SKF Machine Condition Advisor
CMAS 100-SL

P/N 32150500-EN
Revision B

⚠ ***WARNING!*** Read this manual before using this product. Failure to follow the instructions and safety precautions in this manual can result in serious injury. Keep this manual in a safe location for future reference.

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SKF Reliability Systems
Limited Warranty

WARRANTY

Subject to the terms and conditions contained herein, SKF warrants to the Buyer that for the warranty period indicated below the products sold by SKF that are listed below (the "Products"), when properly installed, maintained and operated, will be free from defects in material and workmanship and shall be fit for the ordinary purposes for which the Products are designed.

BUYER'S LIMITED REMEDIES

This limited warranty defines SKF's sole and exclusive liability and Buyer's sole and exclusive remedy for any claim arising out of, or related to, any alleged deficiency in any Product sold by SKF, even if such claim is based on tort (including negligence or strict liability), breach of contract, or any other legal theory.

If the Product does not conform to this limited warranty, Buyer must notify SKF or SKF's authorized service representative within thirty (30) days of discovery of the nonconformity; provided, however, that SKF shall not be liable for any claim for which notice is received by SKF more than thirty (30) days following the expiration of the applicable warranty period for the Product. Upon receipt of timely notification from Buyer, SKF may, at its sole option, modify, repair, replace the Product, or reimburse Buyer for any payment made by Buyer to SKF for the purchase price of the Product, with such reimbursement being pro rated over the warranty period.

WARRANTY PERIOD

Except as expressly provided below, the warranty period for each Product shall commence on the date the Product is shipped by SKF to Buyer.

90-DAY WARRANTY

Products warranted for ninety (90) days by SKF are as follows: cable assemblies, MARLIN QuickConnect (MQC), magnetic temperature probes, and all refurbished equipment.

ONE-YEAR WARRANTY

Products warranted for one (1) year by SKF are as follows: all Microlog products and accessories, all MARLIN data managers (MDM), all MARLIN Condition Detectors (MCD), all Wireless Machine Condition Detectors (WMCD), all Multilog Condition Monitoring Units (CMU, TMU), Multilog Local Monitoring Units (LMU), all Wireless Monitoring Systems V/T, all Vibration PenPlus, all Machine Condition Advisors (MCA), all transmitters, all SKF software, all Monitor Interface Modules (MIM), all Machine Condition Transmitters (MCT), MicroVibe P and Custom Products with the prefix of CMCP (with the exception of any consumable or expendable items).

TWO-YEAR WARRANTY

Products warranted for two (2) years by SKF are as follows: all standard Eddy Probes, Eddy Probe Drivers, and Eddy Probe Extension Cables, Multilog On-line Monitoring system (DMx), and all M800A and VM600 Machinery Monitoring Systems.

For all On-line Systems that have satisfied Criteria 1 and 2 below, the warranty period shall be either thirty (30) months from the date the On-line System is shipped by SKF to Buyer, two (2) years from the date the On-line System is installed and commissioned by SKF, or two (2) years

from the date on which the installation of the On-Line System has been audited and commissioned by SKF or its authorized service representative, whichever period ends first.

Criteria 1.

Devices used with a Multilog Condition Monitoring Unit (CMU), Multilog Local Monitoring Unit (LMU), including, but not limited to, the sensing device, the interconnect cabling, junction boxes, if any, and the communications interface, must consist only of SKF-supplied or SKF-approved devices and/or components. The computer provided by Buyer must meet the requirements stipulated by SKF.

Criteria 2.

SKF or its authorized service representative has installed the On-line System or has audited the installation and commissioned the On-line System.

“On-line Systems” are defined as systems consisting of Multilog Condition Monitoring Unit(s) (CMU), Multilog Local Monitoring Unit(s) (LMU), and any sensing or input devices, the interconnect cabling between the sensing or input devices and the Multilog Condition Monitoring Unit(s) (CMU), Multilog Local Monitoring Unit(s) (LMU), and the cabling between the Multilog Condition Monitoring Unit (CMU), Multilog Local Monitoring Unit (LMU) and the proprietary SKF communications interface with the host computer.

FIVE-YEAR WARRANTY

Products warranted for five (5) years by SKF are as follows: all standard seismic sensors (accelerometers and velocity transducers).

