Motor Condition Monitoring Devices
K6CM series

Stay alert to motor failures with 24/7 motor condition 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

Load abnormality
Comprehensive current diagnosis (Ver.UP) NEW
Bearing wear
Vibration & temperature monitoring
Insulation degradation
Insulation resistance monitoring

NEW

CI
VB
IS
Monitor 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

- Bearing wear
- Abnormality of rotary shaft
- Overload
- Cavitation (for pumps)
- Insulation degradation

Example of patrol inspection items

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Vibration</th>
<th>Heat generation</th>
<th>Decreased electrical resistance</th>
<th>Overcurrent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing wear</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Insulation degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Open phase</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notify the factory floor with stack light

Reduce the amount of required manual inspections

K6CM informs you when your motor requires maintenance

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.
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.

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

What is comprehensive current diagnosis?

- **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”**

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.
Motor Condition Monitoring Device Lineup

Comprehensively monitors motor and load abnormalities through degradation level

**K6CM-CI**

Comprehensive current diagnosis type

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.

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.
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.
  - Noise components.
  - The current waveform of motors.
  - Motor and load are normal (including noise components).

- **Motor and load are normal**
  - Analyzing the current waveform into the frequency components.
  - Drive frequency components.
  - Noise components.

**Irregular change**

**Degradation level 1**
- **Motor and load are normal** (in environment with inverter noise).
- **Cavitation** occurs.
- Degradation level 1 can monitor abnormalities that have affect on the entire current waveform.

**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.

**Irregular change**
- **Cavitation components**
  - (Changing irregularly)
  - Since cavitation components appears at the low peak, the value of degradation level 2 will be small.

**Periodic change**

**Degradation level 2**
- **Motor and load are normal** (in environment with inverter noise).
- **Misalignment** occurs.
- Degradation level 2 can monitor abnormalities of certain frequency components other than noise components of inverter.

**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 components**
- (Changing periodically)
- Since the abnormality is clearly captured even in environment with inverter noise, the value of degradation level 2 will large.

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

K6CM-VB

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.

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

Pre-amplifier and Vibration & temperature sensor
K6CM-VBS

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

<table>
<thead>
<tr>
<th>Bearing condition</th>
<th>Motor condition</th>
<th>Motor vibration</th>
<th>Measurement range by sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Grease degraded</td>
<td>Damages</td>
<td>Breakdown</td>
</tr>
<tr>
<td>Working smoothly</td>
<td>Working smoothly</td>
<td>Abnormal noise occurs</td>
<td>Overheating/shaking</td>
</tr>
<tr>
<td>No vibration</td>
<td>High frequency</td>
<td>Acceleration</td>
<td>Amplitude: small</td>
</tr>
<tr>
<td>High frequency</td>
<td>1 to 10 kHz</td>
<td>Amplitude: medium</td>
<td></td>
</tr>
<tr>
<td>High frequency</td>
<td>0.01 to 1 kHz</td>
<td>Amplitude: large</td>
<td></td>
</tr>
<tr>
<td>Out of range of measurement by sensor</td>
<td>Within range of measurement by acceleration</td>
<td>Within range of measurement by velocity</td>
<td></td>
</tr>
</tbody>
</table>

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

Insulation resistance monitoring type

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.

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 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 the 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.

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 stabilize. This function can delay the start of monitoring after the trigger input.

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.
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

Error history display

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.

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.
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.

### Degradation progress/failure mode correspondence table

<table>
<thead>
<tr>
<th>Failure mode</th>
<th>Setup period</th>
<th>Operation period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inside the motor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation degradation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormality of rotary shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Rotor/stator abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormality of rotary shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Imbalance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Misalignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outside the motor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cavitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Device abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Overload</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Motor and load condition**

- **Setup period**
  - Early operation
  - Insulation degradation
  - Grease degradation

- **Operation period**
  - Early operation
  - Failure mode
    - Insulation degradation
    - Grease degradation
    - Bearing abnormality
    - Abnormality of rotary shaft
      - Rotor/stator abnormality
      - Imbalance
      - Misalignment
    - Load abnormality
      - Cavitation
      - Device abnormality
      - Overload

**Adjustment**

- Faulty installation
- Faulty centering etc.

**Early operation**

- Faulty mounting
- Faulty operating condition
- Faulty load part

**K6CM-CI** (Comprehensive current diagnosis type)

**K6CM-VB** (Vibration/temperature monitoring type)

**K6CM-IS** (Insulation resistance monitoring type)
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

<table>
<thead>
<tr>
<th>Degradation progress period</th>
<th>Breakdown period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulation degradation</strong></td>
<td><strong>Insulation breakdown</strong></td>
</tr>
<tr>
<td>K6CM-IS (Insulation resistance monitoring type) [Insulation degradation]</td>
<td>K6CM-CI (Comprehensive current diagnosis type) [Degradation level]</td>
</tr>
<tr>
<td>K6CM-VB (Vibration &amp; temperature monitoring type) [Acceleration]</td>
<td></td>
</tr>
<tr>
<td><strong>Bearing damage</strong></td>
<td><strong>Bearing breakdown</strong></td>
</tr>
<tr>
<td>K6CM-VB (Vibration &amp; temperature monitoring type) [Velocity]</td>
<td>K6CM-VB (Vibration/temperature monitoring type) [Temperature]</td>
</tr>
<tr>
<td><strong>Degradation progress of motor</strong></td>
<td><strong>Degradation progress of load</strong></td>
</tr>
<tr>
<td>[Degradation level]</td>
<td>[Degradation diagnosis type] [Degradation level]</td>
</tr>
</tbody>
</table>

The measurement value in each model is a typical example.