

SKF Enlight Collect IMx-1 System

Automated machine monitoring for reliable rotation



The SKF Enlight Collect 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

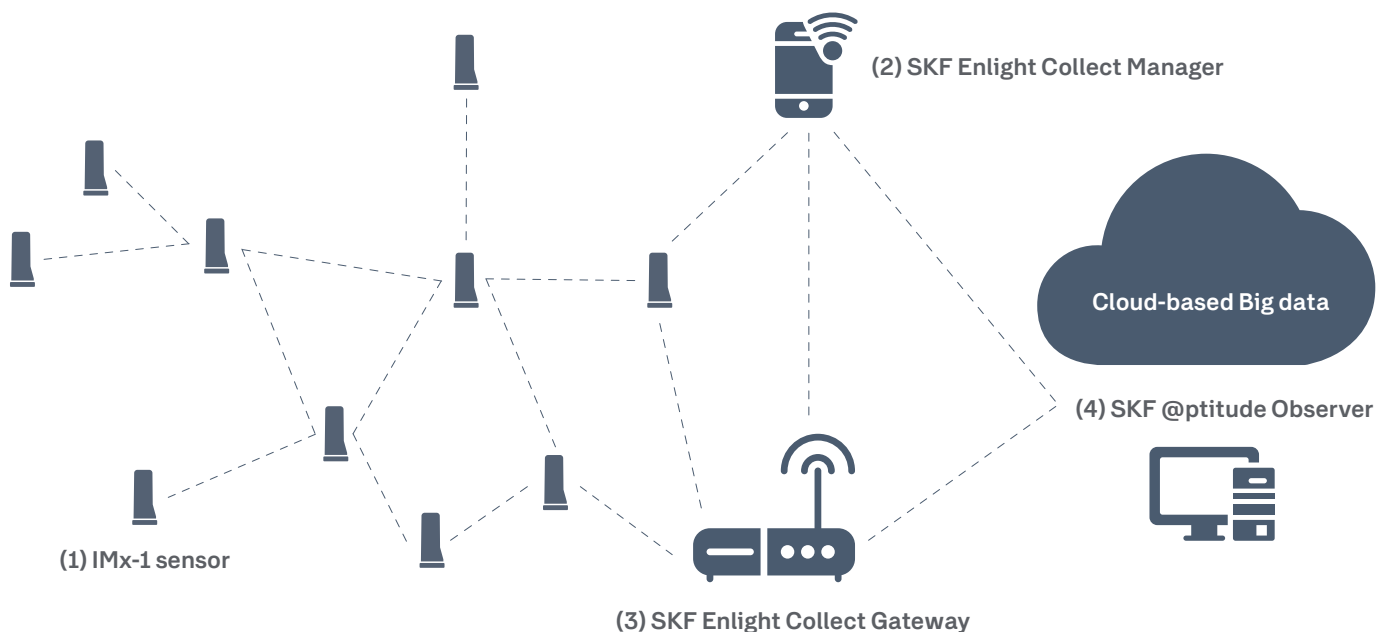
- SKF Acceleration Enveloping for early detection of defects in bearings and gears, and other impact type phenomena
- Temperature measurement
- Configurable data acquisition and processing
- Periodic measurements
- On-demand measurements
- Mesh network communication
- Up to 4-year sensor battery life (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
- Modbus TCP/IP connectivity for process gating and trending

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 WiFi, Mobile Data (LTE) or a wired Ethernet interface.

(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	Band 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	8192 samples / 3200 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

Certifications (CMWA 6100)	Mira mesh low energy mesh radio network (2.4 GHz ISM band) Europe: RED 2014/53/EU United States: FCC/CFR 47 part 15 Canada: ISED/RSS-GEN/102/247 Brazil: Anatel Korea: KCC Japan: Giteki United Kingdom: UKCA
Certifications (CMWA 6100-EX)	Europe: RED 2014/53/EU United States: FCC/CFR 47 part 15 Canada: ISED/RSS-GEN/102/247 Brazil: Anatel Taiwan: NCC United Kingdom: UKCA
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, Mira mesh and Flight modes
Mode switch	By Bluetooth/NFC from app or timeout
Handset requirements	Android 9 or later, NFC and Bluetooth 4.2 capability required Any iPhone 7 or later running iOS 11 or later