OTHER SKF PRODUCTS

Any SKF product supplied hereunder but not covered by this limited warranty shall be either covered by the applicable SKF limited warranty then in place for such product or, if no such warranty exists, shall be covered by the 90-day warranty stated above.

THIRD PARTY PRODUCT WARRANTIES

For any third party products sold to Buyer by SKF, SKF will transfer to Buyer any warranties made by the applicable third party product vendor to the extent such warranties are transferable.

CONDITIONS

As a condition to SKF's warranty obligations hereunder and if requested or authorized in writing by SKF, Buyer shall forward to SKF any Product claimed by Buyer as being defective. Buyer shall prepay all transportation charges to SKF's factory or authorized service center. SKF will bear the cost of shipping any replacement Products to Buyer. Buyer agrees to pay SKF's invoice for the then-current price of any replacement Product furnished to Buyer by SKF, if the Product that was replaced is later determined by SKF to conform to this limited warranty.

SKF shall not be obligated under this limited warranty or otherwise for normal wear and tear or for any Product which, following shipment and any installation by SKF (if required by the contract with the Buyer), has, in SKF's sole judgment, been subjected to accident, abuse, misapplication, improper mounting or remounting, improper lubrication, improper repair or alteration, or maintenance, neglect, excessive operating conditions or

for defects caused by or attributable to the Buyer, including without limitation Buyer's failure to comply with any written instructions provided to Buyer by SKF.

SKF shall be free to conduct such tests, investigations and analysis of the Products returned to SKF, as it deems reasonable and proper in the exercise of its sole judgment. As a further condition to SKF's obligations hereunder, Buyer shall offer its reasonable cooperation to SKF in the course of SKF's review of any warranty claim, including, by way of example only, Buyer's providing to SKF any and all information as to service, operating history, mounting, wiring, or re-lubrication of the Product which is the subject of the Buyer's warranty claim.

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SALE OF ANY PRODUCT BY SKF TO THE FURTHEST EXTENT PERMITTED BY APPLICABLE LAW.

The exclusive remedies provided in this limited warranty shall not be deemed to have failed of their essential purpose so long as SKF is willing and able to perform to the extent and in the manner prescribed in this limited warranty.

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(Revision P, 12-07)

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SKF Machine Condition Advisor

⚠ Safety Instructions

> ⚠ ***WARNING! Failure to follow these safety instructions may result in risk of personnel injury or damage to machinery.***

Personnel Safety

Dress properly. Do not wear loose clothing or jewelry. Keep your hair, clothing, and gloves away from moving parts.

Do not overreach. Keep proper footing and balance at all times to enable better control of the device during unexpected situations.

Use safety equipment. Always wear eye protection. Non-skid safety shoes, hard hat, or hearing protection must be used for appropriate conditions.

Device Safety

Use only accessories that are recommended by the manufacturer.

Do not attempt to open the device.

Device service must be performed only by qualified SKF repair personnel.

Overview

SKF's Machine Condition Advisor easily provides two important machinery health vibration readings and a temperature measurement, and automatically provides alarm information when your machinery's vibration readings exceed accepted guidelines. Vibration measurements include:

- A reading for overall "velocity" vibration, which indicates general machinery condition. This "overall" reading shows a total value for all vibration signals emanating from all machinery components within the instrument's sensor range. The instrument compares the overall vibration value to limits established by ISO 10816-3 guidelines. Measurement values exceeding limits are automatically indicated.
- An "enveloped acceleration" (bearing) vibration reading that filters out all machinery vibration signals except those emanating from rolling element bearings and gearboxes. Bearing vibration readings are automatically compared to limits established by SKF based upon years of statistical analysis of existing databases. This reading helps detect bearing faults in their early stages.

When used together, these two vibration measurements and their alarm comparisons can provide detection of most general machinery faults, and importantly, detection of rolling element bearing faults.

> ➢ Although alarm comparisons are not provided for gearbox readings, overall enveloped acceleration

trending can provide detection of gear faults.

In addition, an infrared temperature measurement is provided to indicate uncharacteristic temperature increases that generally occur as machine and bearing faults worsen and to help detect machinery problems that may not affect machine vibration signals.

