

CMON 2504

Service manual

The CMON 2504 interface card extends the functionality of the SKF Multilog On-line System IMx to include SKF Acoustic Emission Enveloping (AEE) technology. SKF Acoustic Emission Enveloping is an acoustic emission (AE) measurement method that can be used to assess lubrication conditions within a rolling element bearing while it is in service. It can also be used in combination with other SKF condition monitoring equipment and techniques to help identify a range of machinery defects.

Key features

- Enables use of SKF Acoustic Emission Enveloping technology
- Assessment of lubrication conditions within rolling element bearings whilst in service by use of lubrication film breakdown detection
- Enveloped demodulated AE signal at 100 mV/aeE
- Enveloping and filtering of 100 to 500 kHz band pass on AE input
- Two (2) different cable lengths (10 and 20 m) available for the cable assembly



CMON 2504 AE interface card.



CMSS-ONL-2504 cable assembly.

Contents

CMON 2504 and CMSS-ONL-2504 Service Manual

1. Overview
2. Document Conventions
3. CMON 2504 – Card Description
 - 3.1. Key Features
4. CMSS-ONL-2504 – Cable Description
5. CMSS 786M Dual Sensor
6. CMAC 2504 Acoustic Emission Signal Pulse Generator
7. CMON 2504 and CMSS-ONL-2504 Installation Validation and Debugging Procedure
8. Troubleshooting
9. FAQ

1. Overview

The intended audience for this document is Certified Service Technicians and technical support personnel who provide detailed technical work to customers, either over the telephone or in person. It is assumed that these people are already familiar with the SKF @ptitude Monitoring Suite as well as Microsoft operating systems for desktop PC. It is also assumed that these people are familiar with SKF Microlog portable equipment.

The CMON 2504 card provides the necessary interface between an acoustic emission sensor (specifically the CMSS 786M dual sensor) and the SKF Multilog On-line System IMx.

The purpose of this document is to provide the information required to assist users in the installation and commissioning of SKF Acoustic Emission Enveloping (AEE) systems for the SKF Multilog On-line System IMx including the following:

- SKF CMON 2504
- CMSS-ONL-2504
- CMSS 786M

2. Document Conventions

The following naming conventions are used throughout this document. The shorter terms presented on the left below are synonymous with the corresponding term on the right.

AE	Acoustic emission
AEE	SKF Acoustic Emission Enveloping
aeE	Acoustic Emission Enveloping (units)
IMx	SKF Multilog On-line System IMx
Observer	SKF @ptitude Observer
Microlog	SKF Microlog

3. CMON 2504 – Card Description

The CMON 2504 interface card extends the functionality of the SKF Multilog On-line System IMx to include SKF Acoustic Emission Enveloping (AEE) technology. AEE is an acoustic emission (AE) measurement method that can be used to assess lubrication conditions within a rolling element bearing while it is in service. It can also be used with other SKF condition monitoring equipment and techniques to help identify a range of machinery defects. The CMON 2504 is used with the CMSS-ONL-2504 AE interface cable assembly. The CMON 2504 can be fitted to a DIN rail.

3.1 Key Features

- Enables use of SKF Acoustic Emission Enveloping technology
- Assessment of lubrication conditions within rolling element bearings whilst in service by use of lubrication film breakdown detection
- Enveloped demodulated AE signal at 100 mV/aeE
- Enveloping and filtering of 100 to 500 kHz band pass on AE input
- Two (2) different cable lengths (10 m and 20 m) available for the cable assembly

4. CMSS-ONL-2504 – Cable Description

The standard cable assembly includes a pre-amp embedded in the connector. The cable is intended to be used with the CMSS 786M dual sensor. The sensor glue mount, which is included with the cable assembly, should be fixed to the mounting surface using a thin layer of Loctite 480 epoxy. The use of other epoxies or sensor mounts can significantly attenuate the AE signal.

