

SKF Multilog On-Line System IMx-P



User Manual Part No. 32146500-EN
Revision H

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

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US 6,124,692 • US 6,138,078 • US 6,199,422 • US 6,202,491 • US 6,275,781 • US 6,301,514 •
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US 7,103,511 • US 7,697,492 • WO/2003/048714

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1 Introduction

System Overview

IMx-P is a part of the SKF Multilog On-line System product range. IMx-P is a powerful, versatile device designed to meet the needs of vibration analysts, service providers, and condition monitoring professionals.

In conjunction with SKF @ptitude Observer or Analyst software, the IMx-P provides a complete portable solution for temporary installations and troubleshooting activities. The IMx-P system helps provide early fault detection and prevention, automatic advice for correcting existing or impending conditions and advanced condition-based maintenance to improve machine reliability, availability and performance.

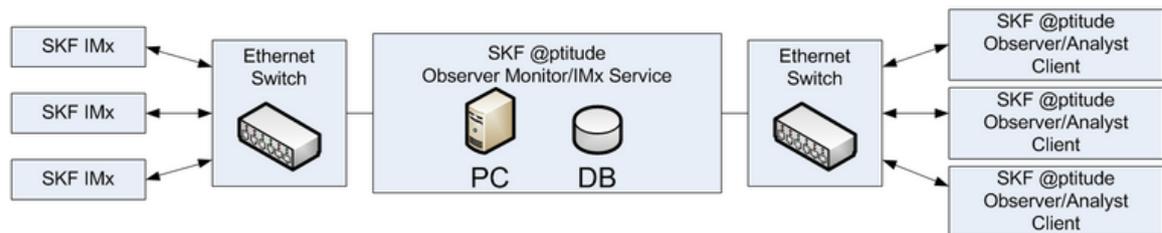


Figure 1 - 1.
System Overview with @ptitude Observer/Analyst.

The picture above illustrates how IMx-P units are linked together in a network that is connected via a LAN to a @ptitude Observer Monitor or Analyst IMx Service. The @ptitude Observer Monitor or Analyst IMx Service in turn can be connected to e.g. a LAN network making it possible for several of @ptitude Observer or Analyst clients to link to this network.

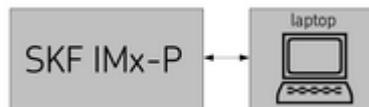


Figure 1 - 2.
IMx-P Connected to a Laptop.

However, most likely scenario of IMx-P setup would be to connect an IMx-P unit directly to a laptop and use SKF Multilog On-line System temporarily, taking advantage of the portability.

@ptitude Observer or Analyst clients can also be installed on the same computer as the @ptitude Observer Monitor or Analyst IMx Service software. Through a general interface, also known as ODBC (open database connectivity), it is possible to link @ptitude Observer Monitor or Analyst IMx Service login computer to an existing database for an existing control or processing system, if desired. The @ptitude Observer

Monitor or Analyst IMx Service, @plitude Observer or Analyst clients and the database can be separated from each other as long as they are on the same network where ODBC calls can travel freely.

It is also possible to connect different types of on-line units in the same network, for example, IMx-P together with IMx-S and/or MasCon systems.

IMx-P Unit



Figure 1 - 3.
SKF Multilog On-line System IMx-P.

Portable and Battery Powered

The SKF Multilog On-line System IMx-P unit is portable and battery powered.

- The built-in battery with four hours of operation time makes it possible to use in places with no available main voltage.
- It is possible to use the on-line system temporarily in order to perform troubleshooting for intermittent faults, installation checkouts for conformity to purchasing agreements, startups and etc.
- The battery has a capacity of 8,5 Ah, 12 V. The charging time of an empty battery is about 16 hours (longer charging time is allowed but not recommended).

Analogue Channels

Each IMx-P unit has 16 analogue channels (dynamic and DC).

- The analogue signal inputs are configurable for a wide variety of sensors.
- Any signals such as acceleration, velocity, temperature, and displacement or other parameters are easily adopted.
- Each input can be configured for standard accelerometers, accelerometer sensor power on/off by software, and process inputs (± 25 V DC).

Digital Channels

Each IMx-P unit has 8 digital channels.

- The digital channels may be used for measuring speed, trigger or digital status indicating when a measurement can take place.
- Digital sensor power is software controlled.

Measurement Points

Each IMx-P unit is capable of configuring measurement points.

- Several measurement points may be configured per channel.
- In addition, Bias Output Voltage (BOV) can be measured and recorded for checking sensor/cable faults for standard accelerometers.
- Individual conditions for warning and alarm may be set for each measurement point.
- Warning and alarm levels may be controlled by machine speed or load.

Auto-diagnosis System

Each IMx-P unit contains a uniquely built-in hardware auto-diagnosis system.

- The unit's unique built-in hardware auto-diagnosis system continuously checks all sensors, cabling and electronics for any faults, signal interruption, short circuits, or power failure.
- Any malfunction triggers an alarm.
- If the main voltage fails or for some reason is disconnected, the battery power automatically takes over.

Storage Capacity

Each IMx-P unit has 8 MB flash memory used for the following:

- 2 MB for firmware, configuration files, etc.
- 2 MB for trend value buffer
 - About 13 000 vibration trend values can be buffered
 - Speed and process data use half the space of vibration
- 4 MB for spectra and time signal buffer
 - About 250 spectra using 1 600 lines with phase and time signal can be buffered
 - If you use more lines, the number of spectrum is reduced.
 - If you use less lines, the number of spectrum is increased
- When a buffer gets full, the oldest data is thrown away.

Initiating IMx-P

Initiating the IMx-P is simple to carry out.

- This is done through an initiating program through @ptitude On-line Device Configurator or Multilog IMx Configurator tool and a (portable) computer using RS232 serial interface.
- The Network Configuration parameters, such as IP address, IMx identification number, etc. are stored in a separate configuration file first, then transferred to the IMx-P memory.

LED Indicators

IMx-P has LED indicators on the front panel.

Table 1-1: IMx-P LED indicators.

