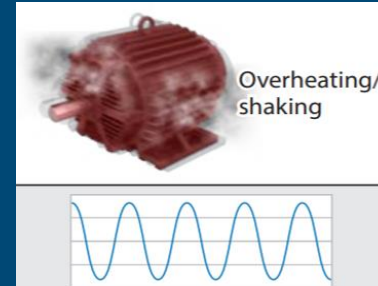
Velocity (mm/s)

Detects for more severe bearing wear

Easy to retrofit

Sensor uses an M6 x 8mm thread which can install into motor casing. Optional magnetic mount is offered for additional mounting flexibility

K6CM ISM – Insulation Resistance Model

Detecting insulation breakdown in 3-phase motors

Highlights

- Rated up to 300A 7.5 kw 3-phase motors
- Measures current leakage and insulation resistance

Ideal for:

- Detecting motor insulation breakdown from heat and foreign debris
- 3-phase motors in harsh environments and exposed to cutting oils, coolant, dust, hydraulic fluid, high humidity

Zero Current Transformer (ZCT)

Installs into existing motor circuit and measures current leakage. The ZCT can measure when the motor is running and works with inverters.

Motor insulation burnout

K6CM Monitoring Tool

Monitor all your motors with one simple software
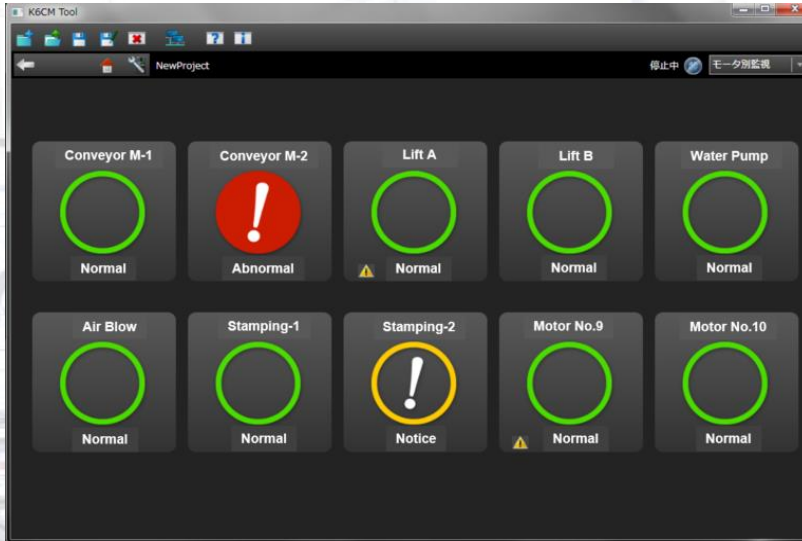
PC Monitoring tool Dashboard

- High level view of motor status
- Monitors up to 10 motors Max

Trending view

Time Stamp view

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K6CM Benefits

24/7 Remote Motor Condition monitoring of various types of motor failures

From

To

Preventative Maintenance

- Frequent manual motor inspections
- High labor costs
- Time consuming inspections

Predictive Maintenance with the K6CM

- Remote condition monitoring of motor
- Real-time alerts of abnormalities
- Less motor inspections
- $ savings in maintenance
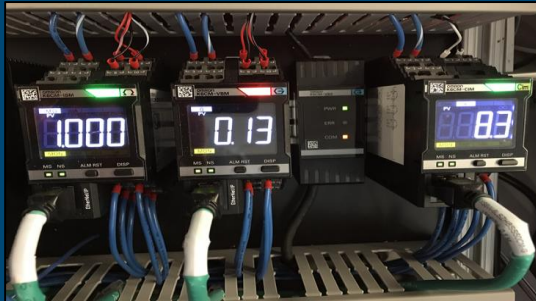
Return on Investment

- Annual cost of motor maintenance (1 motor) $2000 USD
- Cost of motor replacement $16,000 USD (Based on 50hp motor cost and labor)
- Average payback period for the K6CM is 1-2 years for one motor.