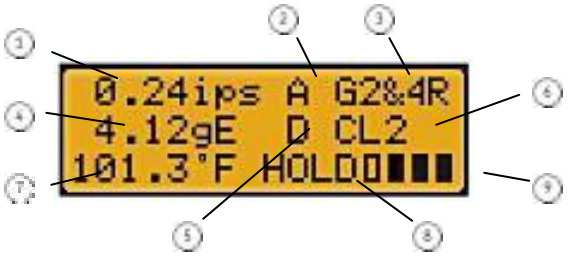
Controls and Functions



The SKF Machine Condition Advisor.

1. LCD display
2. Vibration sensor tip
3. Infrared temperature sensor
4. Select button
5. Browse button
6. AC power / external sensor connector

Display – The Machine Condition Advisor features an LCD digital display that simultaneously shows measurement results on three lines, as described below:



1. Overall vibration reading (**IPS** or **mm/s**)
2. Overall vibration alarm (none, **A**lert, or **D**anger)
3. Overall vibration alarm Group (**G1&3** or **G2&4**) and foundation type (**F**lexible or **R**igid)
4. Bearing vibration reading (**gE**)
5. Bearing vibration alarm (none, **A**lert, or **D**anger)
6. Bearing vibration alarm class (**CL1**, **CL2**, or **CL3**)
7. Temperature reading (**C** or **F**)
8. Measurement status indicator – (**run** or **hold**)
9. Battery charge status (75% charged)

How to Set Up your Machine Condition Advisor

Prior to using the SKF Machine Condition Advisor, you should fully charge its battery and set up the instrument to best measure your specific machinery. In this section, we describe how to:

- Charge the instrument's rechargeable battery.
- Set the instrument's language.
- Set the system units to either English or Metric units.
- Enable / disable the infrared temperature measurement.
- For the instrument's overall vibration measurements, specify your general machinery size, speed, and foundation type by ISO classification group. These settings determine alarm levels for the overall machine vibration measurements.
- For bearing vibration measurements, select a bearing alarm classification based upon the general bearing size and shaft speed of your machinery bearings. This setting determines alarm levels for the bearing vibration measurements.

⚠Battery and Battery Charger Safety Instructions

Batteries are not fully charged out of the box. Before using the batteries and charger, read and follow the safety instructions below.

> ⚠***WARNING! Failure to follow these safety instructions may result in risk of fire, electric shock, or electrocution - or damage to the device.***

- Charge the device's battery only with the recommended SKF battery charger.
- DO NOT immerse the device in water or other liquids.
- Use and store the device according to the following temperature ranges:

  Operating temperature range:

  In use: -10 to +60° C (+14 to +140° F)

  While charging: 0 to +40° C (+32 to +104° F)

  Storage temperature:

  Less than one month: –20 to +45° C (–4 to +113° F)

  More than one month but less than six months: –20 to +35° C (–4 to +95° F)

- ⚠***WARNING!*** Shock hazard. Do not allow liquids to get inside battery charger.
- Do not expose the charger to rain or snow.

- Do not attempt to charge the battery with any charger other than the one described in this manual.
- Do not attempt to use the charger to charge any other type of device.
- Pull by plug, not by cord, when disconnecting the charger.
- Locate the cord so it will not be stepped on, tripped over, or subjected to damaging conditions.
- Do not operate the charger with damaged cord or plug.
- Do not disassemble the charger; return it to an authorized SKF service center for repair.
- Disconnect the charger from the outlet prior to cleaning.
- Do not operate the charger if it is damaged in any way.

Battery Maintenance

Use the following recommendations to prolong the life of your battery:

- If the device is temporarily not in use (and therefore not being regularly charged), it is important that it is recharged at least every 25 to 30 days to prevent damage to the cells.
- The battery capacity (the length of unit's operational / run time) will be reduced at temperature extremes, i.e., both high and low operating temperatures will reduce the amount of time the unit runs from the battery.

How to Charge the Battery

The Machine Condition Advisor uses a rechargeable lithium-ion battery. The CMAC8004 Universal Charger required to charge the battery is included in the Machine Condition Advisor kit.

To charge the battery:

- Connect the CMAC8004 Universal Charger to an AC outlet (if necessary, use the supplied regional AC outlet adapters).
- Align, connect, and tighten the CMAC 8004 Universal Charger's cable to the six-pin connector at the base of the instrument.

