Motor Condition Monitoring Devices
K6CM series

OMRON

Stay alert to motor failures with 24/7 motor condition monitoring
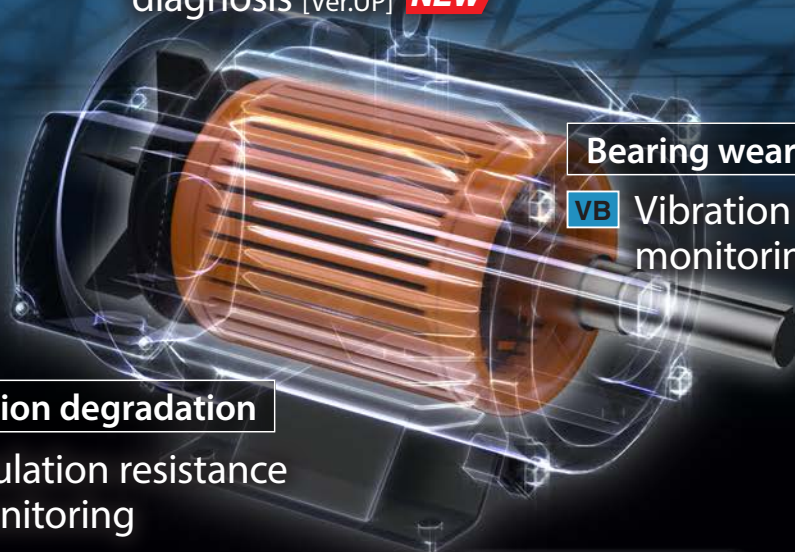
Load abnormality

CI Comprehensive current diagnosis [Ver.UP] **NEW**

Bearing wear

VB Vibration & temperature monitoring

Insulation degradation

IS Insulation resistance monitoring

· Applicable in environment with inverters
· Prioritize maintenance inspections
· Monitor up to 10 motors remotely using the included PC monitoring software
· Clamp-type CT which is easy to install on existing equipment

EtherNet/IP

Modbus

Reduce the amount of required manual inspections
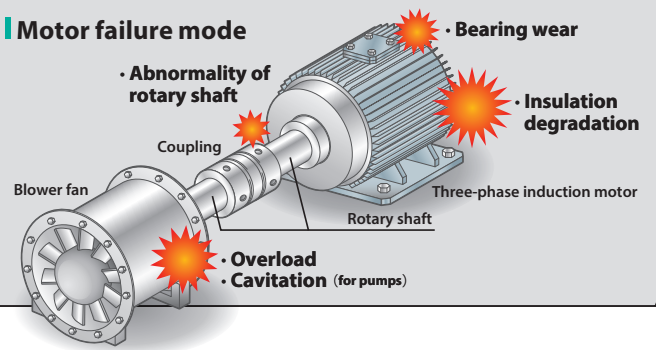# K6CM informs you when your motor requires

[Problems]

It's difficult to prevent motor issues caused by degradation.

The conventional motor condition check had several check items. Therefore a skilled maintenance engineer was required to judge the motor's maintenance timing. Additionally, inspection was time-consuming because there were many motors.

Example of patrol inspection items

Phenomenon / Symptoms	Vibration	Heat generation	Decreased electrical resistance	Overcurrent
Bearing wear	✓	✓		✓
Insulation degradation			✓	
Overload	✓	✓		✓
Open phase		✓		

Motor failure mode

· Bearing wear
· Abnormality of rotary shaft
· Insulation degradation
Coupling
Blower fan
Three-phase induction motor
Rotary shaft
· Overload
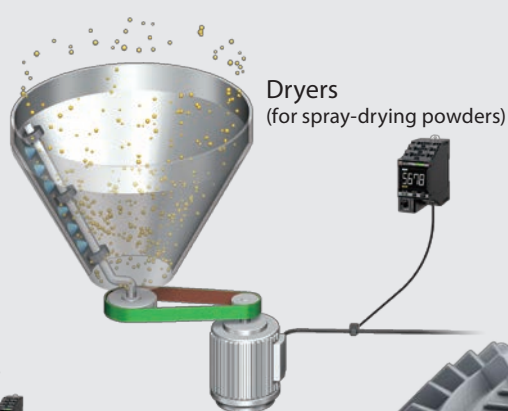· Cavitation （for pumps）