5. CMSS 786M Dual Sensor

The CMSS 786M is a dual sensor which provides both acceleration and acoustic emission (AE) input signals. The sensor is mounted using a sensor glue mount as supplied with the CMSS-ONL-2504. The sensor glue mount, which is included with the cable assembly, should be fixed to the mounting surface using a thin layer of Loctite 480 epoxy. The use of other epoxies or sensor mounts can significantly attenuate the AE signal. The dual sensor is intended to be used with both the CMSS-ONL-2504 cable assembly and the CMON 2504 acoustic emission interface card.

6. CMAC 2504 Acoustic Emission Signal Pulse Generator

The CMAC 2504 is used to inject a known signal into an installation site. The system response to the signal is used to validate the entire installation.

The CMAC 2504 generates a pulse train output with 20 V amplitude, 2.0 μ s pulse width, and a repetition frequency of 70 Hz. To inject a signal, acoustic emission couplant is applied to the acoustic emission transducer, the transducer is connected to the CMAC 2504 and the device is turned on. The transducer is then placed on the test surface (AE sensor or adjacent to AE sensor installation site).

Before testing with the CMAC 2504 ensure that the AE sensor is connected to a CMON 2504 card, which should in turn be connected to an IMx. SKF @ptitude Observer should also be preconfigured to acquire acoustic emission signals.

Testing the system using the CMAC 2504 is performed using the CMAC 2504 transducer to inject the signal onto the same flat metallic surface the AE sensor is installed on, ensuring it is free of paint or residue. Ensure there is a direct transmittance path between the CMAC 2504 transducer and the AE sensor (i.e., no cracks/joints/nuts/bolts, etc., interrupting the path).

The system response for both steps should be viewed in SKF @ptitude Observer (“live” mode is recommended). The system response should be an attenuated pulse train with the same repetition frequency (~70 Hz).

If the system response is not as expected, check the following:

- The AE sensor is fixed and secured on its installation site
- There is acoustic emission couplant on both the AE sensor and the CMAC 2504 transducer
- There are no cracks/joints/nuts/bolts interrupting the transmittance path between CMAC 2504 transducer and AE sensor
- The cable is connected to the AE sensor
- If none of the above resolve the issue, perform testing using the digital voltmeter

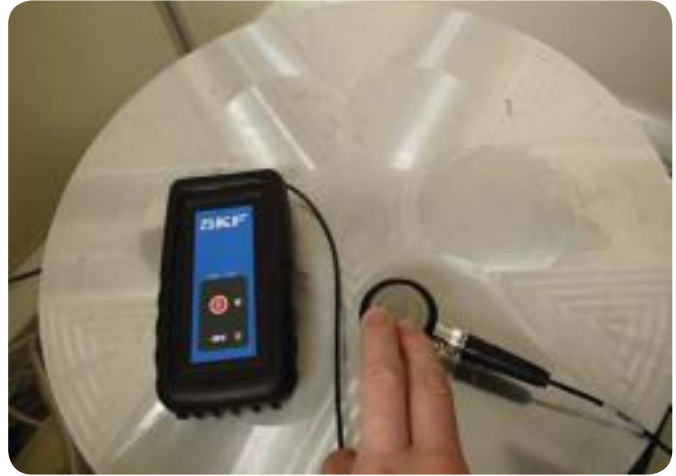


Fig. 1. CMAC 2504 and transducer.