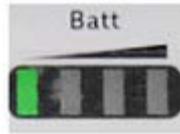
LED Indicator	Behavior	Description
Analog ICP Channel 1–16	On	ICP activated
	Off	ICP not activated
Digital PWR Channel 1–8	On	Sensor power activated
	Off	Sensor power not activated
Batt	See below	Battery level indication. See below for details.
SYS	Red LED on	System fault
	Off	System OK
PWR	Green LED on	System power on
	Off	System power off

Batt (Battery Level Indication)

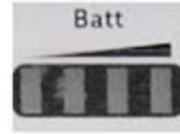
Table 1-2: IMx-P battery level indication.



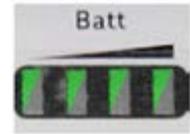
Battery Level Full



Battery Level
Almost Empty



Battery Level Empty



Battery Charging
(LED Flashing)

- The functionality of battery level indication is controlled by **Firmware 2.0 or later** in conjunction with IMx-P upgrade.
- The IMx-P upgrade has been implemented for the **Serial Number 1048** and later.
- It takes a minute in a stable condition to get the battery level indication state.
- For the older versions of IMx-P units:
 - to get the battery level indication functionality, units must be upgraded
 - the battery level indication of not upgraded units is not reliable

Installation

The installation of an IMx-P must be carried out according to the instructions and advice given in this manual. Any deviation from these directions can be made only after consulting with the SKF Condition Monitoring Center Luleå. Installation errors can lead to a situation where the system does not work as intended and machinery faults go undetected. Therefore, contact the IMx-P application engineer at the slightest doubt during the installation.

Note - In general, all cables must be routed as far away as possible from high voltage cables. If this cannot be done, care should be taken to use high quality shielded cables.

Sensor Cables

When routing a sensor cable, it is important that the cable is firmly fixed. The cable may never be allowed to vibrate or oscillate, since this effects the capacitance of the cable, and thereby the measurement result.

The sensor cable may not be routed or bundled together with supply cables because it generates strong magnetic fields.

To connect IMx-P to sensors, the following type of sensor cable is recommended:

- Shielded, twisted pair 2 x 2 x 0,5 mm² (FKAR-PG 2 x 2 x 0.50mm², DUE 4002 or corresponding)

Power Supply

An external power adapter is used as the power supply. SKF provided power supplies must be used with IMx-P. Power supplies differ in characteristics in ways that are not obvious, and there are also physical differences in the DC-plug.

Power Connector

Power connector is a standard main connector.

Cable Shielding

IMx-P sensor inputs are differential type.

Note that the sensor cable screen needs an external ground connection.

Communication Cable

For lengths up to 15 metres, it is recommended to use pre-fabricated Ethernet twisted pair cable FTP type, CAT5/6.

For longer cable lengths, it is recommended to use S-FTP (screened shielded twisted pair) Ethernet cable CAT5/6.

Data Communication

IMx-P unit data communications are compliant with the Ethernet standard 10/100 Mbit.

IMx-P has two Ethernet ports which work like an internal switch.

Ethernet Cable

The Ethernet TP cable on the IMx-P is connected to a standard Ethernet RJ45 connector. Both Ethernet ports have auto detection of crossover or straight through Ethernet cable connection. Basically, IMx-P has a built-in Ethernet switch.

It is possible to connect several IMx-P units in a daisy chain with up to eight units in a single cable layout.

There are two LEDs on RJ45 connector.

- Yellow LED is the Ethernet traffic indicator which flickers whenever there is traffic on the network.
- Green LED is the Ethernet link indicator which lights up when the system is correctly connected to another network device.

Unit Configuration

The ambient temperature can be found in the [Environmental](#) section under Technical Data.

Analogue Inputs

The only setup for the analogue channels is ICP On or Off. ICP On is mainly used for ICP type of accelerometers.

The following are the characteristics of IMx-P analogue inputs.

- Differential inputs
- DC-coupled analogue inputs which can measure both DC and AC signals in range of ± 25 V
- ICP power On/Off by software configuration

Digital Inputs

The following are the characteristics of IMx-P digital inputs.

- Software controlled 24 V sensor power on/off for all digital channels 1 to 8 (power on for 2-wire tacho sensor)
- Digital channels 1 to 4 have trigger level 2,5 V (power off for TTL pulse with external power)
- Digital channels 5 to 8 have trigger level 10 V (power off for 12 to 24 V pulse with external power)

Network Configuration

All IMx-P units must have an identity number between 1 and 255, unique to the database to which it is connected.

It also requires network settings and the IP number and port number of the @ptitude Observer Monitor or Analyst IMx Service to which it should be connected.

The network configuration is done through;

- For Observer clients, On-line Device Configurator in SKF @ptitude Monitoring Suite. For detailed information, refer to @ptitude Observer On-line Device Configurator User Manual.
- For Analyst clients, Multilog IMx Configurator under Admin Tools in SKF @ptitude Monitoring Suite.

There are two ways to configure the network:

- by software: is configured by the software via On-line Device Configurator or Multilog IMx Configurator.
- by DIP Switches (Hardware): is done by configuring HEX rotary DIP switches manually.

Configure by DIP Switches (Hardware)

If you have decided to configure the network manually by hardware, the following logic must be fulfilled.

- The factory default configuration TCP/IP address is 10.0.0.1XY.
- The configuration of DIP switches requires you to set the first three part of the IP address at Create IMx/MasCon16 Config screen of On-line Device Configurator or Multilog IMx Configurator.
- However, the last part of the IP address will be controlled by the HEX rotary switches on the IMx-P unit.
- For example, 10.0.0.1XY, where XY will be derived from HEX rotary switches.
- These last two digits will also form the unit ID.
- The Hex rotary switches for IMx-P are located on the front panel, labeled as HEX1 and HEX2. Refer to IMx-P Front Panel in Drawings chapter for the physical locations.
- The HEX rotary switches have to be set manually with a small screwdriver.

Table 3-1: HEX rotary switch configuration.

TCP/IP address/Unit ID	HEX1 (x10)	HEX2 (x1)
Software defined	0	0
01	0	1
02	0	2
↓	↓	↓
99	9	9
Factory default configuration TCP/IP address: 10.0.0.1XY		

Serial Configuration Interface (RS232)

RS232 interface is used only when the required basic network configuration setup is being done.

The RS232 connector is located on the right hand side of IMx-P front panel, labeled as COM.

Use a serial null modem cable with a 9-pin D-SUB connector.

