

# SKF Dynamic Motor Analyzer – EXP4000

A powerful, portable motor and machine system monitoring instrument for troubleshooting and PdM



## Introduction

Maintenance professionals need to minimize costs associated with unexpected motor failures and production downtime. The SKF Dynamic Motor Analyzer EXP4000 is a motor monitoring and troubleshooting tool that helps maintenance personnel to minimize failures and maximize the uptime of machine systems that drive their businesses.

The EXP4000 is not a motor insulation tester. Instead, it uses advanced software algorithms to monitor and assess conditions across a motor/machine system that impact the health and performance of the motor within the system. It evaluates the quality of power fed to a motor, assesses motor performance indicators, and tracks the amount and condition of load placed on the motor. This visibility across a given machine system – into power, motor and load – makes the EXP4000 a powerful predictive maintenance and troubleshooting solution.

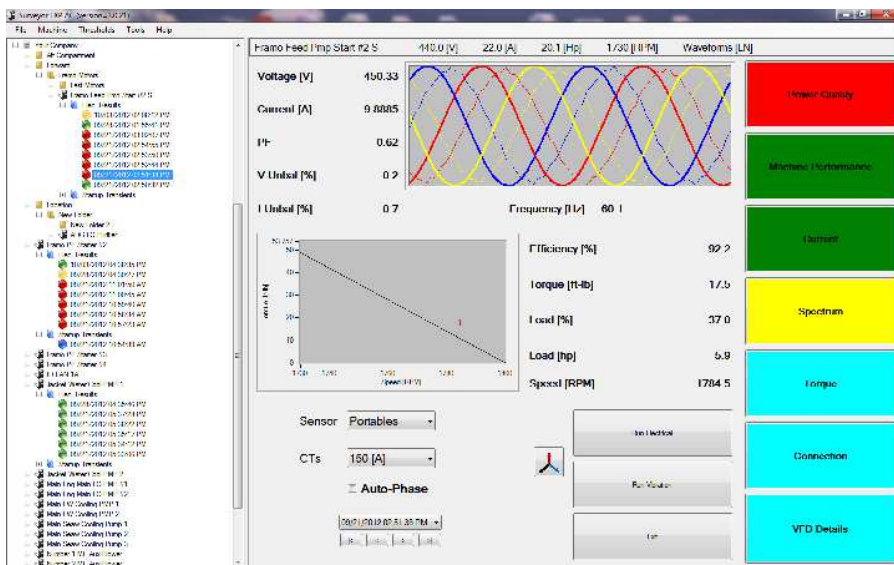
The EXP4000 is designed for rigorous use by maintenance personnel in the field. Whether plugged into a power source or running on its batteries, it can be taken into industrial environments to monitor motors while they are in operation. The analyzer can be connected at a motor junction box, at the instrumentation cabinet, from inside

of a motor control cabinet (MCC), or from the outside of an MCC equipped with an SKF Dynamic Motor Link - EP1000.

Organizations often find maintenance staff at odds over the root causes of a given motor problem. Many mechanical engineers tend to blame the problem on an electrical issue, while electrical engineers will often contend the same problem is mechanical. The EXP4000 is an effective troubleshooting tool, and clearly detects when a problem is either electrical (e.g., when it involves an issues within the motor, or power quality) or mechanical (such as an over-load, or poor application of the motor). It is also a powerful predictive maintenance tool that tracks multiple data types to identify trends that indicate potential problems. Such trends can also be used to troubleshoot an issue to avoid any recurrence of the problem with the same machinery.

The bottom line is that the EXP4000 can help maintenance organizations avoid costly unnecessary downtime by identifying trends and by isolating the root causes of under-performing or malfunctioning equipment.





The user interface of the EXP4000 dynamic motor analyzer features an at-a-glance summary of power, motor and machine condition.