Fig. 2. CMON 2504 wiring diagram – IMx-S

IMx-S

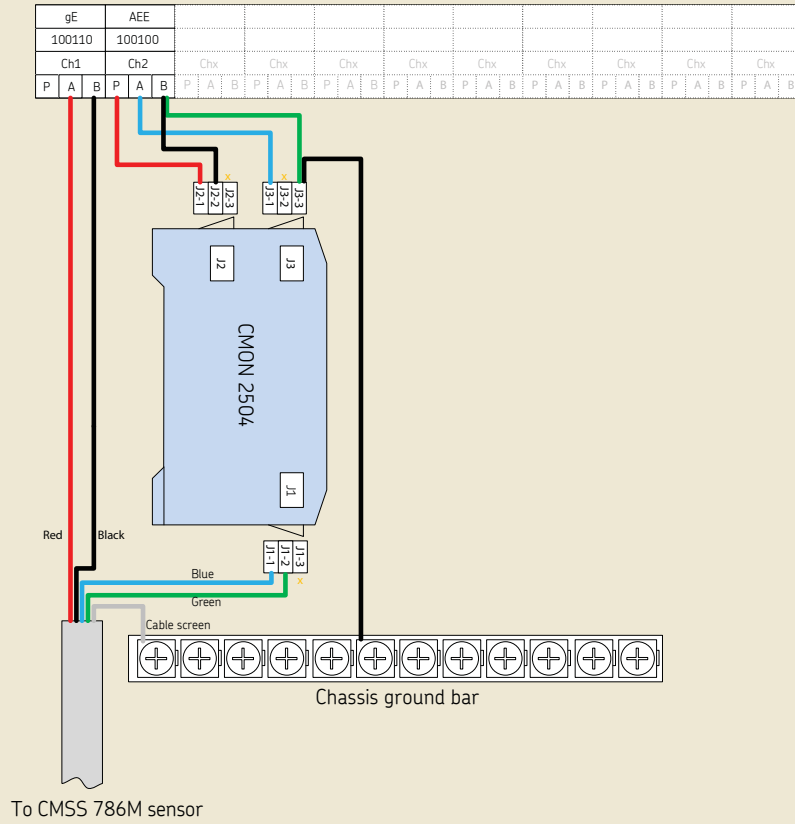
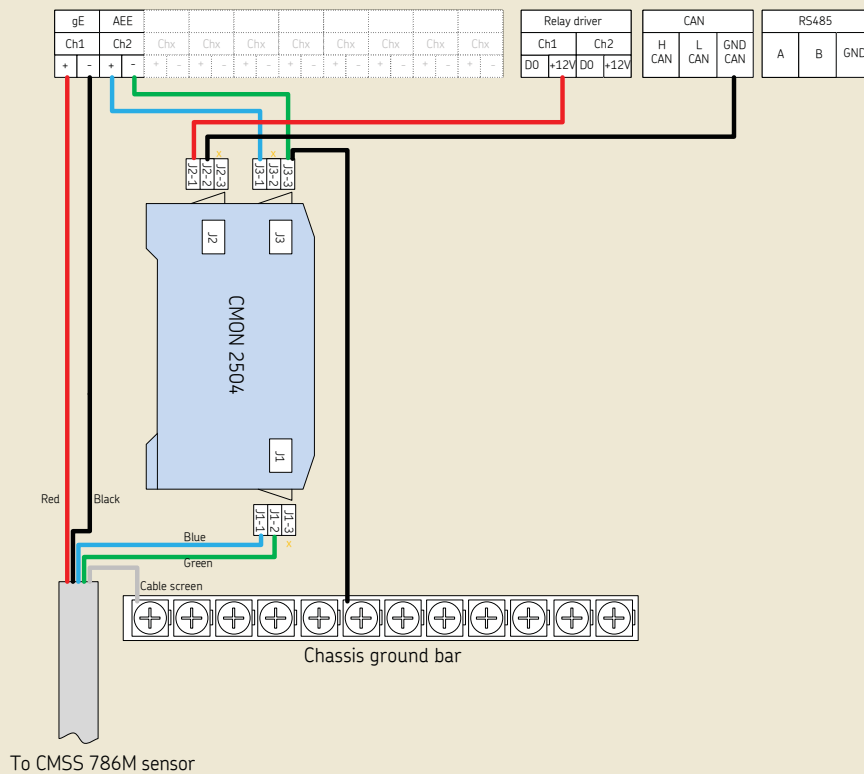


Fig. 3. CMON 2504 wiring diagram – IMx-W

IMx-W



7. CMON 2504 and CMSS-ONL-2504 Installation Validation and Debugging Procedure

The following procedure can be used to identify the source of a malfunctioning AEE installation. This procedure is also required prior to the commissioning of an installation and can therefore be considered standard procedure. The procedure is outlined in flowchart format and only a digital voltmeter is required.

