

## Electrical Condition Monitoring

Use that perspective with the FAG OPTIME E-CM

We pioneer motion

**SCHAEFFLER**

# Which damage could remain undetected without electrical condition monitoring?

A lack of electrical condition monitoring and measurement data can have serious consequences for the safety, reliability and service life of machinery and equipment, as the following examples show.



## Mining

### Damaged insulation

In conveyor belts and crushers, moisture or dust can damage the insulation on electric motors. If this is not detected, it substantially increases the risk of short circuits and in a worst-case scenario can result in a total failure of the crusher during conveying operations, which can then lead to costly production stoppages.

### Rotor bar breakage

Conveyor belt drives are often subject to heavy loads. Without electrical monitoring, a rotor bar breakage is generally not noticed until there is a noticeable power drop or motor starting problems. If undetected, this can even result in a motor fire and consequential damage. As a result, the entire belt system has to be shut down until replacement parts are available.



## Cement industry

### Static eccentricity

In heavy-duty cement mills, the main drive often works under heavy load conditions. In situations where the environmental conditions are unsuitable for vibration sensors, the monitoring of electrical signals can provide indications of potential damage to the motor and mechanical components.

### Damaged insulation

Dust and aggressive media in cement works accelerate insulation aging. If there is no monitoring, short circuits can occur during operation, which in a worst-case scenario can lead to fire and major damage to the drive motor.



## Steel industry

### Voltage fluctuations

In rolling mills, the power supply fluctuates considerably due to the switching on and off of major consumers (e.g., furnaces). However, the control of roller tables and drive systems is dependent on a constant power supply. In the absence of electrical condition monitoring of the power quality, voltage drops or peaks may not be identified, which causes malfunctions, synchronization issues, and higher energy consumption. This in turn can lead to unscheduled production stoppages, time-consuming motor replacement, and potentially, production rejects.

### Good to know

Electrical condition monitoring is also ideal for monitoring the drive train of the cooling roller conveyor. This is only possible with vibration measurement, which involves high technical and financial costs.

If the roller conveyor and thus the hot strip come to a standstill, the radiant heat poses a problem for the on-site sensor technology.



## Paper industry

### Overcurrent

In a paper mill, paper backs up on a roll, which jams the drive motors. This causes the current to rise sharply. Without electrical monitoring this may not be detected. As a result, windings may overheat, insulation can be damaged, and a short circuit or even a motor fire may occur. This necessitates an unscheduled stoppage of the machine, which may not only cause high repair costs but also the destruction of large quantities of the intermediate product.

# CONCLUSION

In addition to vibration-based monitoring, electrical condition monitoring will open up further perspectives. It enables malfunctions or overloads to be detected and diagnosed at an early stage, enabling more efficient and safer production. Electrical condition monitoring helps to prevent failures and extend the service life of machines by initiating appropriate measures.

# What can electrical condition monitoring do?



## Detect and diagnose problems

- It can detect insulation faults (1), cable defects (3), broken rotor bars (2), and dynamic and static eccentricities in good time.
- It alerts to deviations, allowing maintenance to be carried out in a timely fashion.

## Protect equipment and machinery

- It prevents expensive consequential damage due to overload or short circuits.
- It increases the service life of motors and electrical components through early warning and derived measures.

## Improve efficiency in operations

- It enables predictive maintenance and reduces unplanned downtime and production losses.
- It identifies energy saving potential and improves capacity utilization of equipment and systems.

## Document and analyze

- It collects and saves measuring data for fault analysis and to optimize processes.

# How can you make condition monitoring holistic and smart?

The combination of electrical and vibration-based monitoring allows a holistic assessment of machinery, reduces downtimes, and optimizes maintenance intervals.

And this is precisely the kind of solution that the Schaeffler Lifetime Solutions team offers with the OPTIME Ecosystem. OPTIME sensors are used to monitor the vibration patterns of machines, while the FAG OPTIME E-CM identifies and diagnoses electrical problems. And even better, lubricators are part of the Ecosystem as well. The user benefits from having all machine data – vibration-based, electrical, or lubrication-related – displayed on a single dashboard.