Monitors the 3-phase induction motor which is critical to facility operations
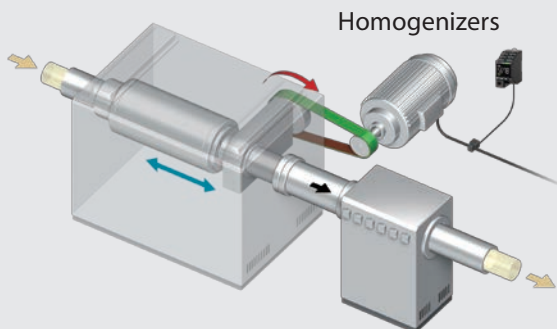
Ventilation fans in odorous gas treatment facilities
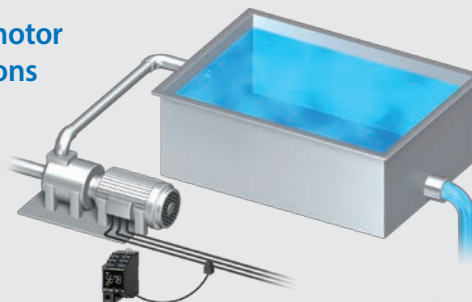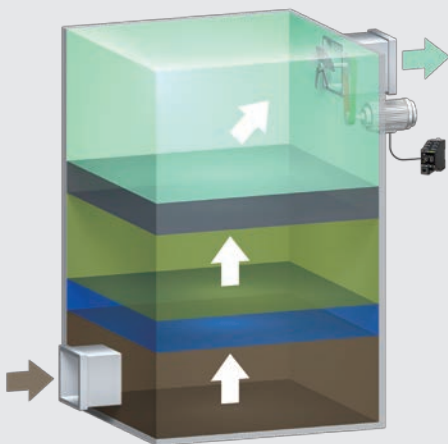
Washing pumps for automotive components

Dryers (for spray-drying powders)

Homogenizers

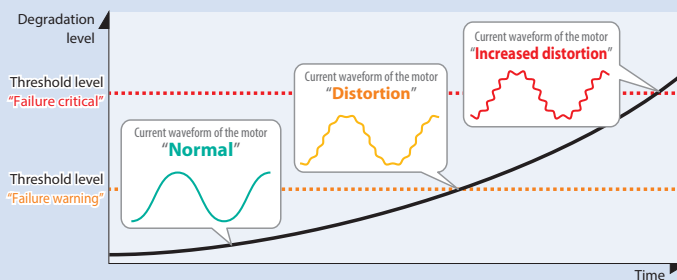### Notify the factory floor with stack light

maintenance

Motors can be maintained in advance of failure due to degradation.

K6CM(comprehensive current diagnosis type) can consistently monitor the degradation tendency of the motor by observing the current waveform of the motor and processing complex analysis such as the frequency analysis, instead of a skilled maintenance engineer.
Additionally, you can understand the motor's maintenance timing without depending on an engineer, because K6CM provides threshold value setting.

What is comprehensive current diagnosis?

Degradation level

Threshold level "Failure critical"

Threshold level "Failure warning"

Current waveform of the motor "Normal"

Current waveform of the motor "Distortion"

Current waveform of the motor "Increased distortion"

Time

When an abnormality occurs in the load such as bearing, rotary shaft, or reducer, the motor does not rotate smoothly and a distortion occurs in its current waveform.
K6CM measures its distortion as a degradation level.

Monitor up to 10 motors with PC software

With the accessory software "Motor Condition Monitoring Tool", you can monitor motor conditions remotely.

* The screen is a sample image.

TPM
2018TPM優秀商品質
開 発 賞
TPM Awards

K6CM Motor Condition Monitoring Devices
❖ Development Award of the TPM Award for Excellent Products 2018
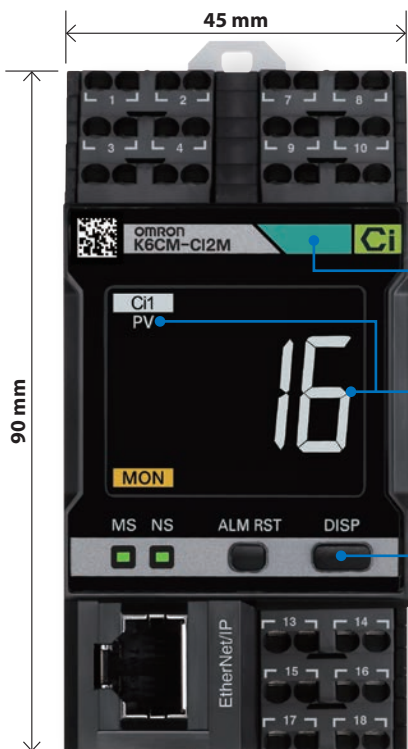❖ GOOD DESIGN AWARD 2018

OMRON K6CM-CI2M Ci

EtherNet/IP

Modbus

Motor Condition Monitoring Device Lineup

Note. Applicable motor type: three-phase induction motor

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type 01 Comprehensively monitors motor and load abnormalities through degradation level

K6CM-CI

Load abnormality   Overload   Open phase

Comprehensive current diagnosis type

OMRON K6CM-CI2M   Ci

Alarm bar display
- Green : Status normal
- Yellow : Failure warning
- Red : Failure critical