Note that the following nomenclature (J1-1, etc.) is used when referring to the CMON 2504 terminals (Input + etc.).

- J1-1: AE sensor signal / phantom power line (Input +)
- J1-2: AE sensor 0 V return (Input -)
- J1-3: not used
- J2-1: +12 to +24 V DC power supply input (Supply +)
- J2-2: 0 V DC power supply input and signal ground (Supply -)
- J2-3: not used
- J3-1: AE DIN interface demodulated output (Output +)
- J3-2: not used
- J3-3: Signal ground (Output -)

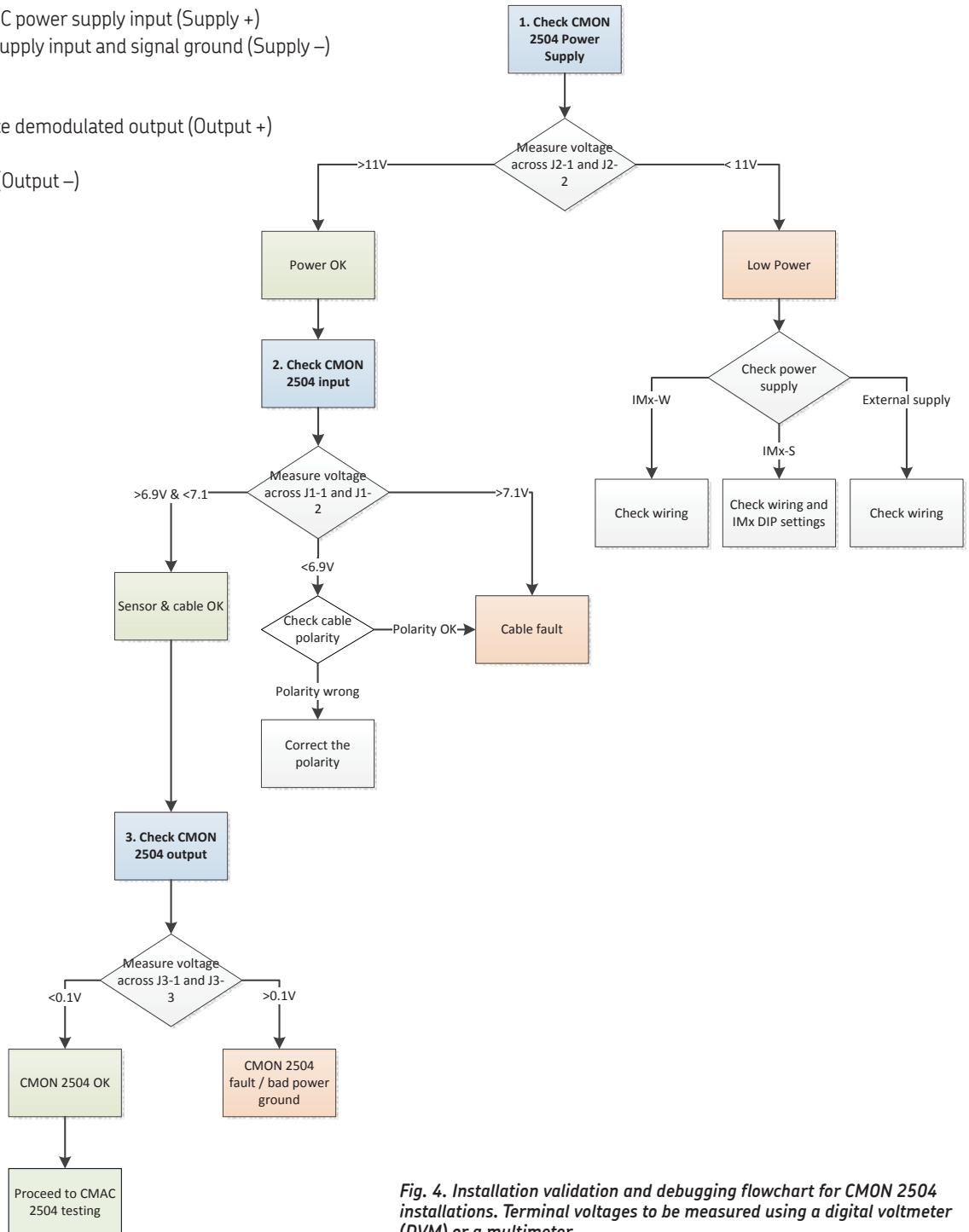


Fig. 4. Installation validation and debugging flowchart for CMON 2504 installations. Terminal voltages to be measured using a digital voltmeter (DVM) or a multimeter.

8. Troubleshooting

Fault Incorrect polarity of CMSS-ONL-2504 cables at Input terminals to CMON 2504
Effect If the polarity of the input wires to the CMON 2504 is incorrect then the output signal will be low in amplitude and should show little if any response to testing using the CMON 2504. The voltage across the input terminals (as determined by the debugging flow chart) will be less than 6.9 V.
Corrective Measure Swap the input wires to the CMON 2504. Using the debugging flowchart as a guide, check the CMON 2504 terminal voltages. The voltage across the input terminals should be between 6.9 V and 7.1 V. Confirm the system is functioning correctly by testing with the CMAC 2504.

Fault Low power
Effect Little if any meaningful signal being acquired by IMx as CMON 2504 cards not receiving sufficient power.
Corrective Measure <ul style="list-style-type: none"> • Check that the connections between the power supply and the CMON 2504 are correct and that the power supply is configured to supply the correct input voltage (i.e., >11 V). Correct if necessary. • Check that the screw terminals in the CMON 2504 are gripping only the metal part of the wires and not the wire insulation. Correct if necessary. • If the IMx is an IMx-S, then check that the DIP switch settings are correct. If not, then power off the IMx unit and correct the DIP switches as appropriate.

Fault Poorly connected wires in CMON 2504