K6CM Applications

The K6CM Motor Condition motor can be used in a wide variety of industries and applications

OMRON

Pump Applications

- Water/Waste water pumps
- Cooling tower pumps
- Hydraulic pumps
- Industrial chiller pumps
- Well pumps

Fan Applications

- Air handling units
- Ventilation fans
- Cooling tower fans
- Exhaust heat fans

Mixing equipment

- Spray dryer equipment
- Homogenizer equipment
- Storage tank mixers

Transportation Equipment

- Conveyors
- Lifting stations
- Elevator traction motors

K6CM Success Story

Hospital minimizes downtime by installing K6CM vibration models on critical air handling units

Challenge:

A top research hospital experienced several unexpected air handling unit motor failures. Failures of the air handling unit motors impacted critical biomedical research material.

Solution: The K6CM-vibration model was capable of monitoring vibration conditions of the air handling unit motors and drive systems. The maintenance crew can have real time visibility of the air handling unit condition and respond faster to issues while reducing maintenance costs.

Results : The hospital maintenance crew installed 9 K6CM vibration models into 3 air handling units throughout the facility. The K6CM monitors vibration of the motor bearings as well as the drive bearings of the fan.

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Medical facility minimizes downtime and protects valuable research with predictive maintenance solution

Case Study | March 2020
automation.omron.com

A diagram of the building automation system showing K6CM units on one of the AHUs.

K6CM vibration data in building automation platform
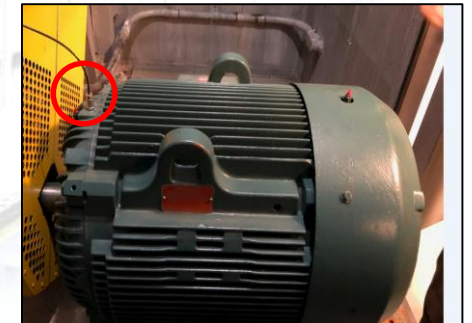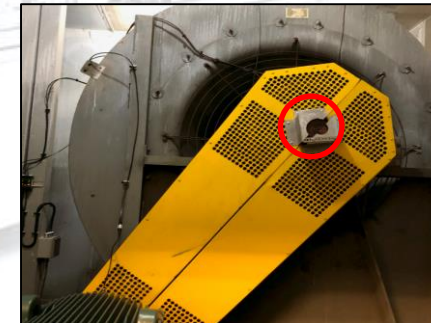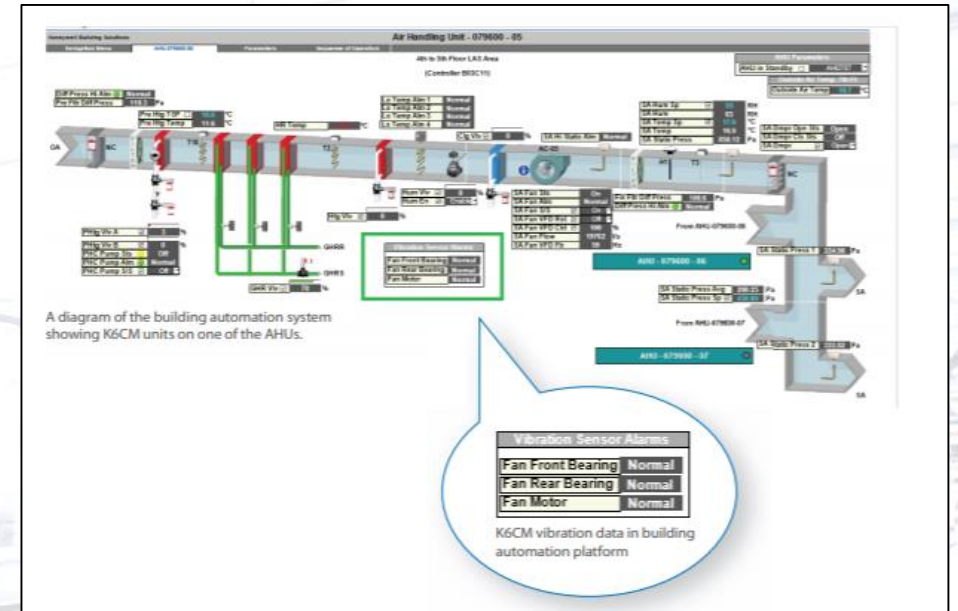
Industrial Fires