Ci1
PV

Display
- [PV] : Present value
- [MIN] : Minimum value
- [MAX]: Maximum value

MON

MS NS ALM RST DISP

EtherNet/IP

Switches the units of the measured value displayed
- [Ci1] : Degradation level 1
- [Ci2] : Degradation level 2
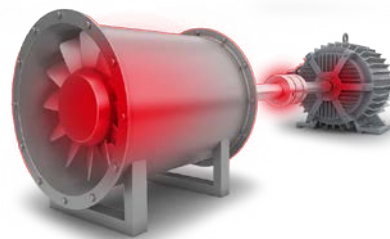- [A] : Current

<Actual size>

special CT
K6CM-CICB

Easy setup!
To perform monitoring, simply clamp the CT to the power line connected to the three-phase induction motor.
The maximum of measurement range of 600A.

45 mm
90 mm

Also detects load abnormalities

When a load abnormality occurs, the current waveform of the motor changes, which allows the load abnormality to be detected.

Multiply to monitor the abnormalities by measuring degradation level 1 and degradation level 2, that are measured with different algorithms

Degradation level 1

Degradation level 1 is suited to monitoring abnormalities that have an irregular affect on the shaft of the motor because it can quantify the degree of deviation between the smooth sine wave of the ideal state and the entire current waveform as obtained during the sampling period.

[Abnormality detection]
Cavitation, Air contamination, etc.
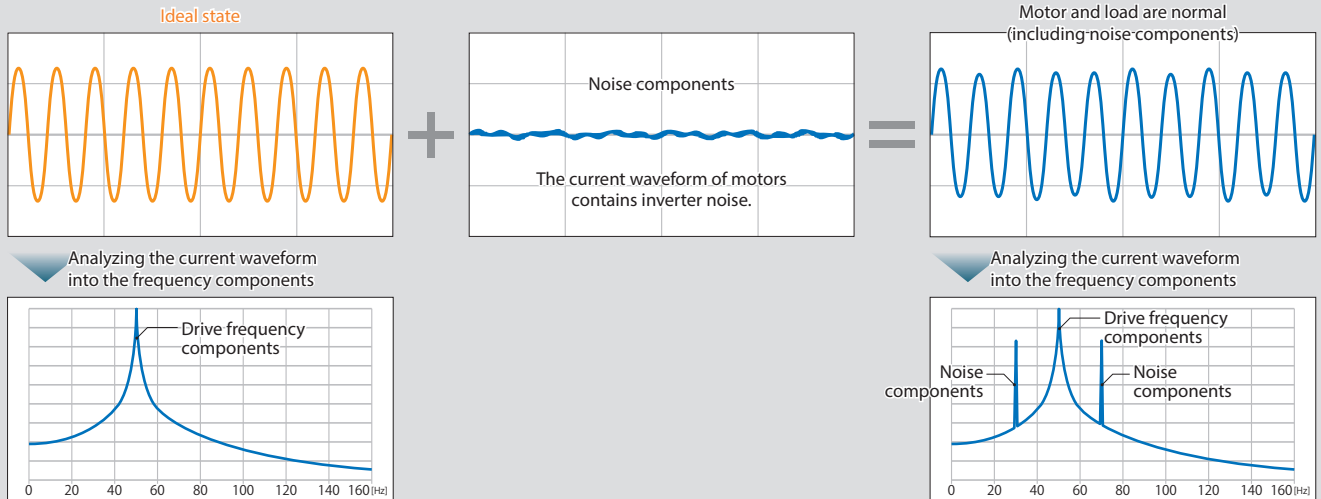
Degradation level 2   *NEW*

Degradation level 2 is suited to monitoring abnormalities which occurs periodically because certain frequency components among the frequency components affecting the rotating shaft of the motor are clearly captured and quantified. Even in environment with inverter noise, a motor or load abnormality can be captured with excellent sensitivity.