With the new FAG OPTIME E-CM, electrical condition monitoring has now been added to the OPTIME Ecosystem, enabling error sources like insulation faults, winding damage, overload, overcurrent or current fluctuations to be detected.

## OPTIME Digital Service

- Easy-to-use mobile app
- Powerful web-based dashboard for desktop PCs



**Sensors for current measuring**  
Rogowski coils or current transformers enable the safe measurement and monitoring of high currents and protect measuring devices in the control cabinet

## FAG OPTIME E-CM

- Monitors electrical condition and measures the energy of up to two electric motors (AC)
- Diagnoses the health of the AC motor and its components



Discover all elements of the OPTIME Ecosystem  
[> Link](#)

## Suitable for a wide range of machines, covers numerous faults

### Machine types

- Compressors
- Centrifugal pumps
- Fans and blowers
- Grinders and crushers
- Generator-coupled machines

### Frequent faults

#### Electrical

- Loose cables
- Broken rotor bar
- Inverter malfunction
- Stator and rotor short circuit
- Overload

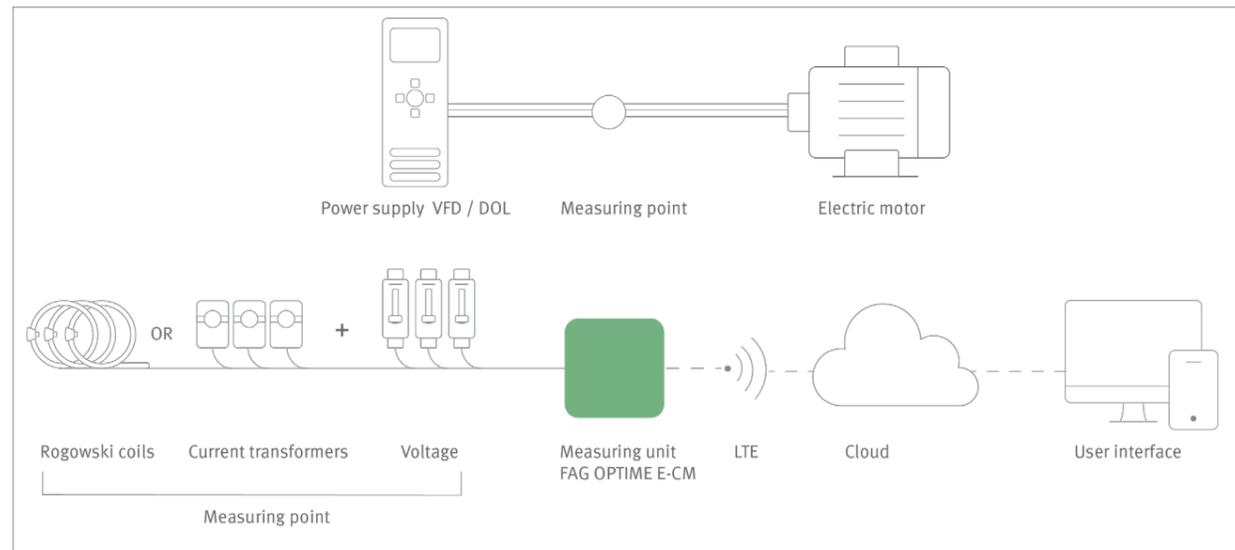
#### Mechanical

- Eccentricity
- Bearing defect
- Misalignment of shaft or belt

#### Load-related

- Cavitation
- Blockage
- Unusual operating conditions

## How does FAG OPTIME E-CM work?



### FAG OPTIME E-CM

Installed in a control cabinet, the FAG OPTIME E-CM is independent of ambient conditions. This means that even high-temperature applications or hard-to-access machinery like submersible pumps can be monitored. For vibration sensors, such areas are difficult to monitor or cannot be monitored at all.

In the control cabinet, the system offers protection from motor overload, monitors speed and load distribution, detects heavy startups, extends pump monitoring, identifies the best efficiency point (BEP), and tracks power consumption. Plant electricians can easily integrate the solution retrospectively to optimize the service life of machines.