## Test domains

The Windows 7-based EXP4000 acquires data using several testing domains. These include:

- Power quality
- Machine performance
- Current
- Spectrum
- Torque
- Variable-frequency drives
- Continuous monitoring
- Transient analysis
- Vibration
- Efficiency

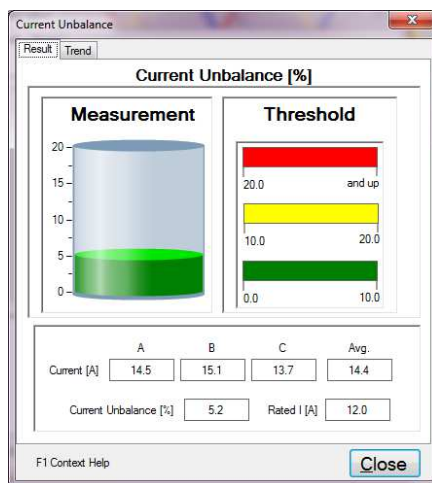
Data collected from tests performed in these domains can be captured and stored for use in reports, maintenance records, and trend analysis. Data is stored in a standardized database format (Microsoft Access), so it is compatible with a wide range of report generation and retrieval tools used by maintenance organizations. Records of multiple motors with data from multiple EXP4000 reports are easily created on the analyzer itself, and can be combined with other reports that can be shared with other users on desktop and laptop PCs. Reports are easy to print with connection to any Windows-compatible, plug-and-play printer.

The EXP4000 hardware and software is designed for ease of use. Software features include graphically-displayed data such as phasor diagrams, three-phase currents and voltages, instantaneous voltage and symmetrical components. The data provides an operator with valuable power information as well as the means to ensure the analyzer is

properly connected in order to accurately monitor a motor. The analyzer simplifies the monitoring process using test thresholds to provide at-a-glance red-yellow-green for the following test domains: current, power quality, machine performance, spectrum, torque, and VFD.

### Current

Problems such as over-loading, poor connections, misconnections, iron saturation and miswound motors are difficult to detect without the right equipment. The EXP4000 evaluates current and current unbalances to assess the overall electrical condition of the motor/machine system.



The EXP4000 provides views of different measurements with user-defined thresholds

## Power quality

If the power being fed to a motor/machine system has any distortion, imbalances or improper levels for the motor, it can create problems that shorten the motor's service life. The EXP4000 identifies power quality problems that can unnecessarily stress a motor. The instrument monitors power, voltage and current levels/imbalances, and total as well as harmonic distortion. These can identify such problems as:

- improper tap settings on supply transformers
- poorly-distributed single-phase loads
- an excessive number of VFDs without proper filtration
- excessive non-harmonic frequencies on a given VFD
- improper filters
- missing or open power-factor correction capacitors
- high-resistance connections

|                              | A     | B     | C     | Avg/Sum |
|------------------------------|-------|-------|-------|---------|
| <b>kW</b>                    | 2.7   | 2.7   | 2.4   | 7.8     |
| <b>kVA</b>                   | 1.3   | 1.6   | 1.4   | 4.3     |
| <b>kVA</b>                   | 3.0   | 3.1   | 2.8   | 8.9     |
| <b>PF</b>                    | 0.90  | 0.86  | 0.87  | 0.88    |
| <b>V</b>                     | 205.2 | 207.5 | 204.6 | 205.8   |
| <b>I</b>                     | 14.5  | 15.1  | 13.7  | 14.4    |
| <b>THD V</b>                 | 1.7   | 1.3   | 1.3   | 1.4     |
| <b>THD I</b>                 | 2.0   | 1.6   | 2.3   | 2.0     |
| <b>Cf V</b>                  | 1.42  | 1.41  | 1.41  | 1.41    |
| <b>Cf I</b>                  | 1.48  | 1.48  | 1.45  | 1.47    |
| <b>Voltage Unbalance [%]</b> |       |       |       | 0.86    |
| <b>Current Unbalance [%]</b> |       |       |       | 5.20    |
| <b>Frequency [Hz]</b>        |       |       |       | 60.0    |

The EXP4000 provides a detailed power analysis view

## Machine performance

Maintenance staff often do not detect problems with operating equipment that could ultimately lead to motor failure, such as thermal overloads or machine degradation issues that put undue stress on a motor. The EXP4000 evaluates the operational health and performance of a motor, and identifies stress-inducing problems at their source. The instrument analyzes effective service factor, load, operation condition, and efficiency to detect any issues.

## Spectrum

Hard-to-detect issues such as broken rotor bars or bearing faults can be detected and isolated with the instrument's spectrum analysis capabilities. These include demodulated spectrum, harmonics and rotor bar tests, which all help to confirm mechanical vs. electrical problems.