[Abnormality detection]
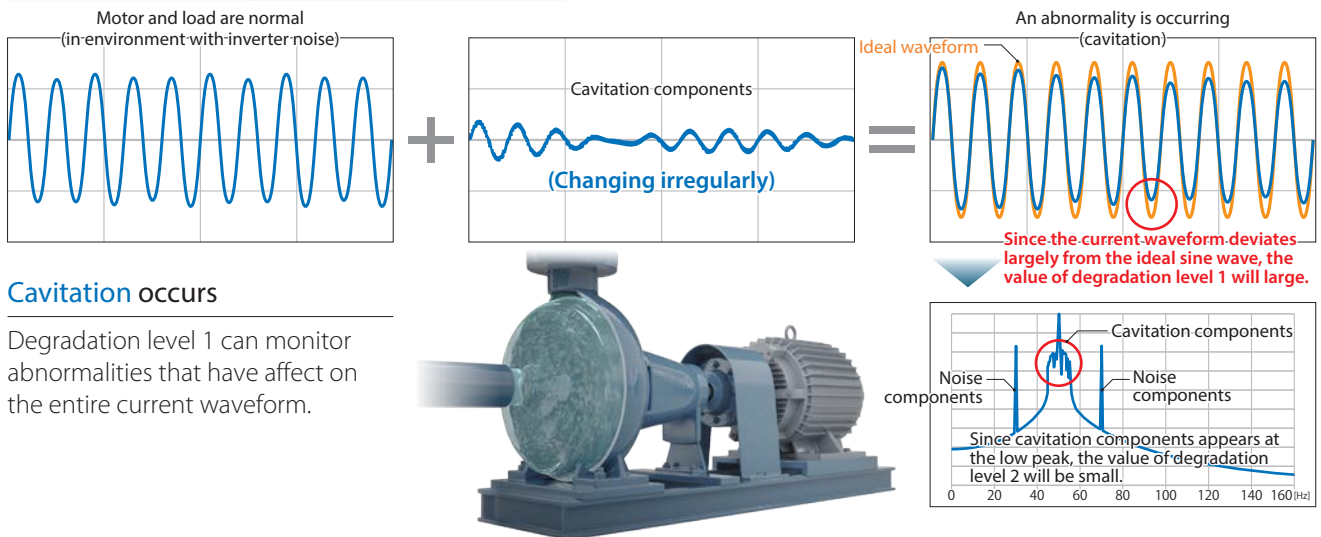Misalignment, Load imbalance, Foreign matter adhesion, etc.

Comprehensive current diagnosis parameters are applicable for a wide range of motor abnormalities.

Normal state when inverters are used

Ideal state

Analyzing the current waveform into the frequency components

Drive frequency components

0 20 40 60 80 100 120 140 160 [Hz]

Noise components

The current waveform of motors contains inverter noise.

Motor and load are normal (including noise components)

Analyzing the current waveform into the frequency components

Drive frequency components

Noise components

Noise components

0 20 40 60 80 100 120 140 160 [Hz]

Irregular change ▶ Degradation level 1

In the case of the abnormality with higher sensitivity of degradation level 1.

Motor and load are normal (in environment with inverter noise)

Cavitation components

(Changing irregularly)

Ideal waveform

An abnormality is occurring (cavitation)

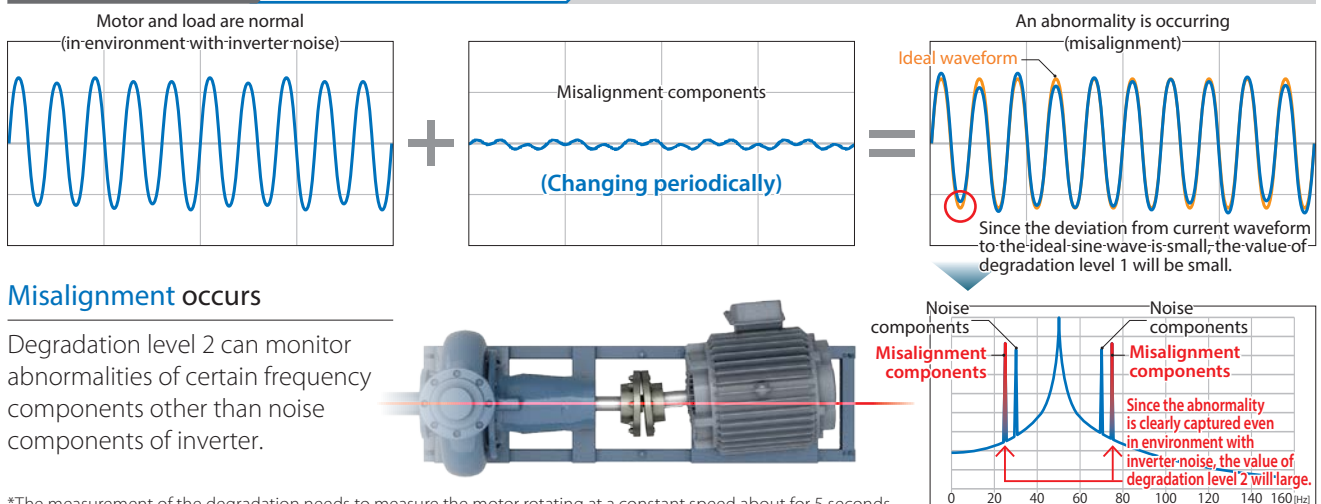**Since the current waveform deviates largely from the ideal sine wave, the value of degradation level 1 will large.**

Cavitation occurs

Degradation level 1 can monitor abnormalities that have affect on the entire current waveform.

Cavitation components

Noise components

Noise components

Since cavitation components appears at the low peak, the value of degradation level 2 will be small.