The solution is suitable for all kinds of three-phase motors on compressors, rotary pumps, fans, blowers, grinders and crushers.

### The technology behind it

Setup is simple and flexible: For current measurement, split-core current transformers or Rogowski coils with a measuring range of 1 to 400 A can be used. The distance between the measuring point and the measuring unit can be up to 10 m and is bridged by means of a cable.

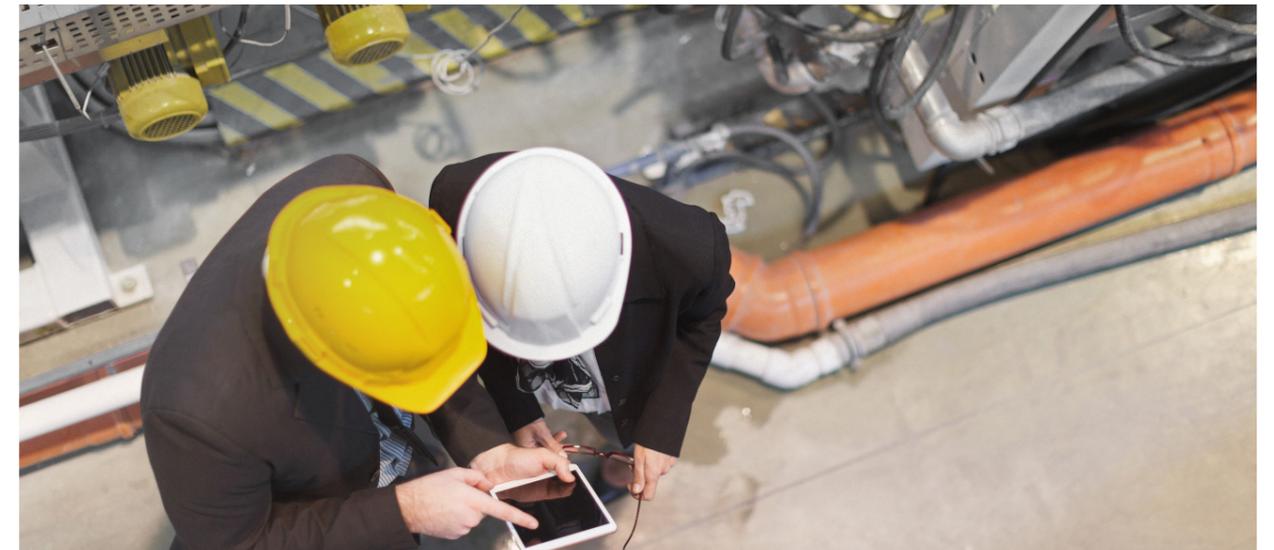
The voltage measurements are taken via a fused 2A cable connection, although in the case of high voltages, voltage transformers can also be used.

The OPTIME solution consists of a cloud platform with a user-friendly interface that allows a comprehensive assessment of the condition of electric motors in respect of rotor and stator – including the analysis of stator, rotor and eccentricity. Moreover, important motor KPIs like frequency, current, speed and load are displayed. Additional information provides details of thermal overload, heavy load conditions, and phase deviations in current and voltages.

Some KPIs are optionally available via a REST API.

More technical information on FAG OPTIME E-CM is provided starting on [Page 10](#).

## How quickly is the solution operational?



Following installation and a two-week learning phase, the FAG OPTIME E-CM is fully operational.

# 1

You conduct an analysis and define, **independently or with our support**, which machines or equipment parts should be monitored. On this basis, the Schaeffler Lifetime Solutions team prepares a proposal.

# 2

We deliver the hardware in the desired quantities based on the offer and the previously prepared target/actual analysis and concept.

# 3

Your expert installs the FAG OPTIME E-CM and connects the current transformers. An electrical setup test is performed during operation.

# 4

We will take care of the digital implementation of the solution and assist with provisioning.