It is recommended to use a short length cable for RS232 interface in order to maintain full communication speed.

Important - RS232 connector is used only when the required basic network configuration setup is being done. Therefore, the cable should not be connected to RS232 connector at any other time.

Table 3-2: RS232 connector pinout.

RS232 Connector Pinout	
Pin	Description
1	NC (Not Connected)
2	Rx
3	Tx
4	NC (Not Connected)
5	GND
6	NC (Not Connected)
7	NC (Not Connected)
8	NC (Not Connected)
9	NC (Not Connected)

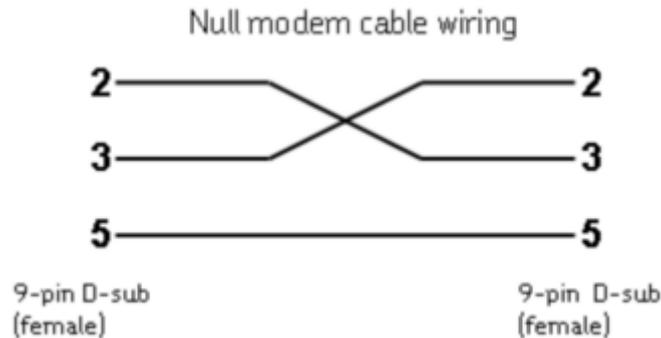


Figure 3 - 1.
Null Modem Cable Wiring.

IMx-P Time

IMx-P has a backup power capacitor which keeps the time for at least a month if IMx-P was disconnected from a power inlet.

To correct or set IMx-P time, use one of the following methods.

- **Automatic time synchronization**

This method is preferable since IMx-P will continuously synchronize the time with the computer that has @plitude Observer Monitor or Analyst IMx Service running.

IMx-P uses a built-in function (NTP) in Windows for time synchronization.

In order to activate time synchronization, refer to Time Synchronization chapter in "@ptitude Observer Installation Manual".

- **Manual set time**

Use "Set time" function in @ptitude Observer or @ptitude Analyst application.

In @ptitude Observer, the function is found under a tab menu called "On-line", then "MasCon/IMx units" interface.

In @ptitude Analyst, the function is found at Transfer / Online / Status.

Export ODS Data

The measurement data collected by IMx-P unit can be exported to be used for ODS (operating deflection shapes) analysis. ODS analysis generates a 3-D model to illustrate how the structure and machinery respond to the dynamic vibrations. Therefore, points of excessive deflection, structural weaknesses and resonances can be identified and help understand how the equipment behaves dynamically under working conditions.

The export of measurement data is done through @ptitude Observer, a function called **Export ODS data** which can be found within Measurement Date interface.

Export ODS data exports a selected measurement incident to a universal file format (UFF) which then can be imported into a software that can do machine movement animation such as ME' Scope.

For more information on how to use this function, refer to @ptitude Observer User Manual / System Operation / Measurement Date.

For more information on ODS analysis, for those with the access to SKF Media Finder, may refer to the publications on NMO ESS.

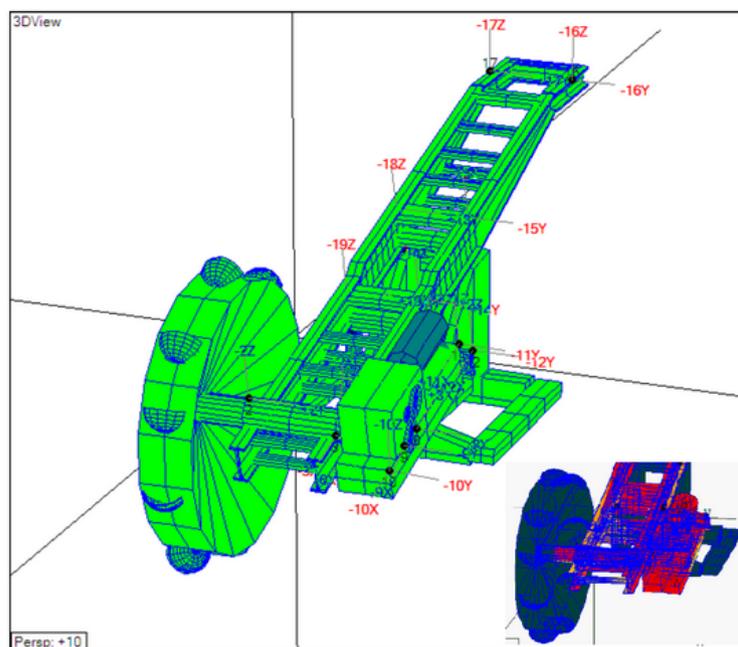


Figure 4 - 1.
Example of an ODS Illustration.

Diagnostic Expert System

By using rule based trend curves based on FFT, it is possible to trend predefined diagnostics such as unbalance, misalignment, bearing faults, cavitations, electric faults, etc., which in turn can help you improve systems by modifying or creating new ones.

