SKF Enlight Collect IMx-1 System

Automated machine monitoring for reliable rotation

The SKF Enlight Collect IMx-1 System

An SKF Enlight Collect IMx-1 System consists of:

- Battery powered wireless sensors (SKF Enlight Collect IMx-1)
- A line powered communication and network manager gateway (SKF Enlight Collect Gateway)
- Host software for data trending visualization and analysis (SKF @ptitude Observer version 12.2.0 or later)
- A mobile phone app for sensor and gateway commissioning (SKF Enlight Collect Manager)

The sensor is a data-collector and radio combined into one compact battery-operated device. It measures and processes vibration and temperature for detection of common issues with rotating equipment including:

- Unbalance
- Misalignment
- Looseness
- Electrically induced vibration
- Early stage damage to bearings and gears

The sensor communicates its information over a low energy mesh network – designed to route data around the wireless obstacles presented by typical industrial environments – back to a host gateway. This, in turn connects to the plant's network, or to the internet for connection to monitoring services hosted by SKF.

The system enables machinery health data to be collected automatically and turned into actionable machine maintenance information, enabling valuable predictive maintenance staff to be freed from the task of routine data collection and to concentrate on higher value tasks.

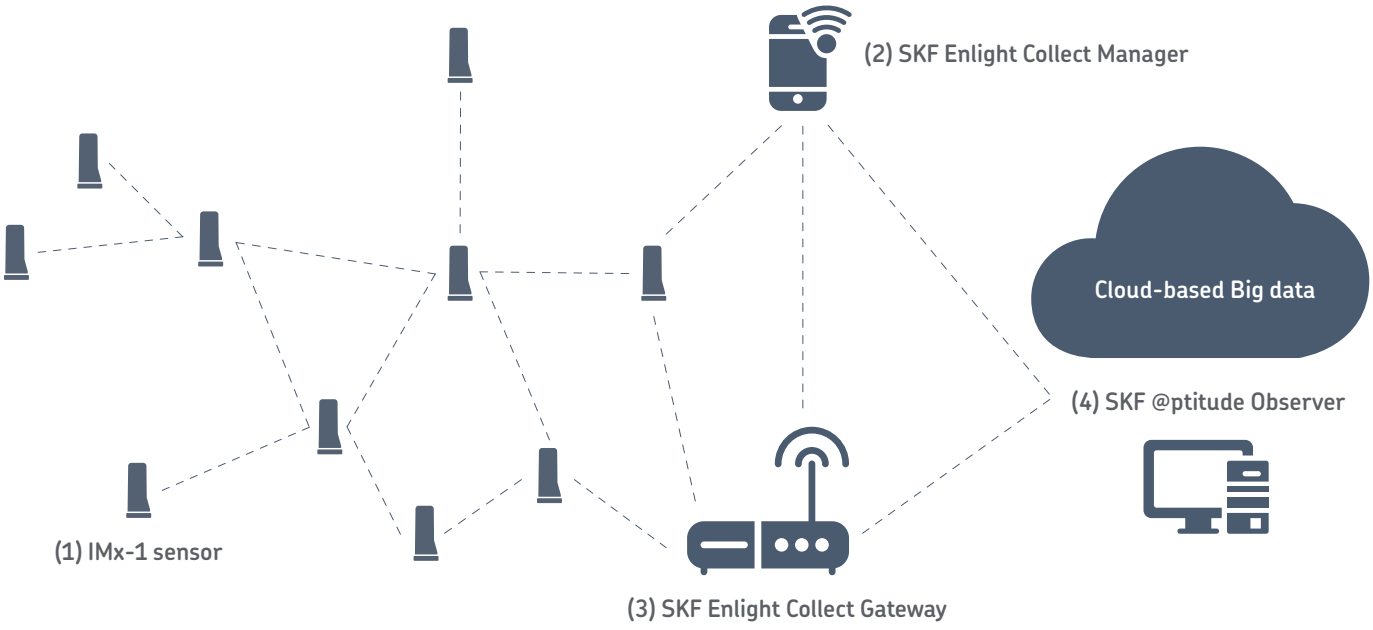
Features

- Overall level and dynamic vibration data
- Broadband acceleration and velocity measurements
- SKF Acceleration Enveloping for early detection of defects in bearings and gears, and other impact type phenomena