These capabilities are enhanced with the high resolution of the spectrum image, a high sample rate and the ability of the user to click and zoom in for detailed views of a given segment of the spectrum. The analyzer can set frequency markers on a graph that are specific to a given machine system's design.

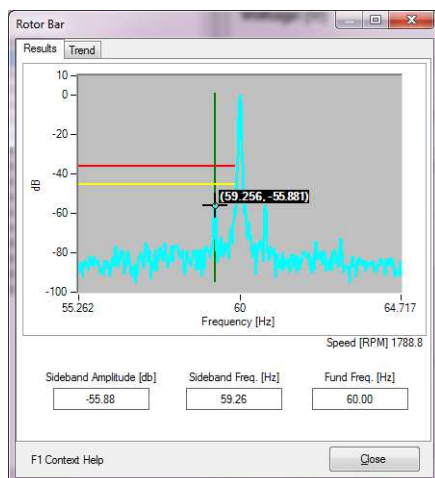
## Time waveforms

Time waveforms are essential for swift identification of underlying causes of warning or caution level parameters and transient conditions. They graphically represent voltage, current and torque vs. time.

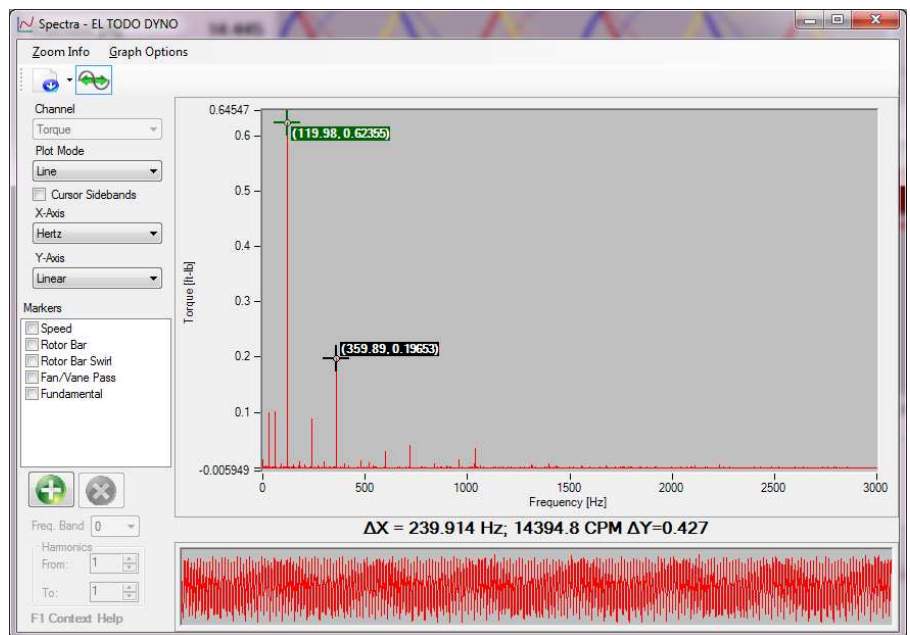
## Torque

Transient conditions can easily over-stress a machine system, but be very difficult to identify and assess. SKF's innovative torque analysis capabilities within the EXP4000 provide the means to find torque-related problems.

The torque time and spectrum signatures are used to diagnose mechanical problems, and to clearly identify transient conditions. Users can accurately identify such issues as cavitation, bearing problems, mechanical imbalances, eccentricities, misaligned shafts and more.



**Rotor bar spectrum analysis screen on the EXP4000**



**Torque spectrum and time waveform displays are just two of the EXP4000's many powerful graphical representations of machine system health and performance**

## Transient startup

The ability to accurately troubleshoot any motor/machine issues at start-up involves distinguishing if a problem is with the power fed to the motor, the motor itself, or the load placed on the motor. The only way one can do this is by monitoring all three phases of current, voltage and torque. The EXP4000 performs a startup analysis with a transient analysis tool. Traces of RMS currents and voltages from each of the three phases are captured. The analyzer displays amplitude of voltage, current and torque at startup, and allows a user to zoom in on, pan and hover with a cursor to read the data from specific points on graphs.