# 5

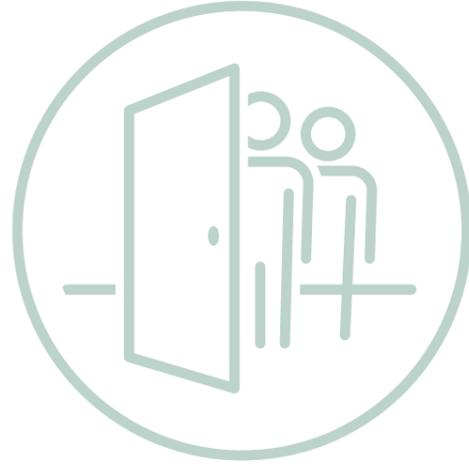
This is followed by a two-week learning phase for the system. During this period, types of problems can be identified conditionally.

# 6

Following the learning phase, the solution is fully operational.

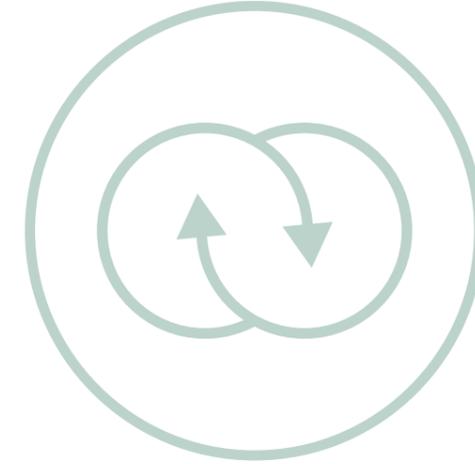
# What additional perspectives do you have?

Your benefits with FAG OPTIME E-CM



# Have you ever thought about a combination?

Electrical and vibration-based condition monitoring



## BENEFITS



### Simple analysis and visualization

The OPTIME App provides you with an overview of all data. An alert is displayed if there are any changes to the electrical health of your machine. You can take action immediately and thus avoid unscheduled downtimes.



### Monitor two motors simultaneously with just one device

The option of being able to monitor two motors simultaneously makes the installation even more efficient thanks to lower total outlay and distinct cost benefits as a result.



### Monitor in any ambient conditions – hot, cold or wet

The measuring technology for monitoring electrical motor signals is always installed in the control cabinet at the power supply of the drive unit. This means that the measurement is not affected by the ambient conditions at the machine itself.



### Vibration-based and electrical data at a glance on one dashboard

A dashboard displays the condition data from the vibration-based and electrical monitoring. The lubrication monitoring data can also be displayed on the dashboard if the smart lubricators OPTIME C1 or FAG OPTIME C4 are installed.

## BENEFITS

The combination of electrical and vibration-based monitoring allows a holistic assessment of machinery, reduces downtime, and optimizes maintenance intervals.

	vibration-based	electrical
Types of problems identified or diagnosed	<ul style="list-style-type: none"> <li>Bearing defects</li> <li>Imbalance and alignment faults</li> <li>Gear defects</li> <li>Resonances</li> <li>and many more mechanical problems</li> </ul>	<ul style="list-style-type: none"> <li>Insulation faults – winding to winding, phase to phase, phase to earth</li> <li>Cable defect – loose cable connection, damaged insulation</li> <li>Broken rotor bar</li> <li>Dynamic eccentricity – mechanical imbalance</li> <li>Static eccentricity – shaft displacement</li> </ul>
Measured variable	Acceleration, speed	Motor current, motor voltage
Monitoring	For example: Bearings, shafts, gearboxes, fans, motors, pumps	For example: Power supply, three-phase motors (rotor, stator), shaft eccentricity, pump efficiency
Limitations	Very limited insight into electrical components	Limited* insight into mechanical defects

\* Alternative, if ambient conditions prevent the use of vibration sensors.