Effect Severely degraded signal acquired by IMx. Little if any meaningful data acquired.
Corrective Measure Check that the screw terminals in the CMON 2504 are gripping only the metal part of the wires and not the wire insulation. Correct if necessary Ensure that all wires are connected as specified.

Fault Cable fault
Effect Severe degradation of sensor signal.
Corrective Measure Check all wire connections and ensure that there is no short-circuiting of wires due to frayed wire ends, etc. If this does not resolve issue, then replace the CMSS-ONL-2504 cable and return faulty cable to SKF CMC Livingston.

Fault Electrical noise (mains interference) evident in signal
Effect Excess electrical noise can lift the noise floor and can mask interesting low amplitude acoustic emission activities. This manifests itself at 100 Hz or 120 Hz peaks in the spectrum depending on whether the local mains frequency is 50 Hz or 60 Hz.
Corrective Measure The following measures are part of the recommended installation process. <ol style="list-style-type: none"> 1. Ensure that the negative output terminal (J3-3) is connected to the ground rail on the IMx chassis. 2. The sensor shield should only be grounded at one end – due to the installation process of the CMSS 786M dual sensor – it is not assured that the sensor is grounded at the machine end, therefore it is recommended to try connecting the CMSS-ONL-2504 shield to the IMx ground to see if this reduces the electrical noise. 3. Is a Vogel lubrication system (or similar) connected into the IMx? If the IMx is an IMx-W, then the lubrication system may be the source of electrical mains hum in adjacent channels. To correct this, it is recommended to use channel 15 and channel 16 of the IMx-W for the lubrication system and to use the associated DIP switches to isolate these channels (set switches to 1100 and refer to IMx-W manual for full isolation details). 4. Check that the machine being instrumented is grounded. If it is not possible to earth the machine, then it is recommended that you contact SKF CMC Livingston for guidance with corrective measures.