An average of 37,000 industrial fires occur in the US each year

- Electrical distribution and lighting equipment was found to be the leading cause
- High voltage control panels are considered to be a high risk area for industrial fires

Causes of control panel fires

Loose connections

Solid State Relays Overheating

Overheating transformers

Variable frequency drive overheating

Wiring insulation breakdown
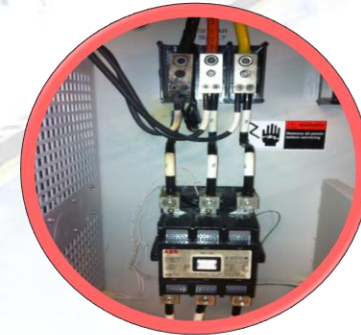
Contactor overheating

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K6PM Thermal Condition Monitor

A remote monitoring solution to detect increases in temperature

OMRON

Key features

- DIN-rail mount controller with LCD display and alarm bar
- Thermal Infrared Sensors
  (can use up to 31 sensors per controller)
- Transistor outputs for external alarms
- Free PC monitoring software
- Ethernet/IP & Modbus TCP communication

Specifications

- 24VDC input voltage
- Temperature monitoring range : 0-200°C
- Resolution: 32 x 32 (1,024 pixels)
- Accuracy: +/- 5°C (at ambient temperature of 25°C)

K6PM-THS3232
Thermal Infrared Sensor

K6PM-THMD-EIP
Controller

EtherNet/IP / Modbus
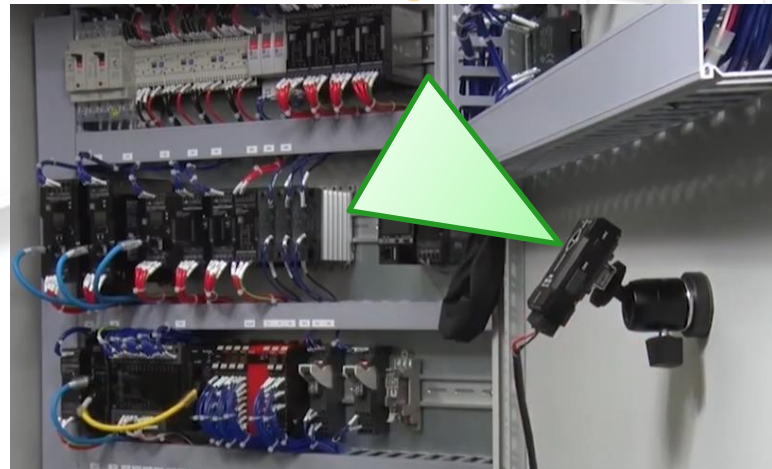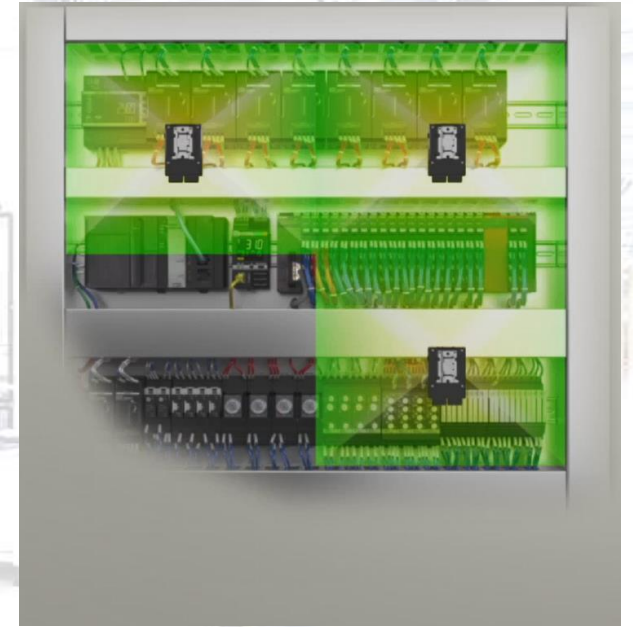
K6PM Thermal Infrared Sensor
A remote monitoring solution to detect increases in temperature