0 20 40 60 80 100 120 140 160 [Hz]

Periodic change ▶ Degradation level 2

In the case of the abnormality with higher sensitivity of degradation level 2.

Motor and load are normal (in environment with inverter noise)

Misalignment components

(Changing periodically)

Ideal waveform

An abnormality is occurring (misalignment)

Since the deviation from current waveform to the ideal sine wave is small, the value of degradation level 1 will be small.

Misalignment occurs

Degradation level 2 can monitor abnormalities of certain frequency components other than noise components of inverter.

Noise components

Noise components

Misalignment components

Misalignment components

Since the abnormality is clearly captured even in environment with inverter noise, the value of degradation level 2 will large.

0 20 40 60 80 100 120 140 160 [Hz]

*The measurement of the degradation needs to measure the motor rotating at a constant speed about for 5 seconds.

Motor Condition Monitoring Device Lineup

Note. Applicable motor type: three-phase induction motor

type 02 Monitors bearing abnormalities through vibration and temperature
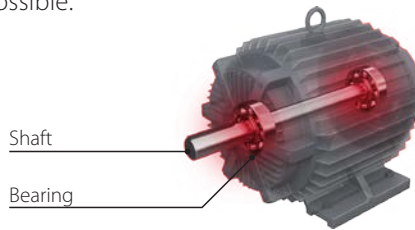
K6CM-VB

Bearing wear   **Overload**   **Open phase**

Vibration & temperature monitoring type

Detects abnormalities in bearings

By constantly monitoring for vibrations, it can detect signs of abnormalities in bearings and the like as soon as possible.
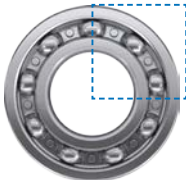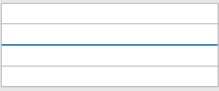
Shaft

Bearing

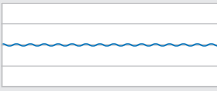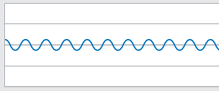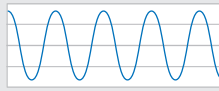## Constantly monitors temperature

The surface temperature of the routinely inspected motor can be measured at the same time as vibrations.

This eliminates the need to measure the temperature on site.

Pre-amplifier and Vibration & temperature sensor
K6CM-VBS

*Use K6CM-VBSAT1, the adhesive attachment if the motor cannot be tapped.

Measuring vibration detection frequency up to 10 kHz can detect motor abnormalities at the earlier stage.

Bearing condition	New	Grease degraded	Damages	Breakdown
Motor condition	Working smoothly	Working smoothly	Abnormal noise occurs	Overheating/ shaking
Motor vibration			The values change shortly and rapidly when motors are shaking by damages. Monitored by acceleration.	The values change largely and slowly when motors are shaking by breakdown. Monitored by velocity.
Measurement range by sensor	No vibration	High frequency Amplitude: small	**Acceleration** 1 to 10 kHz Amplitude: medium	0.01 to 1 kHz Amplitude: large **Velocity**
	Out of range of measurement by sensor		Within range of measurement by acceleration	Within range of measurement by velocity

Constantly monitors the insulation resistance

K6CM-IS

Insulation degradation

Insulation resistance monitoring type

+ special ZCT
(IRT)
K6CM-ISZBI
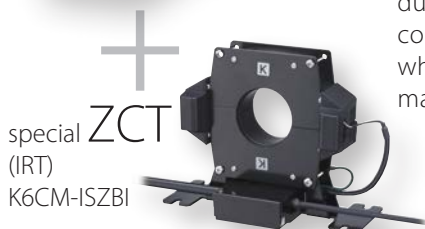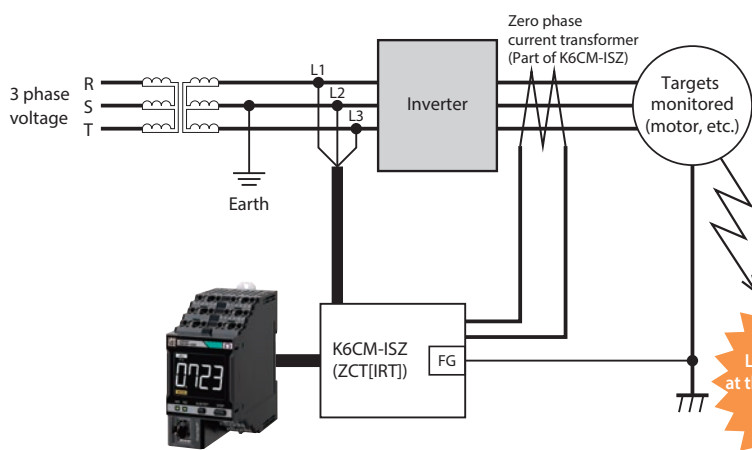
Measures insulation resistance

With conventional products, measurement with a Megger Tester was necessary to check for insulation degradation. K6CM-IS can be used to perform this inspection during operation, making it possible to constantly monitor degradation trends while reducing the burden on the maintenance personnel.
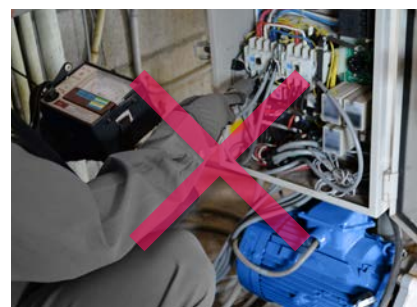
This eliminates the need for complicated insulation resistance measurements.