A progress bar scrolls across the display as charging occurs. A "**charge complete**" message displays when the battery is fully charged (typically within four hours).

⚠ ***WARNING! Access to the battery compartment is not permitted on the Machine Condition Advisor in compliance with the IP54 rating. The battery must be replaced at the factory. For battery replacement, contact your local SKF Sales office, or go to http://www.skf.com/cm.repair.***

Battery Charge Status

When fully charged, the Machine Condition Advisor's battery provides approximately 10 hours of continuous use. Battery charge status is indicated using four vertical bars in the display's lower right.



Each filled bar represents approximately 25% of remaining battery life. It is recommended you fully recharge the battery when only one bar remains (at approximately 25% of remaining battery life).

- If temperature readings are not required, the infrared temperature sensor may be disabled to extend battery life. Reference the following **How to Make Selections in Setup Mode** section for details.

How to Make Selections in Setup Mode



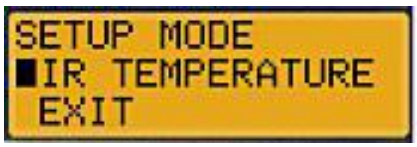
1 Select button
2 Browse button

- Press either the Select or Browse button to turn the instrument on.



- From the measurement display, press and hold the Browse button (approx. 1 sec) to enter **Setup Mode**.

The **Setup Mode** menu appears showing the first two menu options.



In all **Setup Mode** menus:

- Use the Browse button to move the blinking cursor between menu options.

- Use the Select button to select the option indicated by the blinking cursor.
    - ➢ In sub-menus, an arrow indicates the currently selected option.



Use this method to set options from the instrument's menu structure, as described below.

Setup Mode

IR Temperature
On or **Off**

Exit (exits back to measurement mode)

Language
English, French, German, Spanish, Portuguese, or **Swedish**

System Units
English (IPS) or **Metric (mm/s)**

Alarm Velocity Group
1 and 3 (G1&3) or **2 and 4 (G2&4)**

Foundation
(R)igid or **(F)lexible**

Enveloped Acceleration Class
CL1 or **CL2** or **CL3**

How to Choose the Correct "Alarm Velocity Group" for your Machinery

The **Alarm Vel**ocity **Group** you specify (**G2&4** or **G1&3**) determines the instrument's "overall vibration" alarm limits. Therefore, you should select the Group that best describes the general size, type, and speed of the machinery you're measuring. Note that these machine group classifications adhere to ISO standard 10816-3, which rates overall velocity vibration levels for standardized machinery classifications. Options are:

Groups 2&4 (default)
The ISO standard Group 2 and 4 classifications define the following type of machinery:

- Medium size machines and electrical machines with a shaft height between 160 mm and 315 mm.
- These machines are normally equipped with rolling element bearings, but may use sleeve bearings, and operate at speeds above 600 RPM.
- These machines include pumps with multi-vane impellers and integrated drivers.

Groups 1&3
The ISO standard Group 1 and 3 classifications define the following type of machinery:

- Large machinery and electrical machines with a shaft height greater than 315 mm.
- These machines are generally equipped with sleeve bearings, but may use rolling element bearings.
- These machines include pumps with multi-vane impellers and integrated drivers.

Rigid or Flexible Foundation?

An additional factor in ISO machinery classifications is whether the machinery is mounted on rigid or flexible foundations. Therefore, an additional setting that helps define your Alarm Velocity Group's overall vibration alarm levels is whether the machinery you're measuring has **Rigid** (default) or **Flexible** foundations.

- In **Setup Mode**, select the **Foundation** option that describes the mounting type for machinery you're measuring (**Rigid** or **Flexible**).

How to Choose the Correct "Enveloped Acceleration Classification" for your Machinery

The **Env**eloped **Accel**eration **Class**ification (**CL1, CL2,** or **CL3**) you specify determines the instrument's "bearing vibration" alarm levels. Therefore, you should select the Enveloped Acceleration Class that best describes the general size and speed of the bearings you're measuring.

Options are:

CL1
Bearings with a bearing bore diameter between 200 mm and 500 mm and a shaft speed below 500 RPM.