OMRON

Width 43 mm

Built-in ambient temperature sensor

Height 60 mm

K6PM-THS

Length 17.8 mm

Magnet

RS-485 connection

CH1   CH2   CH3
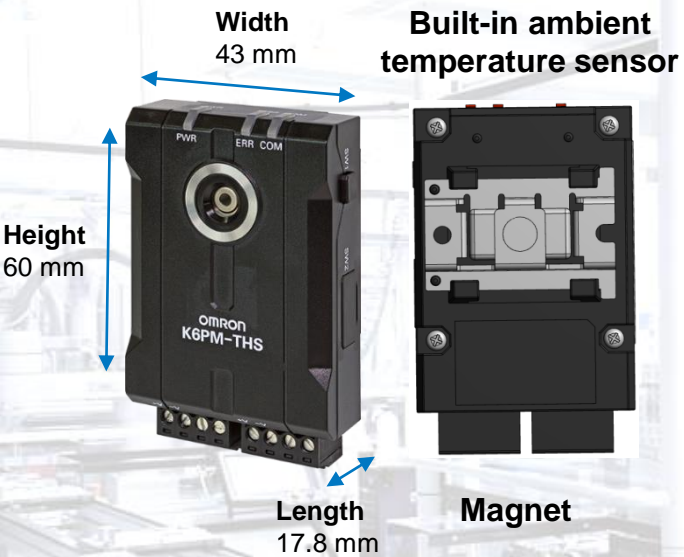
Flexible mounting options

Key sensor features

- Compact size
- Uses RS-485 connection to controller
- 31 sensors per controller
- Additional ambient temperature sensor
- Wide 90° x 90° Field of View
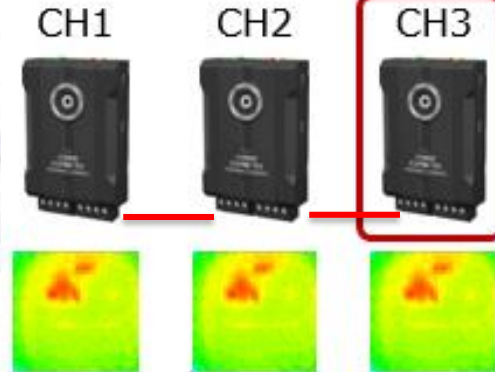
SEG 1	SEG 2	SEG 3	SEG 4
SEG 5	SEG 6	SEG 7	SEG 8
SEG 9	SEG 10	SEG 11	SEG 12
SEG 13	SEG 14	SEG 15	SEG 16