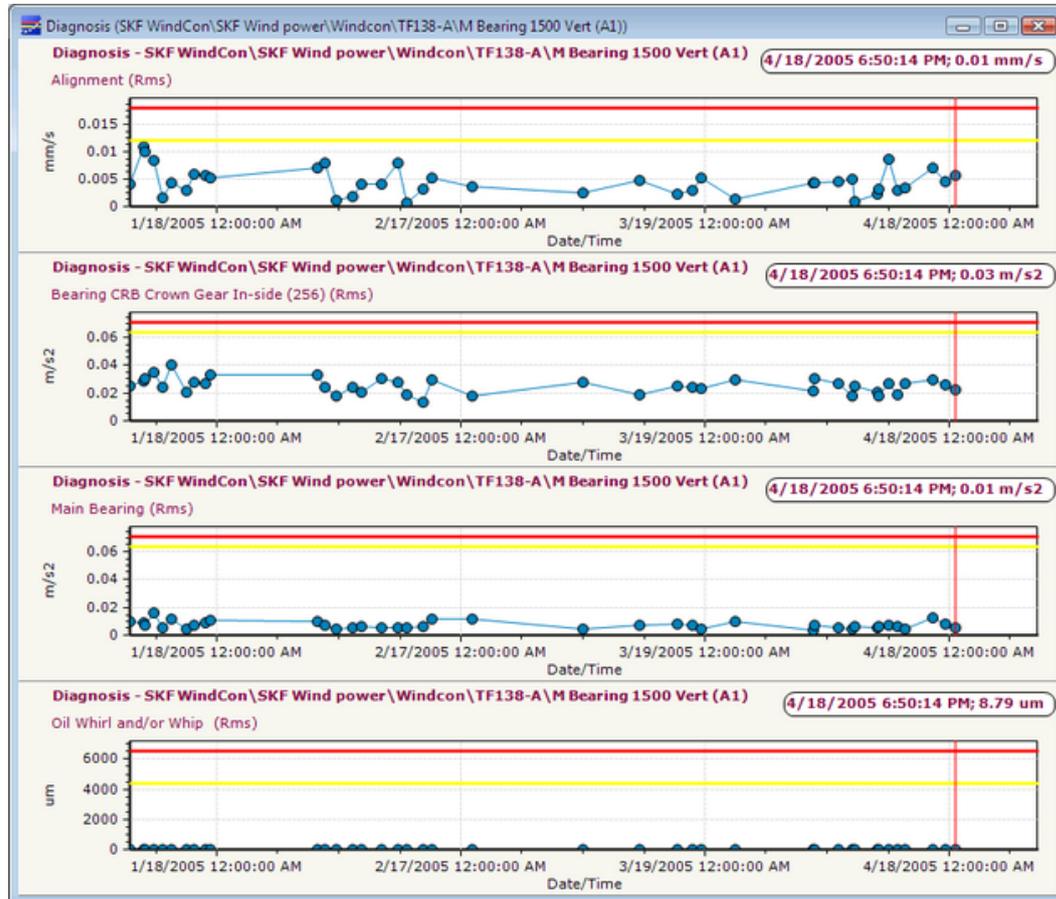


Figure 4 - 2.
Example of Diagnostic Expert System Graphic Displays.

Transients

A transient is considered as a non-stationary vibration event due to changes in loads or process i.e. run-up or coast down events. In these cases, the spectral components are dispersed in the spectrum making it impossible for analysis.

However, with transient groups in @plitude Observer/Analyst, it is possible to analyze this kind of events using an appropriate configuration depending on clients needs.

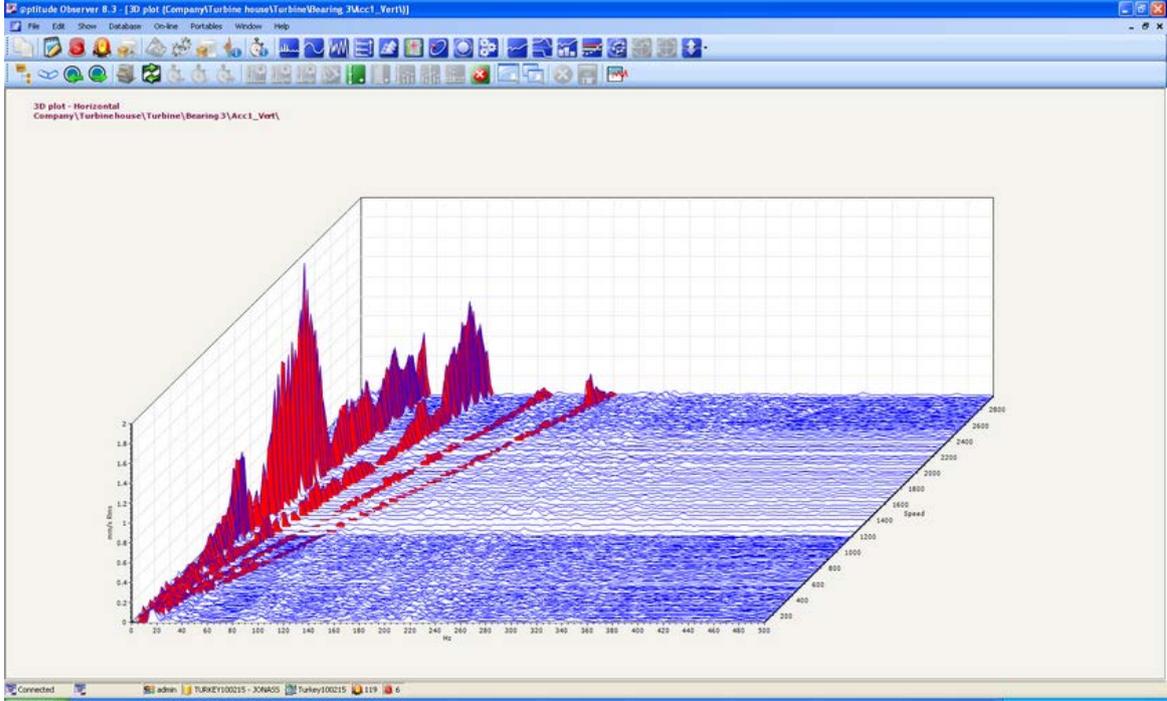


Figure 4 - 3.
Example of a 3D Plot Obtained During a Run-up.