CL2 (default)
Bearings with a bearing bore diameter between 50 mm and 300 mm and a shaft speed between 500 RPM and 1800 RPM.

CL3
Bearings with a bearing bore diameter between 20 mm and 150 mm and a shaft speed from 1800 RPM to 3600 RPM.

How to Use the Machine Condition Advisor



1. LCD display
2. Vibration sensor tip
3. Infrared temperature sensor
4. Select button
5. Browse button
6. AC power / external sensor connector

The SKF Machine Condition Advisor is very simple to use.

General steps for use are:

- Turn the instrument on.
- Place the sensor tip (or a connected external sensor with magnetic tip) against the machine you're measuring and wait for the vibration readings to stabilize.
- Press the Select button to hold (freeze) the measurement readings.
- View the display to determine if the vibration readings are in Alert or Danger alarm levels.

Each step is described in more detail in following sections.

Turn the Instrument On

- Press either the Select or Browse button to turn the instrument on.

    - The instrument automatically turns off after 2 minutes of inactivity, or you may press and hold the Select and Browse buttons simultaneously to immediately turn off the instrument.

The title screen briefly displays, then the measurement screen displays in RUN mode.



In RUN mode, vibration measurements are continuously repeated, and results update continuously.

Place the Sensor Tip against the Machine

- Press the pen's sensor tip against your measurement POINT on the machine.

    - For optimal sensor placement, reference the **Sensor Placement Techniques** section later in this manual.

Press the Select Button to Hold the Measurements

- When the measurement results stabilize, press the Select button to “hold” the measurement results.
    - Keep the instrument motionless when pressing the Select button to hold measurements, movement will cause readings to fluctuate. Note that using the external sensor with magnet attachment provides more stable measurement results.
    - It is recommended that you take infrared temperature measurements with the instrument’s probe tip pressed against the machine, and never from more than 4” (10 cm) away from target.



Measurement results freeze, HOLD appears on the display, and alarm indicators appear for the overall vibration and bearing vibration measurements if their measurement results exceed limits for the specified machinery classifications.

View Measurement Alarm Status

When measurement results are in alarm, record the measurement location and values for later analysis and trending purposes.

- For help with trending, use the "Advisor Trend.XLS" spreadsheet provided on the product CD.

- Repeat this procedure for your next measurement POINT. To take measurements at the next location, press the Select button again to release the HOLD function. The HOLD indicator disappears, the RUN indicator appears and measurements resume.

How to Use the Optional External Sensor



Use the external sensor with magnet attachment to increase the consistency and quality of your MCA's vibration measurements. Also, magnetic mounted sensors provide higher sensitivity to vibration signals occurring at higher frequencies (i.e., bearing fault vibration) than do probe tip sensors. Thus, use the external magnetic mounted sensor to facilitate earlier detection of bearing problems vs. the MCA's internal sensor.

- Use of the instrument's optional external sensor affects battery life.

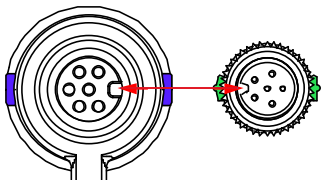
An external sensor kit (CMAC 112-K) is available for the Machine Condition Advisor. The kit consists of:

A 100 mV/g accelerometer sensor with integral cable (CMAC 111), and

A magnet attachment (CMAC 109) for the accelerometer.

To connect the external sensor:

- Screw in and tighten the magnet to the external accelerometer sensor.
- On the MCA's connector, locate the small notch into which the cable connector's keyway fits.



- Align the cable connector's keyway to the MCA connector's notch and press gently to join the two connectors.
- Tighten the screw lock on cable's connector to secure. (do not over tighten).
- Alternatively press the two connectors gently together and slowly rotate one connector until the keyway slides into the notch, & then tighten the screw lock to secure.

To perform vibration measurements using the external sensor:

- Connect the external sensor to the instrument as described above.
    - ➢ When using an external sensor, the temperature measurement is automatically disabled.
- Place the sensor's magnet on your machine measurement POINT.

> ⚠ ***WARNING! Do not allow the external sensor's cable to become tangled in rotating machinery components. Serious damage or injury may occur.***

- Press either the Select or Browse button to turn the instrument on. The title screen briefly displays, then the measurement screen displays in RUN mode.