24.5	29.5	32.1	23.8
24.5	33.4	24.5	23.7
23.5	24.1	23.8	23.5
23.2	23.4	23.5	23.4

K6PM Thermal Condition Monitor Software Tool

Monitor all the K6PM thermal infrared sensors in one software

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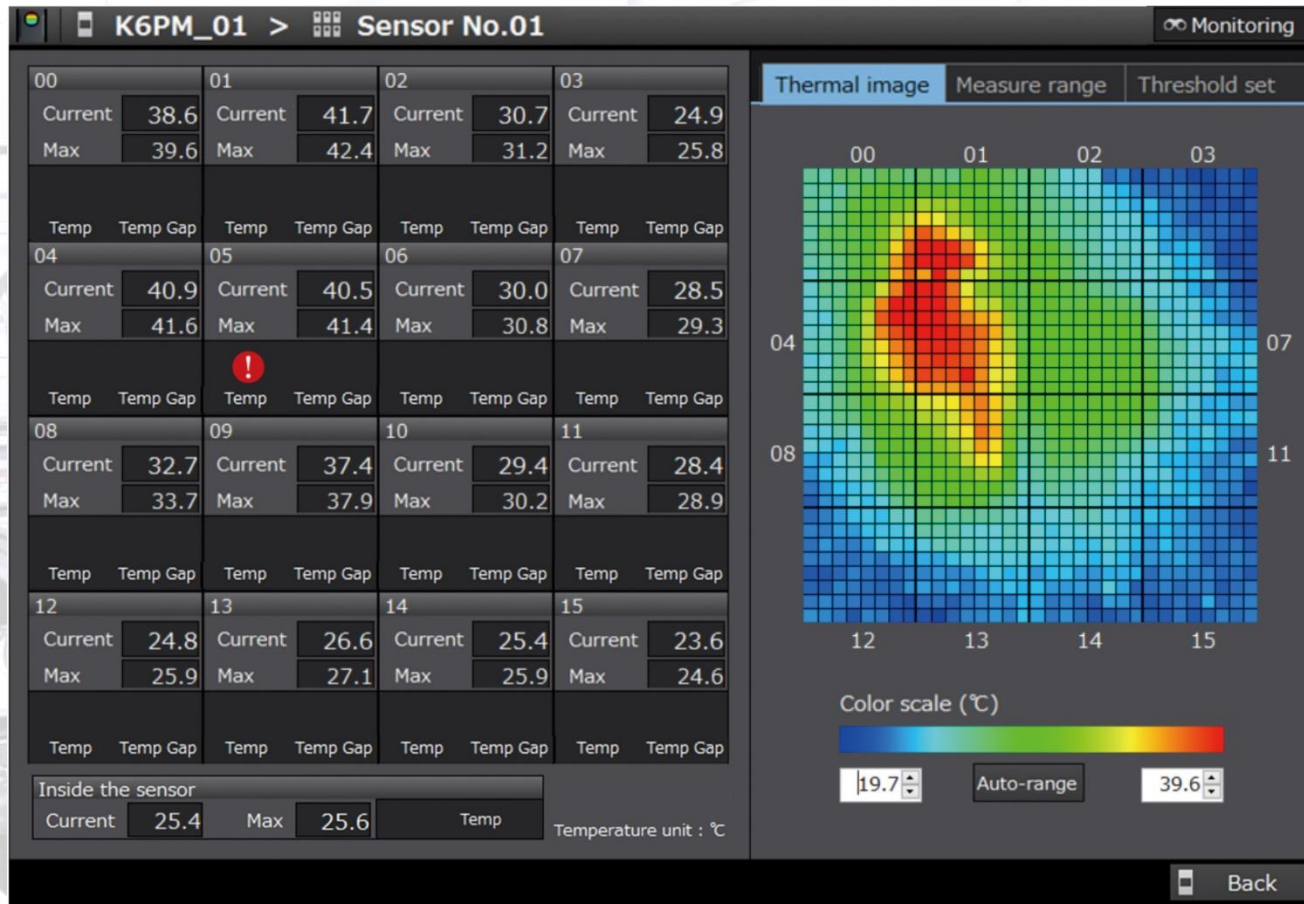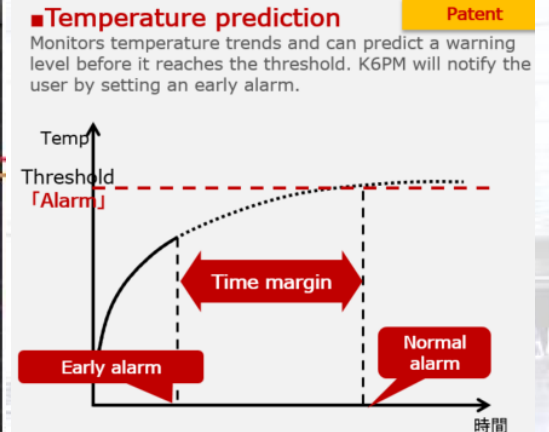
Key features