## VFD monitoring

VFDs pose a unique set of challenges for maintenance professionals. The EXP4000 has the means to monitor and effectively troubleshoot this increasingly popular motor drive technique. The analyzer displays the V/Hz relationship with respect to time. This helps with setup and commissioning, and improves the ability to troubleshoot VFD issues.

## Continuous monitoring

Inconsistent problems, or machine system issues that don't occur very often, are easy to miss with short-term or route-based monitoring. The EXP4000 can continuously monitor machine systems for several days to collect and analyze information and identify problems that can't always be detected

in the short windows of time typical of route-based testing.

## DC monitoring

The EXP4000 provides the means to monitor DC motor voltages and currents in a DC motor's operational environment. It provides spectrum analysis of these signals to identify problems that are otherwise hard to detect or assess.

## Efficiency

The ability to identify under-performing motors has become increasingly necessary in today's era of energy conservation and efficiency. The EXP4000 identifies poorly-performing motors with accurate assessments of efficiency within their current applications. This is especially valuable for motor replacement decision support.

## Full-spectrum PdM

The EXP4000 gives industrial maintenance organizations a powerful tool to troubleshoot problems and avoid potential issues that would result in costly unplanned downtime. When coupled with SKF static motor analyzers such as SKF's Baker AWA-IV, maintenance professionals have the means to minimize unexpected failures while maximizing uptime of motors and the machinery they depend upon. Contact your local SKF representative for a demonstration, or for more information about how the EXP4000 can improve your organization's predictive motor maintenance program.

## EXP4000 Specifications

|   |  |
|---|--|
| Input power                                     | 110 - 250 V AC, 50/60 Hz integrated power supply   |
| Maximum rated measurement/test voltage          | 1 000 V AC, 500 V DC   |
| Current transformers (portable)                 | 0 - 10 A, 0 - 40 A, 0 - 150 A, 0 - 400 A, 1 - 1 000 A, 0 - 3 000 A   |
| Connections (Amphenol military spec twist type) | Power entry module (1)<br>Portable voltage connection (1)<br>Portable current connection (1)<br>EP port (1)<br>Vibration sensor connection (1) |
| Dimensions (case)                               | Width: 44,5 cm (17,5 in)<br>Length: 29,2 cm (11.5 in)<br>Height: 22,2 cm (8.75 in)   |
| Weight  | 6,8 kg (15 lb)   |
| Computer specifications                         | 500 GB hard drive<br>4 GB memory<br>Battery and AC power<br>Windows 7 operating system<br>USB port   |
| Industrial standards                            | NEMA MG-1, IEEE 519, EN61000-2-2, EN61000-2-7, VDE 839-2-2   |

## Service

SKF Condition Monitoring provides world-class global technical support for its motor test and monitoring equipment. From routine calibration to repairs and upgrades for static or dynamic analyzers, our experienced technicians will return your equipment in top condition with fast turnaround and courteous service.

Contact SKF's motor test and monitoring product service at +1 800-523-7514 (in the U.S.), or +1 858-496-3627 from outside the U.S., or email our service department at [service.cmcfc@skf.com](mailto:service.cmcfc@skf.com).

## Training

Want to get the most out of your investment in your SKF analyzer? SKF Condition Monitoring provides training on dynamic motor test and monitoring methods at its training center in Fort Collins, Colorado, USA, or at customer locations on-site, around the globe. Training courses include introductory and advanced seminars on dynamic motor testing that allow you to get the most out of your EXP4000.

For more information, or for reservations, send an email to [sales.cmcfc@skf.com](mailto:sales.cmcfc@skf.com), or call 970-282-1200.

## Product Support Plans

Maximize your EXP4000 analyzer's uptime and performance over the life of the product with SKF Product Support Plans (PSPs). These plans assure the fastest turnarounds for repairs and calibration. For more information about PSPs for electric motor test equipment, contact your local SKF sales representative. In the U.S. call 970-282-1200; for global contacts, visit the electric motor test and monitoring solutions website [www.bakerinst.com](http://www.bakerinst.com) to find a country representative, or send an email to [sales.cmcfc@skf.com](mailto:sales.cmcfc@skf.com).

### SKF USA, Inc.

#### Electric Motor Condition Monitoring

4812 McMurry Avenue, Fort Collins, CO 80525 USA

T: +1 970-282-1200 – +1 800-752-8272

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PUB CM/P2 14547 EN · March 2014