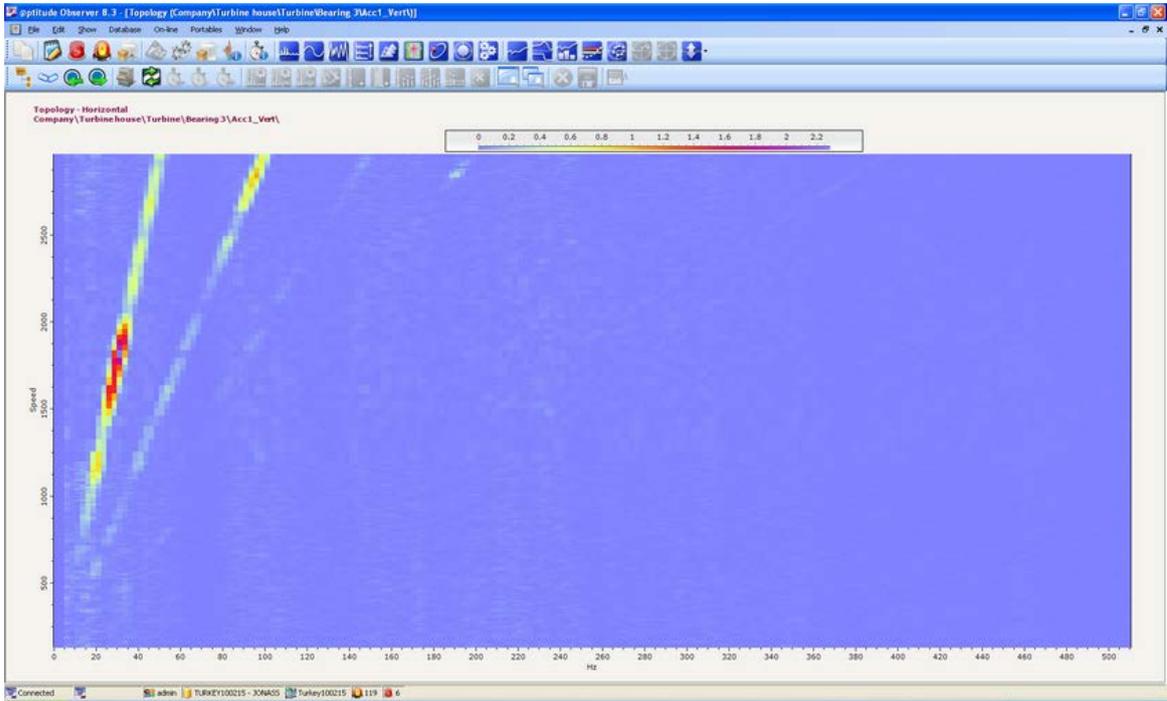


Figure 4 - 4.
Example of a Topology Plot Obtained During a Run-up.

Graphic Displays

There are a number of graphic displays available in @ptitude Observer or Analyst to facilitate data analysis. For more detailed information, refer to "SKF @ptitude Observer User Manual" or "SKF @ptitude Analyst for SKF Multilog On-line Systems User Manual".

- **Spectra** displays vibration amplitude as a function of frequency where all defect frequencies for the whole machine is automatically calculated and can be easily in a plot as vertical bars.
- **Time Waveform** displays the vibration magnitude as a function of time. The time waveform can be easily zoomed and scaling can be done automatically or manually.
- **Phase** spectrum displays the phase with respect to the frequency. Combined with the amplitude spectrum, it is easy to get the phase lag for any peak in the vibration spectrum.
- **History** is used to visualize the variation in machine condition over time in order to identify impending machine faults.
- **3D Plot** displays vibration spectra or envelopes as a function of time, shaft speed, power, temperature, torque or any other DC parameter. It is commonly used during run-up and coast-down.
- **Topology** displays the frequency versus the time or speed and the amplitude color coded. It is a useful display to study transient data like run-ups and coast-downs.
- **Orbit** is one of the best ways to analyze shaft movement. By combining phase and amplitude data from two sensors and plotting them together, it is possible to determine unbalance and alignment problems.
- **Profile** uses triggered acceleration time signal data to represent an unroundness of any circular object.
- **Gear Inspector** helps detecting and visualizing the impact energy as a function of shaft/gear revolutions.
- **Bode Plot** displays any type of data such as vibration amplitude/phase or process data as a function of speed.
- **Trend** displays data as a function of speed and process data. It can also display bias, process, phase, speed and digital data on extra axes.
- **Trend List** displays the raw trend data values in a tabular format.
- **Multi Trend** offers extended functionality to the normal trend plot as it is possible to overlay data from different measurement points or sources.
- **Diagnosis** displays all the attached diagnoses which enables to follow progression of machine faults.
- **Polar** displays a vibration signal at 1, 2, 3 and 4 time the shaft speed in the complex domain.
- **Shaft Centerline** displays a rotor position dynamically which is useful at run-up.
- **Combination Plots** displays two or more types of diagrams for the same measurement.

Measurement Points

There are a number of measurement points available in @ptitude Observer or Analyst to facilitate data analysis. For more detailed information, refer to "SKF @ptitude Observer User Manual" or "SKF @ptitude Analyst for SKF Multilog On-line Systems User Manual".

The following are only some of many available measurement points that are useful.

- Harmonic measurement point is a measurement of a dynamic signal with vibration sensors or Eddy Current Probes such as a vibration monitoring on turbines. It is possible to filter 1x, 2x, 3x or 4x with phase and perform advanced vibration analysis.
- Order tracking measurement point is useful when analyzing machines with variable speed.

If vibration measurements are going to be collected on a variable speed machine which have no stable speed you will probably end up with spectrums that are not sufficient. If a normal FFT is taken during a speed variation then the peaks in the spectrum will smear out, they either will be smaller and wider or completely disappear. For example, it will be difficult to find peaks from bearing frequencies in the normal spectrum collected during a speed variation.

Order tracking measurement point follows the speed constantly and adjusts the spectrum to the speed which is required when measuring vibrations on a variable speed machine. See the difference between two following graphic displays.