The insulation resistance at the secondary side of an inverter can be measured.

3 phase voltage
R
S
T

L1
L2
L3

Earth

Inverter

Zero phase current transformer (Part of K6CM-ISZ)

Targets monitored (motor, etc.)

K6CM-ISZ (ZCT[IRT])   FG

Leakage current at the secondary side of an inverter

Previously, measuring insulation resistance has been difficult because the leakage current at the secondary side of an inverter repeatedly increase and decrease due to the gap between commercial current and inverter current. K6CM-IS can measure the leakage current at the secondary side of an inverter by OMRON's unique technology.

The image of the leakage current waveform at the secondary side of an inverter.

The current value increase and decrease repeatedly.

*The measurement of insulation resistance needs about 10 seconds while driving the motor by direct connection to commercial power supply and about 60 seconds by the inverter.
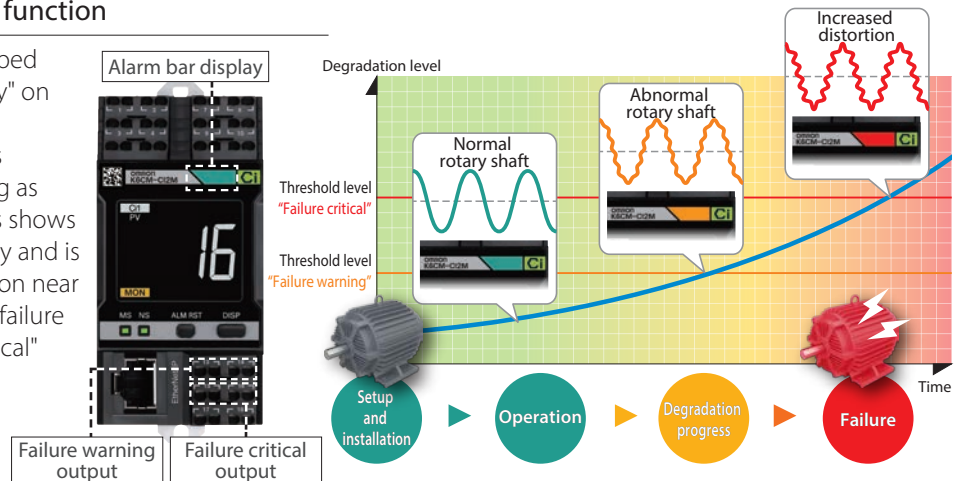
Features Three functions for monitoring motor condition

1 Visual inspection through alarm bar display and two-step output
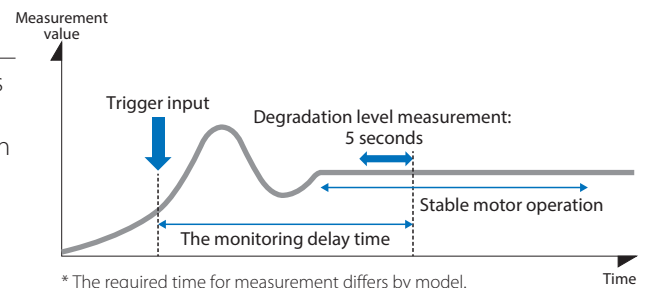
Alarm bar and output function

The K6CM series is equipped with an "alarm bar display" on the front of the product. The condition of motor is displayed by color-coding as green, yellow, or red. This shows the degree of abnormality and is helpful for visual inspection near the motor. Accordingly "failure warning" and "failure critical" statuses are also output. In addition, by using "display auto switching mode", you can see the measurement value in each without operation.

Alarm bar display

Threshold level "Failure critical"

Threshold level "Failure warning"

Failure warning output

Failure critical output

Degradation level

Increased distortion

Abnormal rotary shaft

Normal rotary shaft

Time

Setup and installation ▶ Operation ▶ Degradation progress ▶ Failure

2 Monitors stable values even when load fluctuates

Trigger input function

Equipped with a "trigger input function" that measures the measurement timing according to the motor operation in order to accurately diagnose the condition of motors that are repeatedly started and stopped. The motor condition is determined from the operation signals (auxiliary output of the contactor and the PLC control signal), and measurement is only performed when the motor operation is stabilized, enabling fixed point observation on a daily or monthly basis under the same conditions. And the monitoring delay time function can be used to wait for the measurement values to stablize. This function can delay the start of monitoring after the triger input.