# Product specifications

	Characteristic	Value
<b>Dimensions</b>	Dimensions	104 x 90 x 58 mm (W x H x D)
	Mounting	DIN rail, 35 mm, 6 modules. Must be installed in a mechanically and electrically flameproof enclosure
<b>Operating conditions</b>	Environment	Only for indoor use, IP 20
	Operating temperature	-5 to +60°C
	Humidity	Relative humidity: 5% to 90% Non-condensing
	Pollution degree	2
	Operating altitude	Up to 2000 m
<b>Voltage supply</b>	Main power supply	AC 50 or 60 Hz, 100–480 V (N-Ph or Ph-Ph, effective value) Overvoltage category CAT III 600 V
	Connection	2-pole terminal block 1.5–2.5 mm <sup>2</sup> wires (16-12 AWG) Stripping length: 7 mm Tightening torque: 0.5 Nm
	Consumption	Max. 10 W
<b>Voltage signal inputs</b>	No. of connections	2
	Connection	4-pole terminal block 1.5–2.5 mm <sup>2</sup> wires (16-12 AWG) Stripping length: 7 mm Tightening torque: 0.5 Nm
	Voltage range	N-Ph: 58–300 V RMS Ph-Ph: 100–500 V RMS Max. 300 V referenced to ground
	Frequency range	10–200 Hz (in the event of higher frequencies please consult us)
	Measuring category	CAT III
	Overvoltage category	CAT III 300 V
<b>Current signal inputs</b> (use only with Schaeffler sensors)	No. of connections	2
	Connection	RJ45
	Nominal voltage	333 mV (differential, RMS)
	Maximum voltage	426 mV (differential, RMS)
	Sensors	Set with 3 current transformers or Rogowski coils

# Product specifications

	Characteristic	Value
<b>Ethernet connectivity</b> (reserved for future use)	Measured variable	*Frequency, I <sub>p</sub> , V <sub>pN</sub> , U <sub>pp</sub> , P <sub>p</sub> , P <sub>tot</sub> , S <sub>p</sub> , S <sub>tot</sub> , Q <sub>p</sub> , Q <sub>tot</sub> and PF (vector), voltage imbalance (as per IEC 61557-12)
	No. of connections	2
	Connection	RJ45
<b>RS485 connectivity</b> (reserved for future use)	Interface	10/100 base-T (IEEE 802.3)
	Cabling	Auto MDI/MDIX
	No. of connections	1
<b>Wireless connectivity</b>	Connection	3-pole terminal block, 0.14–1.5 mm <sup>2</sup> Wire cable (25–16 AWG) Stripping length: 7 mm Tightening torque: 0.25 Nm
	Signal level	0 to 5 V (A-B) and -7 to 12 V (GND-A/B)
	Common mode voltage isolation	Max. 1.5 kV
	Speed	9.6 – 115.2 kbps
	Protocols supported	Modbus RTU
<b>WiFi connectivity</b>	Antenna	External 50 ohm
	Connection	SMA
	Protocol	LTE Category 1
<b>WiFi connectivity</b>	Frequency bands	LTE-FDD: B1/2/3/4/5/7/8/12/13/14/18/19/20/25/26/28
	Antenna	Internal
	Protocol	IEEE 802.11 a/b/g/n
	Frequency	2.4 GHz
	Mode	Access point
<b>WiFi connectivity</b>	Security	WPA2 authentication, AES encryption

### \*Description of measured variables

I <sub>p</sub>	Current per phase [A]
V <sub>pN</sub>	Voltage phase-neutral conductor [V]
U <sub>pp</sub>	Voltage phase-phase [V]
P <sub>p</sub>	Power per phase [W]
P <sub>tot</sub>	Power total [W]
S <sub>p</sub>	Apparent power per phase [VA]
S <sub>tot</sub>	Apparent power total [VA]
Q <sub>p</sub>	Reactive power per phase
Q <sub>tot</sub>	Reactive power total
PF	Power factor [0–100%] (P <sub>tot</sub> /S <sub>tot</sub> ) voltage imbalance

# Application

Typical machines for FAG OPTIME E-CM



FAG OPTIME E-CM is especially suitable for machines operating in difficult ambient conditions (high temperatures, under water, difficult or dangerous access).