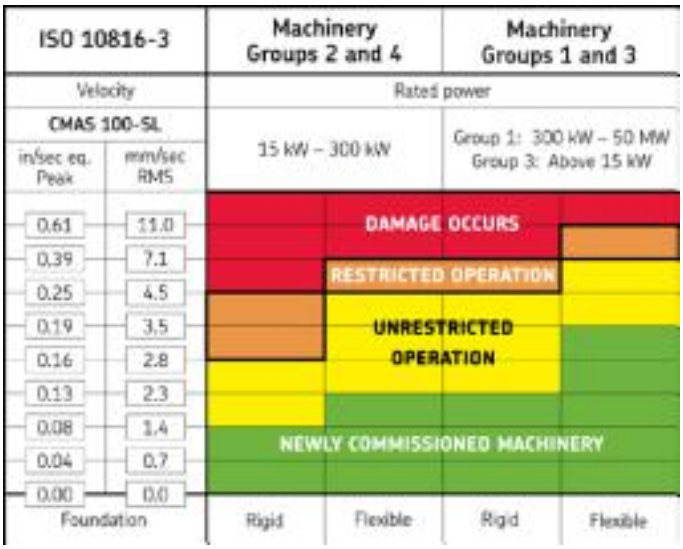
Ext Sen displays at the bottom of the screen indicating external sensor use.

- Perform the remaining measurement steps as previously described.

ISO 10816-3 Severity Chart

The Machine Condition Advisor compares your overall velocity vibration readings to limits established by ISO

10816-3 guidelines. The following severity chart is provided for your reference.



Note that vibration readings in both the green and yellow areas are below alarm levels. Orange indicates measurements in Alert alarm. Red indicates measurements in Danger alarm.

Enveloped Acceleration Severity Chart

Bearing vibration readings are automatically compared to limits established by SKF based upon years of statistical analysis of existing databases. The following severity chart is provided for your reference.

Class	OK	Alert	Danger
CL1	0-1 gE	1-2 gE	over 2 gE
CL2	0-2 gE	2-4 gE	over 4 gE
CL3	0-4 gE	4-10 gE	over 10 gE

Sensor Placement Techniques

Proper hand-held sensor technique is vital to the accuracy of Machine Condition Advisor measurements! In general, it is critical that you perform **consistent** readings.

Perform measurements with the machine operating under normal conditions. For example, when the machinery has reached its normal operating temperatures and is running under its normal rated condition (at rated voltage, flow, pressure and load). On machines with varying speeds or loads, perform measurements at all extreme rating conditions, in addition to selected conditions within these limits.

When placing the sensor on the machine, generally avoid greasy, oily, wet, or painted surfaces, housing splits, and structural gaps. Select the best measurement POINT (specifically avoid unloaded bearing zones), and be consistent in sensor position, sensor angle, and contact pressure.

Sensor Position - If possible, choose a flat surface in the bearing's load zone to press the sensor tip against. Measurements should be taken at the same precise

location (moving the probe only a few inches can produce drastically different vibration readings). To ensure measurements are taken at the exact same spot, mark the measurement POINT with permanent ink, machine a shallow conical hole with a drill point, or use SKF's adhesive measurement disks.

Acceleration enveloping measurements (bearing vibration measurements) are especially sensitive to sensor location. The optimal measurement location for enveloped acceleration measurements is in the bearing load zone, as close to the measured bearing as possible. If the probe is positioned out of the load zone or too far from the measured bearing, the measured signal degrades in amplitude and appears as a lower (and inaccurate) value.

Therefore, when measuring a bearing on a horizontal shaft with a split bearing housing, you should perform measurements on the housing's lower portion (in the load zone) when possible. This allows the overall velocity vibration and acceleration enveloping measurements to be simultaneous and accurate.

- Use the external sensor with magnet attachment to increase the consistency and quality of your MCA's vibration measurements. Also, magnetic mounted sensors provide higher sensitivity to vibration signals occurring at higher frequencies (i.e., bearing fault vibration) than do probe tip sensors. Thus, use the external magnetic mounted sensor to

facilitate earlier detection of bearing problems vs. the MCA's internal sensor.