Key Features
Measurement Points

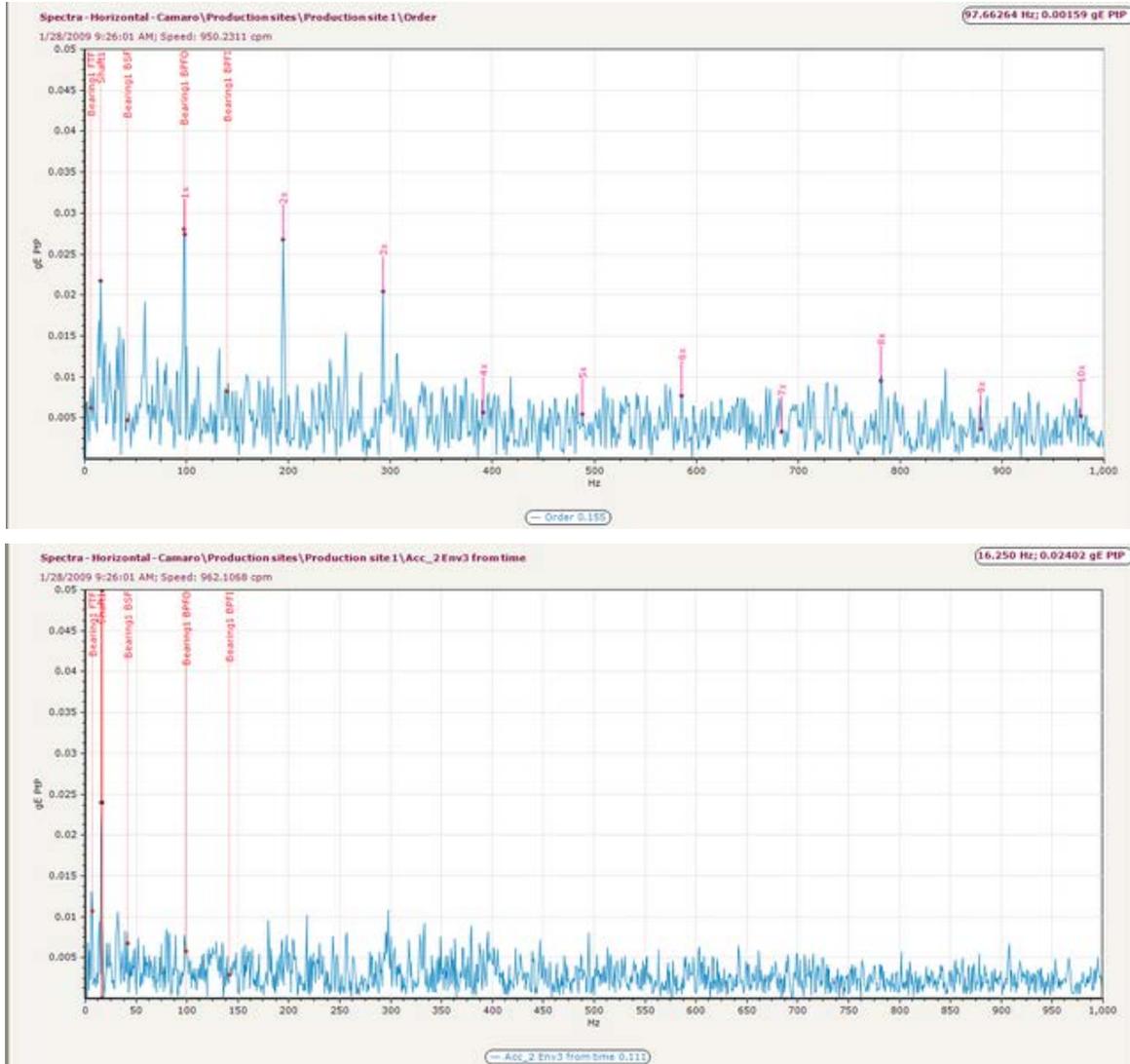
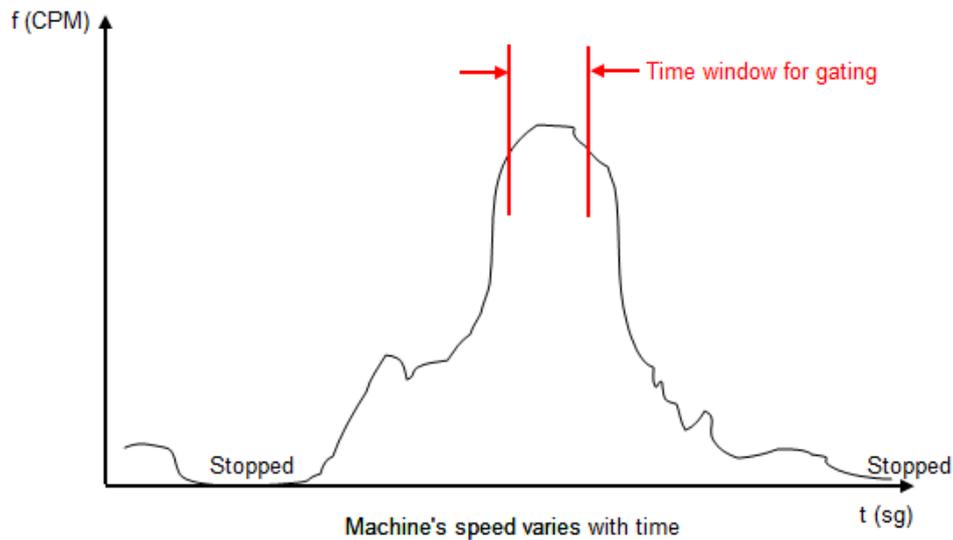


Figure 4 - 5.
Display with Order Tracking on (above) and without Order Tracking (below).

Active Range

With Active range (gating) interface in @ptitude Observer or Analyst, it is possible to capture data under varying conditions such as speed, process or state. It makes data easily traceable, thus facilitating the diagnosis of problems.

A clear example of gating is to measure shooting speed for measuring achievement as shown in the figure below.



For a better understanding, FFT is evaluated at a specific speed range

Figure 4 - 6.
Example of Active Range Interface in @ptitude Observer/Analyst.

Simultaneous Processing

With Simultaneous measurements interface in @ptitude Observer or Analyst, it is possible to set up a simultaneous data processing up to 16 input channels.

The simultaneous data processing of several signals implies a parallel acquisition that each and every one of them are measured at the same time. Whereas a multiplexed acquisition implies that the data acquisition system can only process one signal at a time.

The following graphic illustrates the differences between multiplexed acquisition and parallel acquisition.

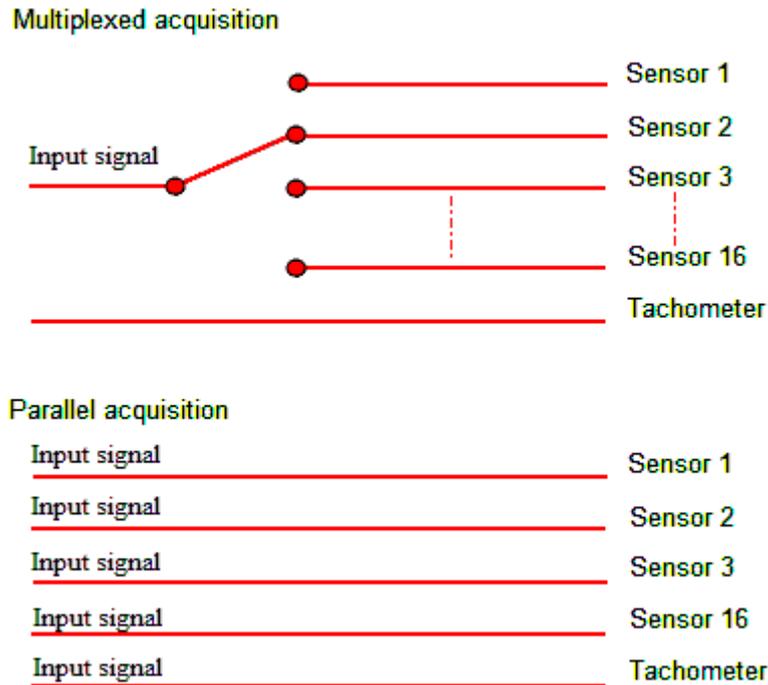


Figure 4 - 7.