- Temperature measurement
- Configurable data acquisition and processing
- Periodic measurements
- On-demand measurements
- Mesh network communication
- 4-year typical sensor battery lifetime (configuration dependent)
- Rugged, compact design
- Gateway is powered from an industrial, wide range, 24 V DC or PoE
- Interfaces to wireless sensors (such as IMx-1), SKF App and software
- Encrypted communications for cybersecurity
- All communication interfaces between the gateway, app and backend are secured using industry standard TLS 1.2

Benefits

- Replacement of manual machinery health data collection and/or widening monitoring coverage
- Increase of the periodic monitoring coverage from months and weeks to days and hours
- Makes automated data collection easier and more affordable
- Data from machines in inaccessible locations or measurement points behind guarding
- Quick and scalable deployment
- Allows reduction of unplanned downtime by identifying and resolving problems before they result in costly machine failure



An Enlight Collect IMx-1 system consists of four elements:

(1) IMx-1 sensors are small enough to be placed at key measurement locations on a machine – usually the bearing housings. The wireless sensors are fixed using the proven mounting methods employed by standard wired industrial accelerometers. The device is battery powered and, in order to conserve energy, spends much of its time asleep – but with one ear open for network commands. Every few hours (configurable) the gateway asks it to wake up and measure the asset's vibration and temperature. Overall measurements are checked by severity algorithms and – if there is a cause for concern – dynamic data is captured for assessment by more complex computing. However, most of the time all is well, so only overall level data is reported and the sensor returns to its sleep mode. Periodically – typically on a weekly basis – waveform data is transmitted to build up the long-term historical trend key to predictive maintenance, previously collected manually every month. In this way, an economic balance between automated complex data collection and sensor battery life can be made.

(2) A Commissioning App – on a mobile phone is used to set up the Gateway and the IMx-1 sensor during installation. At first use, the sensor is awoken with a simple NFC tap and its embedded factory information is linked via Bluetooth® to the App. The user then matches the sensor to its data-point location in the Host Software. Thereafter, control of the sensor passes to the mesh network and the data-collection parameters are downloaded.

(3) A Gateway – this does not just provide a link to the outside world for each sensor. The gateway also manages the mesh network, optimizes the wireless communication paths for the physical environment and requests data collection from all its 'children'. Data and information can then be securely communicated to the outside world using a wired Ethernet interface or wirelessly by Wi-Fi.

(4) Host software from SKF manages all the machine health data, and localized computing results, in order to conclude and communicate actionable maintenance information. How it achieves this can range from a manual evaluation in an on-premises software instance, to automated machine learning operating in a cloud hosted environment.

SKF Enlight Collect IMx-1 – Specifications

Measurements			
Acceleration	10 Hz to 10 kHz, overall true pk-pk and dynamic, up to 50 g		
Velocity	10–1 000 Hz, overall RMS and dynamic, up to 100 mm/s		
SKF Acceleration Enveloping	Bands ENV 2[1)] and ENV 3, overall true pk-pk and dynamic		
Temperature measurement	–40 to +85 °C (sensor operating range)		
Data Acquisition and Edge Computing			
Selectable maximum frequency	Options for 50 to 10 000 Hz		
Selectable samples/FFT line resolution[1)]	1 024 to 16 384 samples / 400 to 6 400 lines		
Alarms	Configurable Alert & Danger alarm setpoints		
Typical configuration	Overall level values collected and uploaded every 6 hours 2048–point TWF collected and uploaded every week More frequent data if in alarm		
Mesh Network Wireless Communication	2.4 GHz ISM band low energy mesh radio network		
Certifications	Europe: RED 2014/53/EU Americas: FCC/CFR 47 part 15, IC Brazil: Anatel Korea: KCC Japan: Giteki		
Inter-node maximum range	10 m to 20 m typical, depending on plant topology		
Configuration Wireless Communication			
App – sensor interface	NFC (Near Field Communication) and Bluetooth		
Modes	Bluetooth, Mesh and Flight modes		
Mode switch	By Bluetooth/NFC from app or timeout		
Handset requirements	Android 7 or later, NFC and Bluetooth 4.2 capability required Any iPhone 7 or later running iOS 11 or later		
Physical	For dimensions, see drawing on page 6		
Mounting	1/4–28 UNF female, recommended torque 2.9 Nm		
Weight	142 g		
Housing material	Potted thermoplastic		
Sensor base	304L or 303 stainless steel		
Flammability	UL 94 V–0		
Environmental			
IP rating	IP69K		
Mechanical impact rating	According to IEC 60068-2-31, free fall procedure 1		
Operating temperature range	–40 to +85 °C		
Storage temperature range	Recommended maximum temperature: 30 °C		
Humidity	Suitable for installation in high humidity areas		
Hazardous area rating	Safe area use only (ATEX/IECEx Zone 1[2)] pending)		
Power Source	Non-replaceable lithium battery		
Typical lifetime[1)]	4 to 8 years[1)] (configuration dependent)		
Factors adversely affecting battery life	Temperature: extended exposure to 70 to 85 °C range Data collection: higher resolutions, more frequent uploads Wireless environment: longer transmission times		