Measurement value

Trigger input

Degradation level measurement: 5 seconds

Stable motor operation

The monitoring delay time

Time

* The required time for measurement differs by model.

3 Self-diagnosis function that improves system reliability

Self-diagnosis function

When constantly monitoring for a long period of time, unexpected failures and other problems of measuring devices must be taken into consideration. The K6CM series is equipped with a self-diagnosis function as standard. The reliability of the system is improved by monitoring the service life of the device to be measured.

Status display "AGE"

Lights up when the guideline for the replacement time is reached.

Motor Condition Monitoring Tool

The setting and monitoring tool software "Motor Condition Monitoring Tool" and the K6CM series are linked. Both allow the motor condition to be monitored visually with green, yellow, and red color-coding.

(Motor Condition Monitoring Tool is stored on the CD shipped with the K6CM device.)
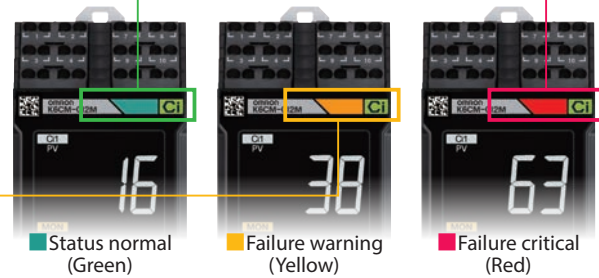
Motor condition list display

The conditions of up to 10 motors are displayed as a list through the K6CM series connected to the network.
The data of up to 30 K6CM units can be viewed.
(Three types of K6CM can be installed to one motor)

Displays condition list at same time as device displays

- ■ Status normal (Green)
- ■ Failure warning (Yellow)
- ■ Failure critical (Red)

Error history display

- Vibration/temperature monitoring type
- Insulation resistance monitoring type
- Comprehensive current diagnosis type

Displays the alarm statuses of multiple motors.
Allows changes in the motor condition to be checked as a time series.

Trend graph display

Allows the measured value trends to be checked on graphs.

Initial setting

Initial settings of the K6CM series such as trigger input settings, motor information registration, network settings, and threshold adjustment can be made from a PC.