Fault CMON 2504 fault
Effect Severe degradation of sensor signal.
Corrective Measure Replace the CMON 2504 card and return faulty card to SKF CMC Livingston.

Fault No response to CMAC 2504 test stimulus
Effect System cannot be validated.
Corrective Measure <ol style="list-style-type: none"> 1. Tap the sensor sharply (taps need only be light) and observe response. This should identify if the CMAC 2504 is defective or if it is indeed the installation. 2. If no response still from the system, then check CMON 2504 installation using a voltmeter and the attached flowchart. Check all wire connections and refer to the installation manual to confirm correct installation. 3. Check that software configuration and settings are correct and that a signal from the sensor is being acquired.

Fault AE sensor installed at inappropriate location
Effect AE signal quality not assured.
Corrective Measure <ul style="list-style-type: none"> • Reinstall sensor at an appropriate location. • The optimum location is in the load zone of the bearing. Ensure it is not located close to any surface discontinuities such as boltholes. Also ensure that the transmission path between AE source and sensor as direct as possible (keep number of surface interfaces to a minimum). Note that AE does not travel through air, therefore if there is an air gap between sensor location and AE source then no relevant signal will be obtained.

Fault AE sensor installed incorrectly using: (a) the wrong adhesive (b) the wrong mounting method (c) with insufficient preparation of installation site
Effect AE signal either attenuated or completely killed.
Corrective Measure <ul style="list-style-type: none"> • If using an adhesive sensor mount, then install a new adhesive sensor mount. Ensure that all paint has been removed from beneath the sensor and that the sensor mount will be stuck onto a metallic surface. • Use Loctite 480 to stick the sensor mount to the installation site – the sensor mount should only be glued to metallic surfaces, therefore all paint needs to be removed beneath. • Remount the sensor, ensuring that the sensor is sufficiently coupled with the sensor mount using an appropriate couplant (Sonotech Sono 600 for very short term installations or Marine Silicone Sealant for longer term installations). • If using a stud mount, ensure that sensor is sufficiently coupled using an appropriate couplant (Sonotech Sono 600 for very short term installations or Marine Silicone Sealant for longer term installations).

9. FAQ

What is the product?

It is an Acoustic Emission Enveloping (AEE) Interface that demodulates a specific frequency band of Acoustic Emission (AE) so that standard Condition Monitoring analyzers can acquire and analyze Acoustic emissions for the purpose of monitoring the lubrication quality in bearings.

What is unique about the product?

It utilizes a specific frequency band specifically selected to be sensitive to AE noise from bearing lubrication issues and less affected by high frequency vibrations or electrical interference.

What are the features?

A 100 kHz to 500 kHz frequency band and enveloping with a 5 kHz anti-aliasing filter providing an output of 100 mV per aeE.

What are the benefits?

Provides a method of monitoring for bearing lubrication quality and issues that is far more sensitive than other techniques currently on the market. This allows for the lubrication issue to be corrected prior to damage occurring to the bearing.

What is different from previous SKF products? From competitors products?

With respect to SEE, improved amplification, filters and rectification improving the signal to noise ratio and allowing accurate measurements down to lower amplitudes. With respect to Holroyd, a higher frequency band and a high-pass filter to avoid picking up high frequency vibration.

In what segments/products/vehicles/models are the SKF products/service used?

Wherever IMx units are utilized to monitor high value bearings or equipment and/or there is a business case to monitor for and correct lubrication issues.

Is there a relationship between AE and sub-surface cracking?