Illustration of Multiplexed Data Acquisition versus Parallel Data Acquisition.

Since the multiplexed acquisition can only process one signal at a time, the data collection time can be between two and four times greater than the parallel acquisition. If this is extrapolated to the case of the IMx-P which has 16 input channels, it can then certainly be estimated that the time of data collection will be much less with the simultaneous processing method.

Alarm Group

Alarm group is used to collect data not only from the measurement point that raises an alarm but from other measurement points as well.

It is done by assigning different measurement points to an alarm group.

If one of the measurement points in an alarm group generates an alarm, data on all the measurement points in the alarm group will be saved.

Electrical Waste



Electrical waste and electrical equipment should be recycled according to the WEEE-directive and not be placed in the general refuse. Product should be sent to an approved recycling center for safe recycling, recovery, reuse or sent to SKF Condition Monitoring Center AB for proper recycling.



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6

Technical Data

Environmental

- Size (H x W x D): 125 x 350 x 250 mm (4.92 x 13.78 x 9.84 in.)
- Weight: 5 kg (11.0 lb.)
- IP rating: IP 50
- Temperature range: 0 to +50 °C (32 to 122 °F)
- Humidity: 85% relative humidity, non-condensing

Power Supply Unit

- Standard power unit: Battery charger included (100 to 240 VAC, 50 Hz to 60 Hz, 60 W).
 - SKF provided power supplies must be used with IMx-P. Power supplies differ in characteristics in ways that are not obvious, and there are also physical differences in the DC-plug.
- Rechargeable internal battery (8,5 Ah, 12 V), 4 hours continuous operation
- 16 hours of charging time of an empty battery
- Three different power plugs included (European, UK and US)

Analogue Inputs

- 16 analogue differential inputs (BNC connectors)
- Software controlled ICP power supply for standard accelerometers (4 mA constant current) with LED status
- Input range: ± 25 V
- Impedance: >100 k Ω

Digital Inputs

- 8 digital isolated inputs (BNC connectors)
- Software controlled 24 V two-wire tachometers power with LED status
- TTL, two-wire tachometers, pulse, switches, etc.

- 2,5 V trigger level for channels 1 to 4
- 10 V trigger level for channels 5 to 8

Analogue Measurement

- 24-bit AD conversion enabling continuous transient capture (no gain or AC/DC switching necessary)
- True simultaneous sampling of all 16 channels (no multiplexing)
- Parallel sampling of different channels with different sampling rates
- Frequency range: from DC to 40 kHz
- Dynamic range: 120 dB
- Signal to noise ratio: 90 dB
- Cross-talk rejection: 100 dB
- Accuracy amplitude: $\pm 2\%$ (up to 20 kHz), $\pm 5\%$ (20 to 40 kHz)
- Accuracy phase: $\pm 3^\circ$ (up to 100 Hz)

Digital Measurement

- Frequency range: 0,1 Hz to 12,5 kHz
 - Required pulse width: $> 4 \mu\text{s}$ for electrical positive
 $> 40 \mu\text{s}$ for electrical negative
- Accuracy frequency: 0,05% of measurement value (typically 0,01% up to 2,5 kHz)
- Pulse counting

Signal Processing

- Time waveform
- Vector analysis with circular alarms
- FFT: 100 to 6 400 lines
- Order Tracking
- Digital Peak Enveloping (DPE) 1-4
- Integration/derivation in frequency domain
- Window function: Hanning and Uniform
- Customer formulated mathematical equations
- Dynamic alarm levels, active range determined on multiple parameters
- Data storage on time, event or alarm condition

- Data buffering in flash memory when communication link is down
- Transient capture
- Parametric gating
- Detection of sensor and cable fault
- Watchdog and self testing

Interface

- Two Ethernet: RJ45 connectors
- Built-in 2 port Ethernet network switch possible for daisy chaining
- RS232 service interface
- Power switch (backside)
- Power supply adapter connector

Miscellaneous

- Calibration, traceable to BIPM
- CE certified according to EN61000-6-4 and EN61000-6-2

Quality Control

SKF Condition Monitoring Center, Luleå is ISO 9001:2008 certified.

IMx-P Front Panel

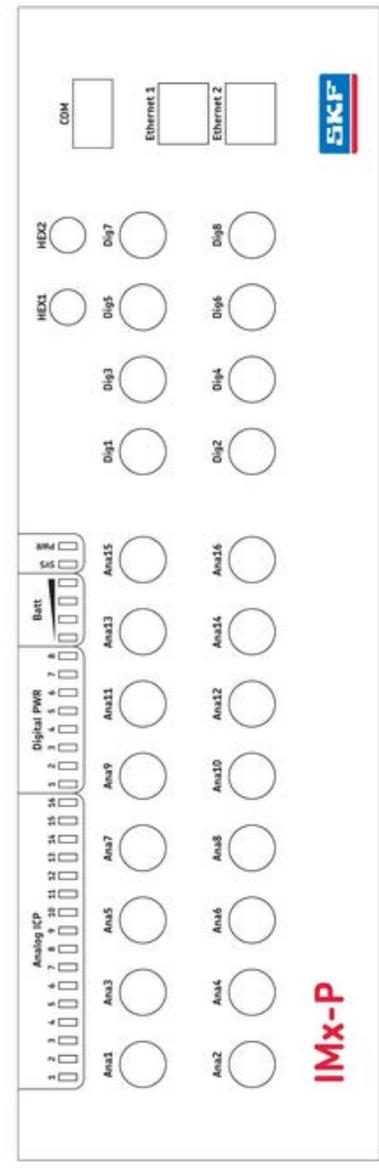


Figure 7 - 1.
IMx-P Front Panel.