Wireless environment and battery life are linked: having more data to upload affects mesh performance and physical obstacles to the wireless network can increase transmission times and create heavily loaded nodes. Sensors used as (measurement only) leaf nodes have a longer expected lifetime than mesh nodes (measurements/mesh).

Other	Self-diagnostics OTA (Over The Air) Firmware updates		
Maximum Radiated Output Power	Bluetooth Low Energy	0.85 mW	[from 2 400 MHz to 2 483.5 MHz]
	Mira mesh	0.95 mW	[from 2 400 MHz to 2 483.5 MHz]
	NFC	Receiver only	[from 13.553 MHz to 13.567 MHz]
Cybersecurity			
Sensor to gateway communication	Encrypted AES (128 Bit)		
Gateway/App to host network communication	Encrypted TLS (4096 bit) Certificates traceable to SKF Wi-Fi: EAP TLS, TTLS and PEAP. Randomized passwords – unique for each gateway Hashing of sensitive configuration data		

SKF Enlight Collect Gateway – Specifications

Inputs	
Via Wireless Mesh Network	Vibration/temperature sensor IMx-1, maximum 100 per gateway Future: Wireless speed/phase reference sensor
Wired	TTL speed/phase[1] and support for external antenna
Mesh Network Wireless Communication	2.4 GHz ISM band low energy mesh radio network
Certifications	Europe: RED 2014/53/EU Americas: FCC/CFR 47 part 15, IC Brazil: Anatel Korea: KCC Japan: Giteki
Sensor to gateway (direct) maximum range	10 m to 30 m typical, depending on plant topology
Configuration Wireless Communication	
App – gateway interface	Bluetooth 4.2
Gateway identification	By QR code or Bluetooth from app/mobile device
Handset requirements	Android 7 or later, NFC and Bluetooth 4.2 capability required Any iPhone 7 or later running iOS 11 or later
Host Network Communication	Wired or wireless Ethernet, or mobile data[1]
Wired Ethernet (default interface)	10/100/1000 Mbps auto negotiation, auto MDI-X Future: Second Ethernet interface, Modbus TCP/IP and OPC UA
Wi-Fi	802.11 a/b/g/n/ac, 2.4 and 5 GHz, WPA2-Personal and WPA2-Enterprise
Mobile network[1]	LTE/UMTS[1] [2]
Physical	
Dimensions	220 x 220 x 50.5 mm, excluding mounting plate
Mounting	4-point mounting, see drawing on page 7
Weight	1 200 g
Housing material	ASA+PC-FR (Flame Retardant) Acrylonitrile Styrene Acrylate + Polycarbonate
Flammability	UL 94 V–0
Connector Interface	
Multi-pole interface	4ea: Power, Ethernet and future: wired inputs and second Ethernet 1ea: SIM card holder (micro-SIM)
Antenna	4ea: Mira mesh, WiFi/BLE, LTE Main and Diversity (SMA female)
LEDs	Two LEDs, Power and Status
Environmental	
IP rating	IP65
Operating temperature range	–20 to +60 °C
Storage temperature range	–40 to +60 °C
Humidity	Maximum 95% (relative) non-condensing
Altitude	Maximum 5 000 m
Hazardous area rating	Safe area use only (ATEX/IECEx Zone 2[2] and NEC Class 1 Div 2 variant[2] pending)
Power Source	Industrial range 24 V DC or Power over Ethernet (PoE)
Industrial range 24 V DC	V DC input: 24 V DC (9-36 V DC); 7.5 W
Power over Ethernet	PoE input: 48 V DC (44-57 V DC); 7.5 W
Other	
Self-diagnostics	Yes
Status and event reporting to the software	Yes
RTC (Real Time Clock)	Yes
OTA Firmware updates – gateway	Yes
OTA Firmware updates – sensors	Yes, all sensors associated with the gateway