Yes, there is a relationship and in a controlled environment this can be easily detected. This is less easy to do in an industrial environment. We cannot however differentiate between sub-surface cracking, a spall progressing or asperity contact.

Should the sensor be mounted near a load zone to get a good signal?

Yes, the sensor should be located as close to the load zone as possible.

J3-3 should be connected to IMx ground. Should this be the digital instrument ground or the chassis ground?

The IMx chassis ground should be used.

How many of the converters can we connect to the +12 V power of the IMx-W?

Up to three CMON 2504 can be connected to each relay, so a maximum of six CMON 2504 can be powered from IMx-W. If more than six CMON 2504 are to be used in an IMx-W, or if relays are in use for another product, then a DIN rail mounted power supply should be used.

Is there a limit to the number of CMON 2504 that can be used in IMx-S?

Each CMON 2504 in an IMx-S is powered from the channel that it is connected to, so the only limitation in the number that can be connected in the IMx-S is physical – i.e., how many can be fitted onto the DIN rail.

Does the use of a 12 V powered speed sensor influence the signal from the CMON 2504?

Yes, the use of a speed sensor does influence the signal. To avoid this, the cable screen should be connected to the IMx chassis ground.

Is it possible to use a magnet to mount the sensor rather than having to remove the paint?

No, the magnet attenuates the AE signal so is not suitable for mounting the sensor.

Why is it so important to remove all the paint before mounting the sensor?

It is important to remove the paint to ensure that the sensor has a good connection and AE transmission path. The layers of paint can both attenuate the AE signal and also electrically isolate the sensor from the machine.

Loctite 480 is recommended for mounting if a drilled and tapped hole is not available. This is a rubber filled epoxy. Does that negatively affect the acceleration ENV readings?

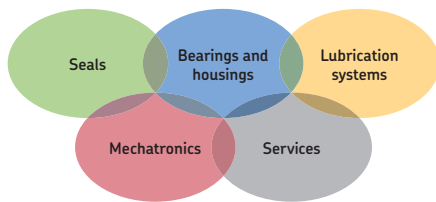
No, the rubber is very good for AE signal transmission and the layer of epoxy is thin enough to not impact the gE signal.

Is it necessary to scrape the paint off the position where the CMAC 2504 transducer will be placed for installation verification?

It would be better to remove the paint, but it is not necessary as the AE signal gets through the paint well enough for this simple test, and also because we don't need the electrical grounding which the paint prevents with the sensor installation.

Is it important to ensure that the glue fills all the gaps?

Yes, this is important as AE cannot travel through air, so any air gaps will attenuate the signal. However, as little epoxy should be used as possible.



The Power of Knowledge Engineering

Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

These competence areas include bearings and units, seals, lubrication systems, mechatronics, and a wide range of services, from 3-D computer modelling to cloud-based condition monitoring and asset management services.

SKF's global footprint provides SKF customers with uniform quality standards and worldwide product availability. Our local presence provides direct access to the experience, knowledge and ingenuity of SKF people.

Please contact:

SKF Condition Monitoring Center – Luleå

Aurorum 30, SE-977 75 · Luleå, Sweden
Tel: +46 (0)31 337 1000 · Fax: +46 (0)920 134 40

Web: www.skf.com/cm

© SKF, @PTITUDE, MICROLOG and MULTILOG are registered trademarks of the SKF Group.

Microsoft is a registered trademark of Microsoft Corporation in the United States and/or other countries.

Loctite is a registered trademark of Henkel Corporation.

All other trademarks are the property of their respective owners.

© SKF Group 2014

The contents of this publication are the copyright of the publisher and may not be reproduced (even extracts) unless prior written permission is granted. Every care has been taken to ensure the accuracy of the information contained in this publication but no liability can be accepted for any loss or damage whether direct, indirect or consequential arising out of the use of the information contained herein.

PUB CM/I3 14117 EN · May 2014