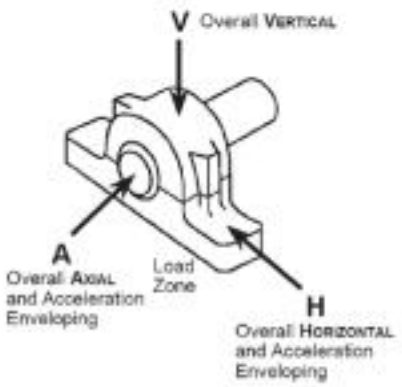
Angle – Always perpendicular to the surface (90°).

Pressure – Even, consistent hand pressure must be used (firm, but not so firm as to dampen vibration signals on smaller machines).

Vibration Analysis Guidelines

With the exception of bearings and gearboxes, most rotating machinery problems show themselves as excessive overall velocity vibration. Also, each mechanical problem generates vibration in its own unique way. We can therefore examine the "type" of overall velocity vibration to identify its cause and take appropriate repair action.

With overall velocity vibration measurements, interpretation of the cause of excess vibration can relate to probe position when taking the measurement; either in the horizontal, vertical, or axial planes.



Horizontal – Typically, imbalanced shafts tend to cause radial (horizontal and vertical) vibrations, depending on the machine support design.

Vertical – Excessive vertical vibration can indicate mechanical looseness as well as imbalance.

Axial – Excessive axial vibration is a strong indicator of misalignment.

It's important to note that these are general guidelines for horizontal shafts and that knowledge of your machinery and proper hand-held sensor techniques are necessary to accurately interpret the cause of excessive vibration.

Infrared Temperature Measurement Guidelines

To perform accurate non-contact infrared temperature measurements, consider the following guidelines:

Infrared Sensor Cleanliness

The MCA's infrared sensor uses a small opening. Dirt, grease, or oil may enter the opening and cause inaccurate temperature measurements. If necessary, clean the opening using alcohol and Q-tips.

Environmental Conditions

Watch for environmental conditions in the working area. Steam, dust, smoke, etc. can prevent accurate measurement by obstructing the MCA's optics.

Ambient Temperatures (the surrounding temperature)

If the MCA is exposed to abrupt ambient temperature differences of 11° C or more (20° F), allow it to adjust to the new ambient temperature for at least 20 minutes before performing temperature measurements.

Emissivity

Emissivity is the measure of an object's ability to emit infrared energy. Emitted energy indicates the temperature of the object. Emissivity can have a value from 0 (shiny mirror) to 1.0 (blackbody). Most organic, painted, or oxidized surfaces have emissivity values close to 0.95. The MCA's emissivity is set to 0.95 to address most surfaces.

Specifications

Vibration Pickup:	Piezoelectric acceleration sensor
Velocity Range:	0.7 to 65.00 mm/s (RMS), 0.04 to 3.60 IPS (equivalent peak), meets ISO 10816
Enveloped Acceleration Range:	0.2 gE to 50 gE +/- 10%
Enveloped Acceleration Band:	SKF Band 3: 500 Hz to 10 kHz
Velocity Frequency Range:	10 Hz to 1,000 Hz, meets ISO 2954
IR Temperature Range:	-20° C to +200° C -4° F to +392° F
IR Temperature Accuracy:	+/- 2° C (+/-3.6° F)
IR Temperature Measurement Distance:	10 cm (4 in.) away from target maximum
Operating Temperature Range:	*In use:* -10° C to +60° C 14° F to 140° F *While charging:* 0° C to +40° C +32° F to +104° F

Storage Temperature Range:	*Less than one month* -20° C to +45° C -4° F to +113° F More than one month but less than six months -20° C to +35° C -4° F to +95° F
Humidity:	95% RH non-condensing
Enclosure:	IP54
Approvals:	CE
Drop Test:	2 meters (6.6 ft)
Supported External Sensor:	Any standard accelerometer with 100 mV/g sensitivity
External Sensor Power:	24 V DC at 3.5 mA
Sensor Cable:	1.5 m (5 ft) cable with M8 socket type connector
Charger Specifications:	Universal AC/DC wall plug-in Input: 90 to 264 V AC, 47 to 60 Hz Output: 5 V DC regulated
Dimensions:	width 1.85" (4.7 cm) length 7.9" (20 cm) thickness 1" (2.54 cm)
Weight:	125 gms (4.4 oz))