- Monitors up to 5 K6PM controllers (155 sensors)
- Thermal image map
- Multiple segment alarms
- Temperature prediction algorithms
- Auto-threshold setting feature

K6PM Thermal Condition Monitor Benefits

24/7 remote temperature monitoring of critical equipment

From

To

Preventative Maintenance

- Performing costly manual thermal inspections for equipment
- Installing PPE to prevent inspector from arc flash and other hazards
- Limited visibility of issues

Predictive Maintenance with the K6PM

- Remote monitoring of temperature conditions
- Reduce manual inspections costs
- Improve worker safety by reducing inspections in hazardous areas

Return on Investment

- Average cost of thermal inspection $2500 USD
- Cost of a panel repair from an electrical fire $80,000 USD (based on internal study)
- Average payback period for investing in the K6PM 1-2 years

K6PM Applications

The K6PM thermal condition monitor can be used in a wide variety of industries and applications

Control Panels

- Motor Control
- Heating equipment
- Power Distribution
- Power Generation

Hydraulic equipment

- Stamping press control valve
- Hydraulic motors and pumps

R&D

- Temperature data logger

Data centers

- Server cabinets

K6PM Success Story

Automotive manufacturer reduces maintenance and downtime on hydraulic stamping press with the K6PM

Challenge:

A global automotive manufacturer experienced a hydraulic valve failure on their stamping press due to contamination in the hydraulics. This caused significant unplanned downtime for the plant since it is used to stamp body panels. Manual thermal inspections were required to detect increases in control valve temperatures of the press.

Solution: The K6PM can monitor the surface temperature of the hydraulic control valve and notify the maintenance staff of abnormal conditions.

Results : The customer installed 5 K6PM thermal image sensors to monitor the control valve temperature of the stamping press. This reduced the amount of maintenance and risk of unplanned downtime