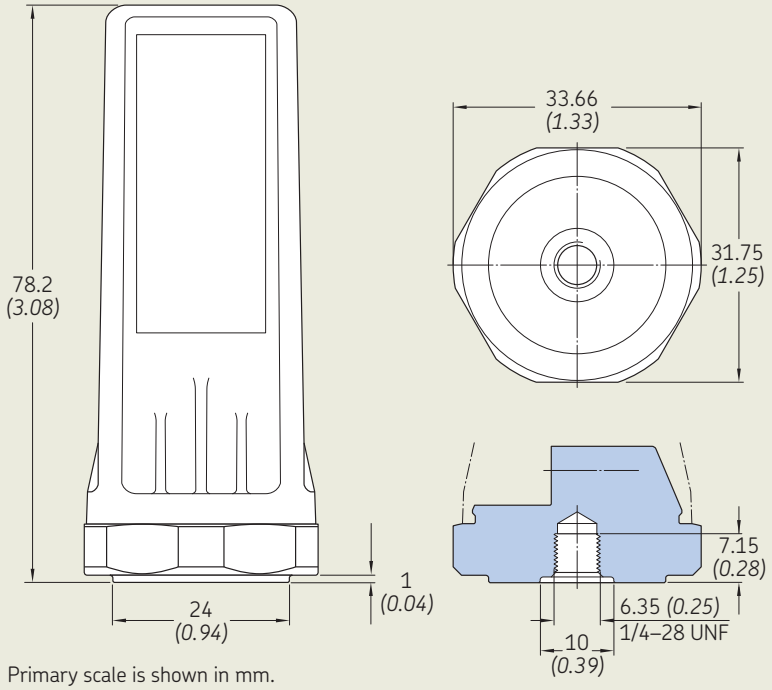
1) Stated feature and/or level of specification is planned to be available in the near future. Version 1.2 release of the product has the following features/level of specifications:

SKF Enlight Collect IMx-1:
SKF Acceleration Enveloping: ENV3
Selectable samples/FFT line resolution: Selectable, up to 4 096 samples/3 200 lines
Typical lifetime: 4 years (configuration dependent)

SKF Enlight Collect Gateway
Support for TTL speed/phase, not yet activated.
Mobile Host not yet activated

2) Certification/qualification pending.

SKF Enlight Collect IMx-1 – Sensor and mounting dimensions



Primary scale is shown in mm.

Ordering information

Part Number	Description
CMWA 6100	SKF Enlight Collect IMx-1
CMWA 6600	SKF Enlight Collect Gateway, supplied with power supply cable (1.5 m) and Ethernet cable (1 m), each with mating M12 connector.

Mounting accessories for SKF Enlight Collect IMx-1 sensors

CMAC 230-05	Acc, stud, mtg, 1/4-28 to 1/4-28, 5-pack
CMAC 231-05	Acc, stud, mtg, 1/4-28 to M8, 5-pack
CMSS 910F	Acc, snsr, cementing stud, 1/4-28, Female
CMSS 910M	Acc, snsr, cementing stud, 1/4-28, Male