Enter the shaft diameter, rotation speed and capacity, and you can automatically set the K6CM-VB threshold.
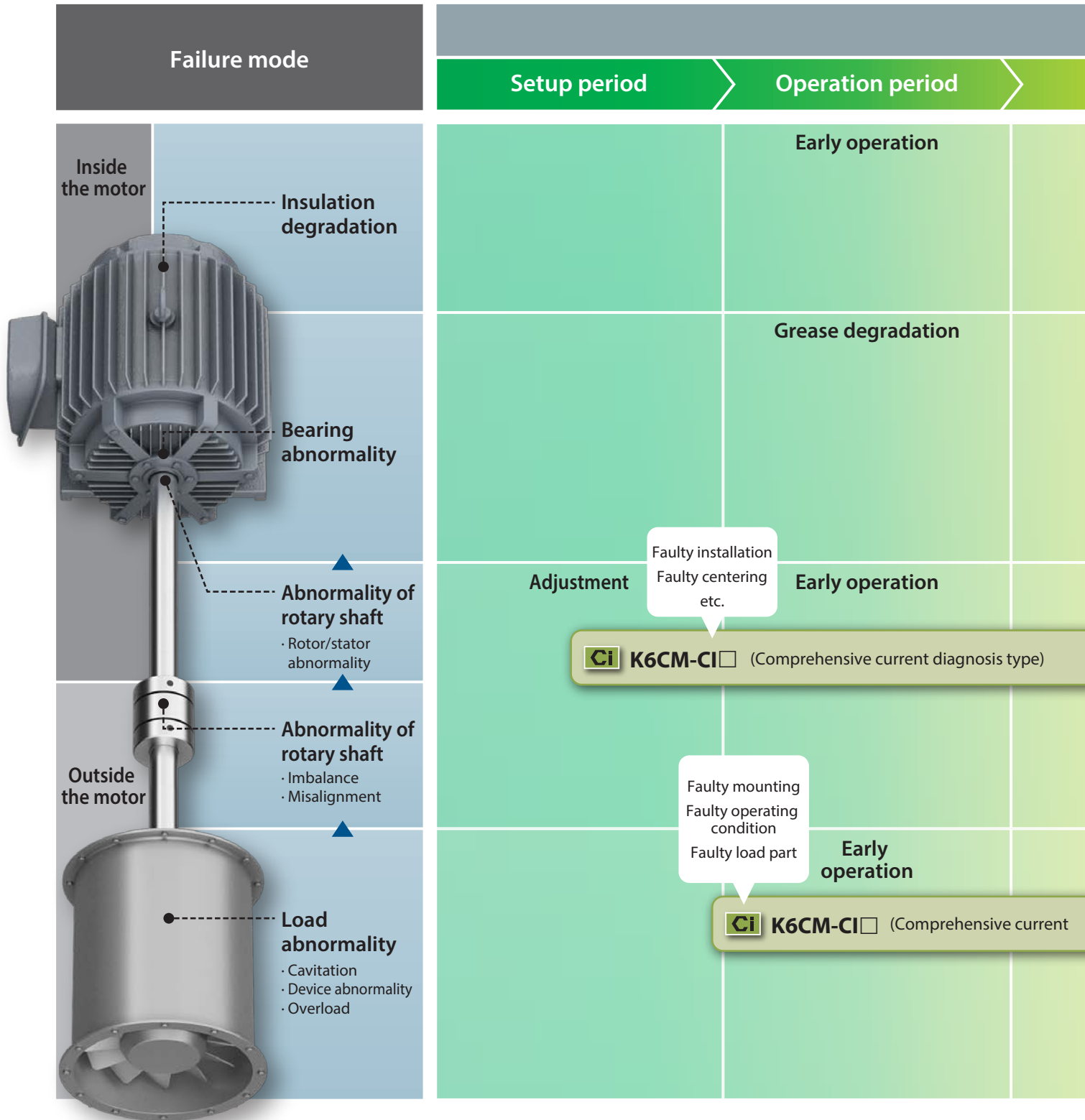
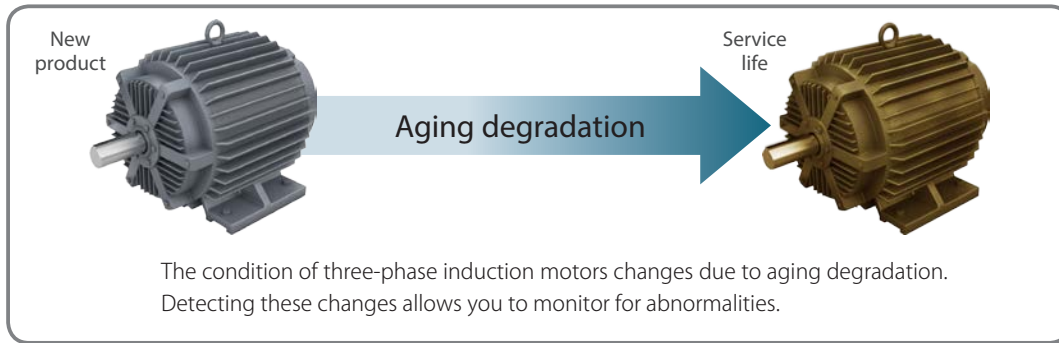### Data can be output as a CSV file

Measured and accumulated data can be output in CSV format. This is useful for creating reports and statistical materials.

Degradation progress/failure mode correspondence table

After installing a three-phase induction motor, performing proper maintenance by monitoring the motor condition will prolong its service life.
Please select the optimal model for the type of abnormality you want to detect.

Failure mode	Setup period	Operation period
Inside the motor — Insulation degradation		Early operation
Bearing abnormality		Grease degradation
Abnormality of rotary shaft · Rotor/stator abnormality ▲	Adjustment — Faulty installation Faulty centering etc.	Early operation
	Ci K6CM-CI☐ (Comprehensive current diagnosis type)	
Outside the motor — Abnormality of rotary shaft · Imbalance · Misalignment ▲	Faulty mounting Faulty operating condition Faulty load part	Early operation
Load abnormality · Cavitation · Device abnormality · Overload ▲	**Ci K6CM-CI☐** (Comprehensive current	

New product

Aging degradation

Service life

The condition of three-phase induction motors changes due to aging degradation.
Detecting these changes allows you to monitor for abnormalities.

Motor and load condition

Degradation progress period	Breakdown period

Insulation degradation

Insulation breakdown

Ω **K6CM-IS□** (Insulation resistance monitoring type) [Insulation degradation]

Bearing damage

Bearing breakdown

Ci **K6CM-CI□** (Comprehensive current diagnosis type) [Degradation level]

G **K6CM-VB□** (Vibration & temperature monitoring type) [Acceleration]

Degradation progress of motor

[Degradation level]

G **K6CM-VB□** (Vibration & temperature monitoring type) [Velocity]

Degradation progress of load

diagnosis type) [Degradation level]

G **K6CM-VB□** (Vibration & temperature monitoring type) [Velocity]

Ci **K6CM-CI□** (Comprehensive current diagnosis type) [Overcurrent]

G **K6CM-VB□** (Vibration/temperature monitoring type) [Temperature]

The measurement value in each model is a typical example.

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