K6PM-TH
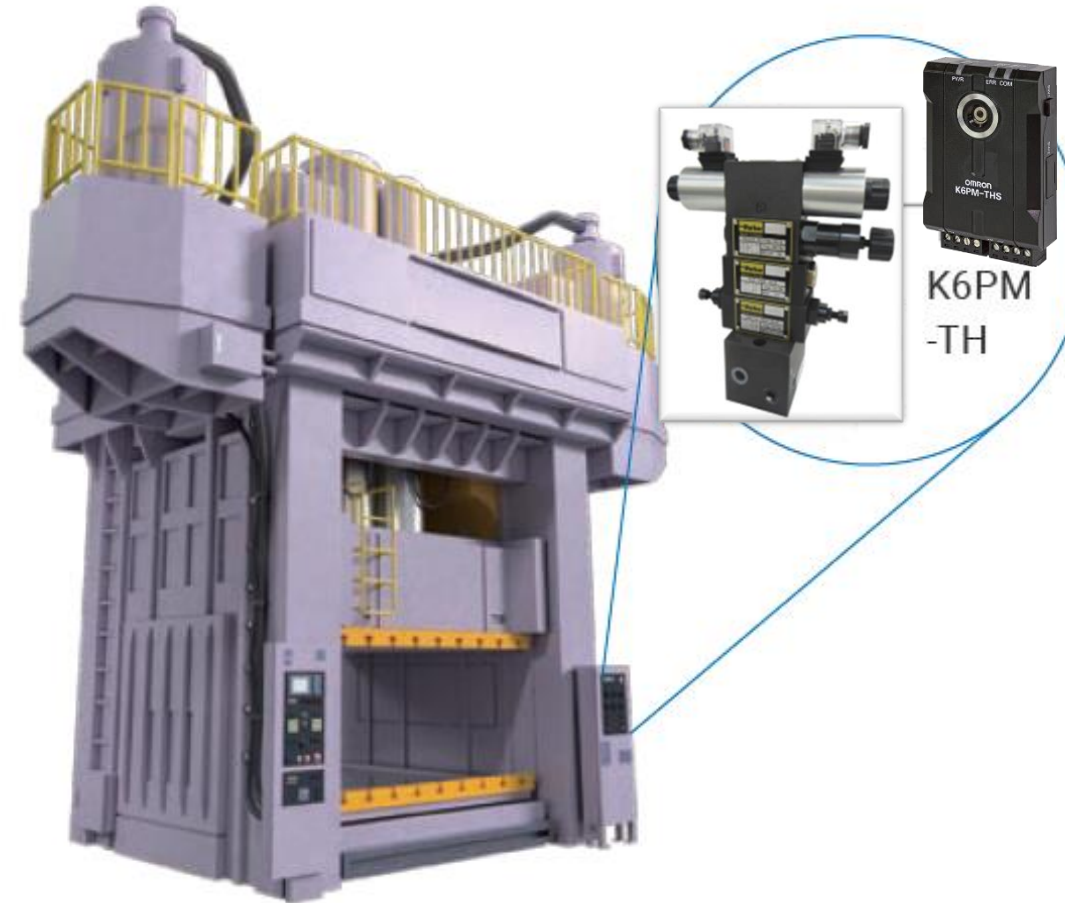
K6PM Success Story

Automotive manufacturer reduces heater ductwork inspections and minimizes fire risks

Challenge:

A global automotive supplier experienced a fire in their paint station due to a series of dryer duct leaks burning up insulation. These leaks were common due to the aging infrastructure of the plant. Frequent inspection for leaks were required with a handheld thermal camera to minimize the risk of fires.

Solution: The K6PM can remotely monitor dryer duct leaks by detecting increases of temperatures in ductwork connections

Results : Customer installed (50) thermal image sensors in various dryer duct connections to monitor for hot spots generation from duct leaks. This solution dramatically reduced maintenance labor and improved worker safety.

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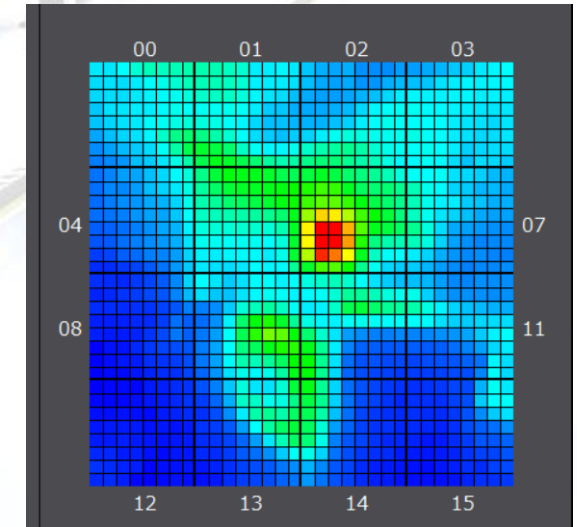
Key takeaways

Omron's Predictive Maintenance solutions

Remote condition monitoring

Easy to retrofit

Reduce maintenance costs

Reduce unplanned downtime

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Visit our Predictive Maintenance Solutions Page!

https://automation.omron.com/en/us/solutions/predictive-maintenance/

Questions?