Application	Characteristics	Installation site
Electric motor	Three phase	<ul style="list-style-type: none"> <li>In control cabinet for electric motors, current transformers on power cables, insulation CAT III 300 V</li> <li>VFD and DOL applications</li> </ul>
Fan	Environment	In control cabinet for electric motors
Compressor	–	In control cabinet for electric motors
Pump	–	In control cabinet for electric motors
Belt drive	–	In control cabinet for electric motors

# Customer testimonials



**“Until now, we had not found a satisfactory solution for electrical condition monitoring that would identify in good time risks like short circuits, insulation and winding faults, or overloads and overcurrent.**

**That’s changed now with the FAG OPTIME E-CM. Because in future we can monitor three-phase motors electrically. I particularly like that the solution is part of the OPTIME Ecosystem. This means that all condition monitoring data – whether vibration-based or electrical – and lubrication data, are available at a glance on a single dashboard. I think this is fantastic.”**

— **Robin Faeser,**  
Central Maintenance / New Technologies,  
Schaeffler Schweinfurt



**“FAG OPTIME E-CM is very useful in the case of special applications, for example motors with alternating load or machines that are difficult to access, such as submersible pumps, or in locations like hot rooms or areas with high chemical loads.**

**My conclusion: Insulation faults, cable defects, problems with rotor bars, or unwanted deviations in the axis of rotation can be detected at an early stage.”**

— **Ivo Ent,**  
Condition Monitoring Coordinator, SPIT

Watch the video messages on our website.



> Scan QR code  
> Use [Link](#)



## Top 3 questions and answers (FAQ)

# 1

**Is FAG OPTIME E-CM a stand-alone solution?**

Yes, the FAG OPTIME E-CM works independently of the OPTIME vibration sensors and lubricators. The solution can be used independently in the OPTIME platform or integrated into an existing OPTIME Ecosystem to achieve additional benefits.

# 2

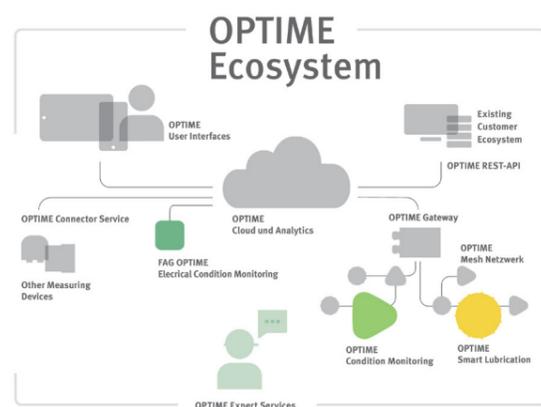
**Can energy consumption and supply network quality be monitored using the FAG OPTIME E-CM?**

Yes, up to two motors can be monitored separately in respect of energy consumption and supply network quality.

# 3

**Can DC motors be monitored?**

No. FAG OPTIME E-CM is only compatible with three-phase (AC) motors.



Find out more about the OPTIME Ecosystem



> Scan QR code  
> Use [Link](#)

Find out more about the FAG OPTIME E-CM



> Scan QR code  
> Use [Link](#)

**BLIND SPOTS?  
NOT IF ALL  
PERSPECTIVES OF  
MACHINE CONDITION  
MONITORING  
ARE CONSIDERED TO  
IDENTIFY PROBLEMS  
IN GOOD TIME!**

**Schaeffler Technologies AG & Co. KG**

Georg-Schäfer-Straße 30  
97421 Schweinfurt  
Germany

[medias.schaeffler.de/en/lifetime-solutions](https://medias.schaeffler.de/en/lifetime-solutions)  
[lifetime.solutions@schaeffler.com](mailto:lifetime.solutions@schaeffler.com)  
Phone +49 2407 9149-66

Every care has been taken to ensure the correctness of the information contained in this publication but no liability can be accepted for any errors or omissions. We reserve the right to make technical changes.

© Schaeffler Technologies AG & Co. KG

Issued: 2026, January  
This publication or parts thereof may not be reproduced without our permission.