Appendix A

Limited Warranty

SKF – Limited Warranty

WARRANTY

Subject to the terms and conditions contained herein and provided that there is no applicable written agreement between the selling entity in the SKF Group (“SKF”) and the Buyer specifically covering the sale of the Products (as defined below) that includes a product warranty, 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 Microlog Inspector applications including hand-held computers, all MARLIN data managers (MDM), all MARLIN Condition Detectors (MCD), all Wireless Machine Condition Detectors (WMCD), all Multilog On-line Systems (IMx), all Multilog Condition Monitoring Units (CMU, TMU), Multilog Local Monitoring Units (LMU), all Multilog Wireless Monitoring Units (WMx), Multilog On-line System Wireless Vibration Transmitter ISA100, all Wireless Monitoring Systems V/T, all Vibration PenPlus, all Machine Condition Advisors (MCA), all Machine Condition Indicators (MCI), all transmitters, all Monitor Interface Modules (MIM), all Machine Condition Transmitters (MCT), all MicroVibes and Custom Products with the prefix of CMCP (with the exception of any consumable or expendable items), Shaft Alignment Systems TKSA 60 and TKSA 80 including hand-held computer, measuring units and accessories.

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, all Multilog On-line Systems (DMx), all Wireless Machine Condition Sensors, and all M800A and VM600 Machinery Monitoring Systems.

For all On-line Systems (as defined below) 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 On-line System (IMx), 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 On-line System (IMx), 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 On-line System (IMx), Multilog Condition Monitoring Unit(s) (CMU), Multilog Local Monitoring Unit(s) (LMU), and the cabling between the Multilog On-line System (IMx), 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: special seismic sensors.

LIMITED LIFETIME WARRANTY

Products covered under this Limited Lifetime Warranty (as set forth below) are as follows: standard seismic sensors of the CMSS 2XXX and CMSS 7XX series (accelerometers and velocity transducers) as marked and published in the SKF Vibration Sensor Catalogue.

- (A) Subject to the terms herein, SKF will provide a “Limited Lifetime Warranty” for the products specified above sold by SKF after April 15, 2014. Under the Limited Lifetime Warranty, those products shall, at the time of shipment, be free from defects in material and workmanship. If any of these products fail to meet the terms of this Limited Lifetime Warranty during the life of such products, SKF, in its sole discretion, will repair, replace or exchange the products for the same model if the necessary components for the products are still available to SKF on a commercially reasonable basis. SKF will not provide a Limited Lifetime Warranty on products damaged by accident, abuse, misuse, neglect, improper installation, problems with electrical power, natural disaster, or by any unauthorized disassembly, repair or modification.
- (B) Upon receipt of any product covered by the Limited Lifetime Warranty, SKF will pay all shipping charges to send the repaired, replaced or exchanged product to the original point of shipment. SKF reserves the right to decline repair or replacement if no fault is found in the product.
- (C) For any warranty claim, the original Buyer must provide SKF with the applicable model and serial numbers, the date of purchase, the nature of the

problem, and proof of purchase. SKF, in its sole discretion, will determine if the Buyer must return the product covered under this warranty to SKF.

- (D) The express warranty set forth in the Limited Lifetime Warranty is in lieu of and excludes any and all other warranties express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
- (E) SKF's sole obligations under this Limited Lifetime Warranty are set forth in paragraphs (A) and (B), and SKF's liability under this Limited Lifetime Warranty shall not exceed the purchase price of the product, plus any shipping and handling charges that SKF may be obligated to pay pursuant to paragraph (B).
- (F) **IN NO EVENT SHALL SKF BE LIABLE OR OBLIGATED TO THE BUYER OR ANY OTHER PERSON FOR SPECIAL, EXEMPLARY, PUNITIVE, INCIDENTAL, DIRECT, INDIRECT, GENERAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BY WAY OF EXAMPLE ONLY, LOST PROFITS OR SAVINGS, LOSS OF BUSINESS OR LOSS OF USE) OR ANY OTHER LOSS, COST OR EXPENSE IN CONNECTION WITH THE PRODUCTS REGARDLESS OF WHETHER OR NOT ANY OF THE FOREGOING WERE FORESEEABLE OR THAT SKF WAS ADVISED AS TO THE POSSIBILITY OF SUCH DAMAGES, LOSS, COST, OR EXPENSE.**
- (G) The Limited Lifetime Warranty applies solely to the original Buyer and is non-transferrable.

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.

EXCEPT WARRANTY OF TITLE AND FOR THE WARRANTIES EXPRESSLY SET FORTH IN HEREIN, IT IS UNDERSTOOD AND AGREED THAT:

- (A) SKF MAKES NO OTHER WARRANTY, REPRESENTATION OR INDEMNIFICATION, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT;**

- (B) IN NO EVENT SHALL SKF BE LIABLE OR OBLIGATED FOR SPECIAL, EXEMPLARY, PUNITIVE, INCIDENTAL, DIRECT, INDIRECT, GENERAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BY WAY OF EXAMPLE ONLY, LOST PROFITS OR SAVINGS, LOSS OF BUSINESS OR LOSS OF USE) OR ANY OTHER LOSS, COST OR EXPENSE IN CONNECTION WITH THE PRODUCTS AND RELATED SERVICES, IF ANY, PROVIDED BY SKF, AND THIS DISCLAIMER SHALL EXTEND AS WELL TO ANY LIABILITY FOR NONPERFORMANCE CAUSED BY SKF'S GROSS OR ORDINARY NEGLIGENCE, AND IN ALL CASES REGARDLESS OF WHETHER OR NOT ANY OF THE FOREGOING WERE FORESEEABLE OR THAT SKF WAS ADVISED AS TO THE POSSIBILITY OF SUCH DAMAGES, LOSS, COST, OR EXPENSE; AND**

- (C) NO PERSON HAS BEEN AUTHORIZED BY SKF TO MAKE ANY FURTHER OR CONTRARY INDEMNITIES, REPRESENTATIONS OR WARRANTIES ON BEHALF OF SKF. THE FOREGOING LIMITATIONS AND DISCLAIMERS OF LIABILITY SHALL BE MADE APPLICABLE TO THE 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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CM-F0001 EN
Revision Y, March 2016

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