Accessories for SKF Enlight Collect Gateway

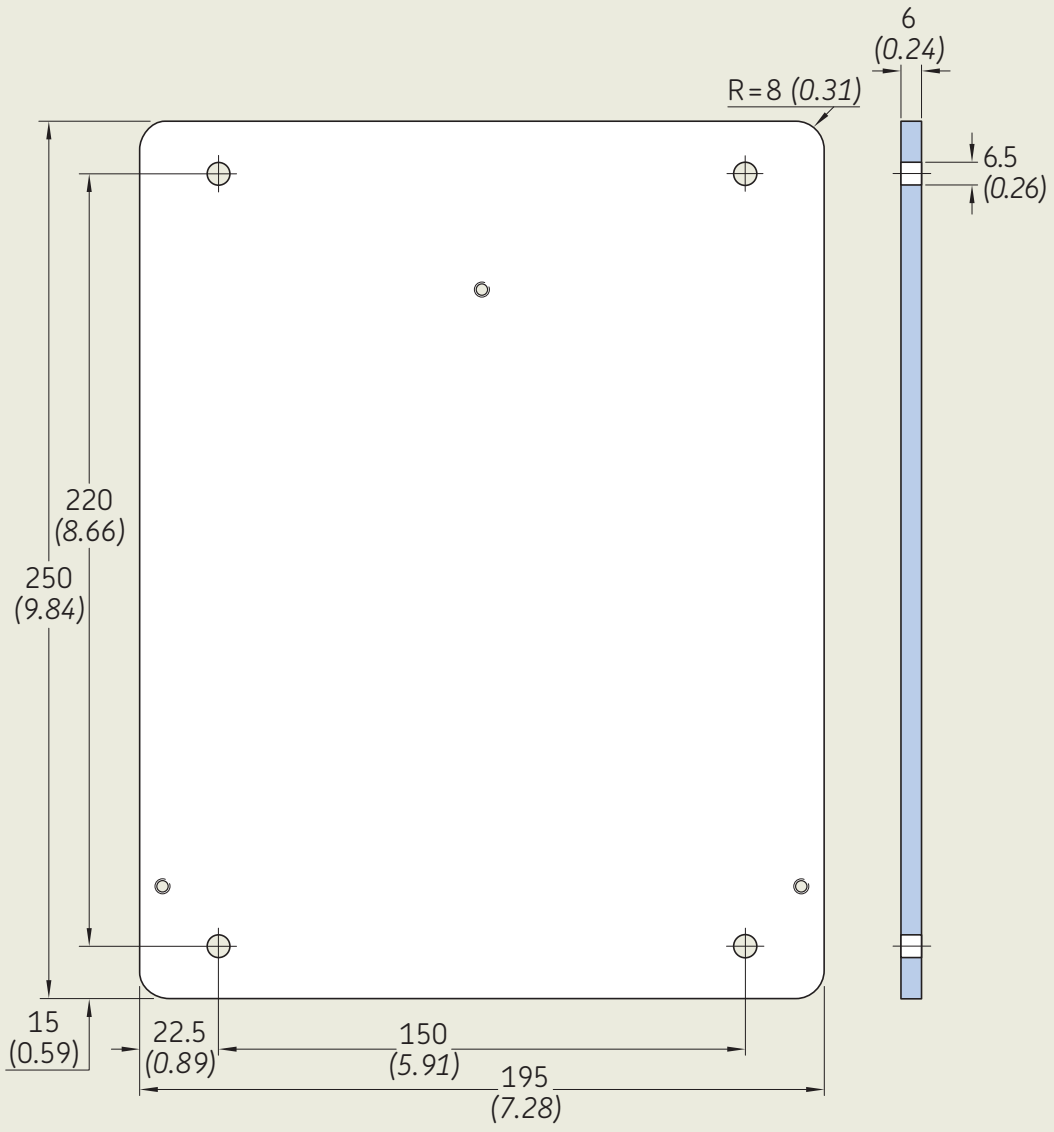
CMAC 6600-NETCBL-1.0M	Ethernet cable (1 m)

The SKF Enlight Collect Manager app for Android devices is available from the Google Play Store.
The SKF Enlight Collect Manager app for iOS devices is available from the App Store.
This app provides features to commission and manage the SKF Enlight Collect IMx-1 system.

SKF Enlight Collect Gateway – Mounting dimensions

The SKF Enlight Collect Gateway, excluding mounting plate, has overall dimensions of 220 mm high, 220 mm wide and 50.5 mm deep. It is supplied fitted to the mounting plate shown below.

This mounting plate has overall dimensions of 195 mm wide, 250 mm high and is 6 mm thick. It provides for a 4-point mounting and has four 6.5 mm, clearance for M6, holes on a 150 mm by 220 mm pitch.



Primary scale is shown in mm.

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