Physical

Mounting	For dimensions, see drawing on page 8
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 (CMWA 6100)	Safe area use only
Hazardous area rating (CMWA 6100-EX)	ATEX Zone 1 – II 2G Ex ib IIC T4 Gb ATEX certificate number: INERIS 22ATEX0007X IECEX Zone 1 – Ex ib IIC T4 Gb Certificate of Compliance number: INE 22.0011X Brazil: INMETRO Certificate of Compliance Number: DNV 24.0089 X

Power Source

Typical lifetime	Non-replaceable lithium battery Up to 4 years (configuration dependent)
Factors adversely affecting battery life	Temperature: extended exposure above 50°C 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
	Wireless speed/phase reference sensor
Wired	Modbus TCP/IP for process gating and trending

Mesh Network Wireless Communication

Certifications (CMWA 6600)	Mira mesh low energy mesh radio network (2.4 GHz ISM band) Europe: RED 2014/53/EU United States: FCC/CFR 47 part 15 Canada: ISED/RSS-GEN/102/247 Brazil: Anatel Korea: KCC Japan: Giteki United Kingdom: UKCA Taiwan: NCC
Certifications (CMWA 6600-EX)	Europe: RED 2014/53/EU United States: FCC/CFR 47 part 15 Canada: ISED/RSS-GEN/102/247 Brazil: Anatel Korea: KCC United Kingdom: UKCA Taiwan: NCC
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 9 or later, NFC and Bluetooth 4.2 capability required Any iPhone 7 or later running iOS 11 or later

Host Network Communication

Wired Ethernet (default interface)	Wired or wireless Ethernet, or mobile data ¹⁾ 10/100/1000 Mbps auto negotiation, auto MDI-X Secondary Ethernet interface: Modbus TCP/IP
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⁾

Physical (CMWA 6600)

Dimensions	220 x 220 x 50.5 mm, excluding mounting plate
Mounting	4-point mounting, see drawing on page 9
Weight	1 200 g
Housing material	ASA+PC-FR (Flame Retardant) Acrylonitrile Styrene Acrylate + Polycarbonate
Flammability	UL 94 V-0

¹⁾ SKF Enlight Collect Gateway
For mobile data external antennas are required.

Physical (CMWA 6600-EX)

Dimensions	400 x 250 x 120 mm
Mounting	4-point mounting and has four 7 mm, clearance for M6 and holes on a 200 mm by 380 mm pitch, see drawing on page 10
Weight	4 000 g
Housing material	Glass Fibre Reinforced Poylester
Flammability	UL 94 V-0

Connector Interface

Multi-pole interface	3ea: Power, 2x 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 (CMWA 6600)	Safe area use only
Hazardous area rating (CMWA 6600-EX)	ATEX Zone 2 – II 3G Ex ec IIC T4 Gc IECEX Zone 2 – Ex ec IIC T4 Gc

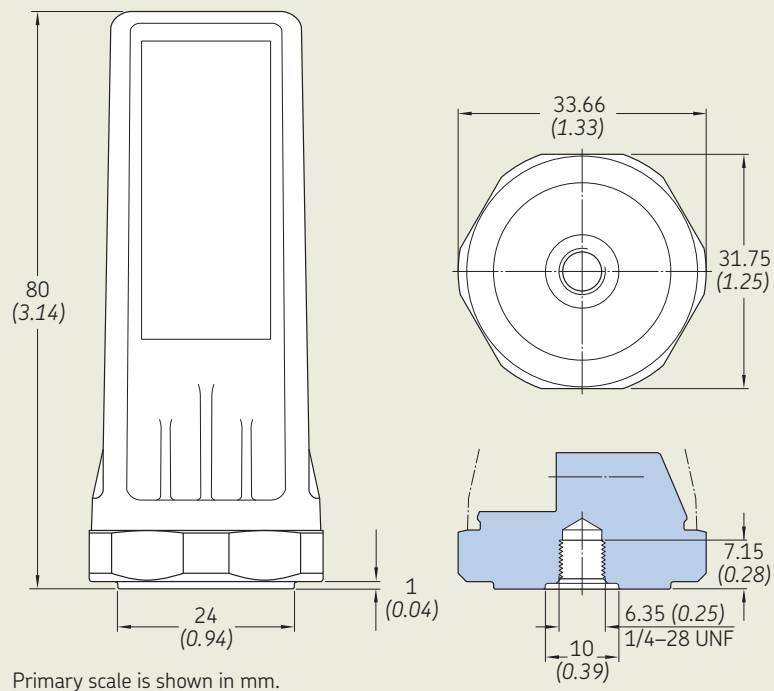
Power Source

Industrial range 24 V DC	Industrial range 24 V DC or Power over Ethernet (PoE) 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

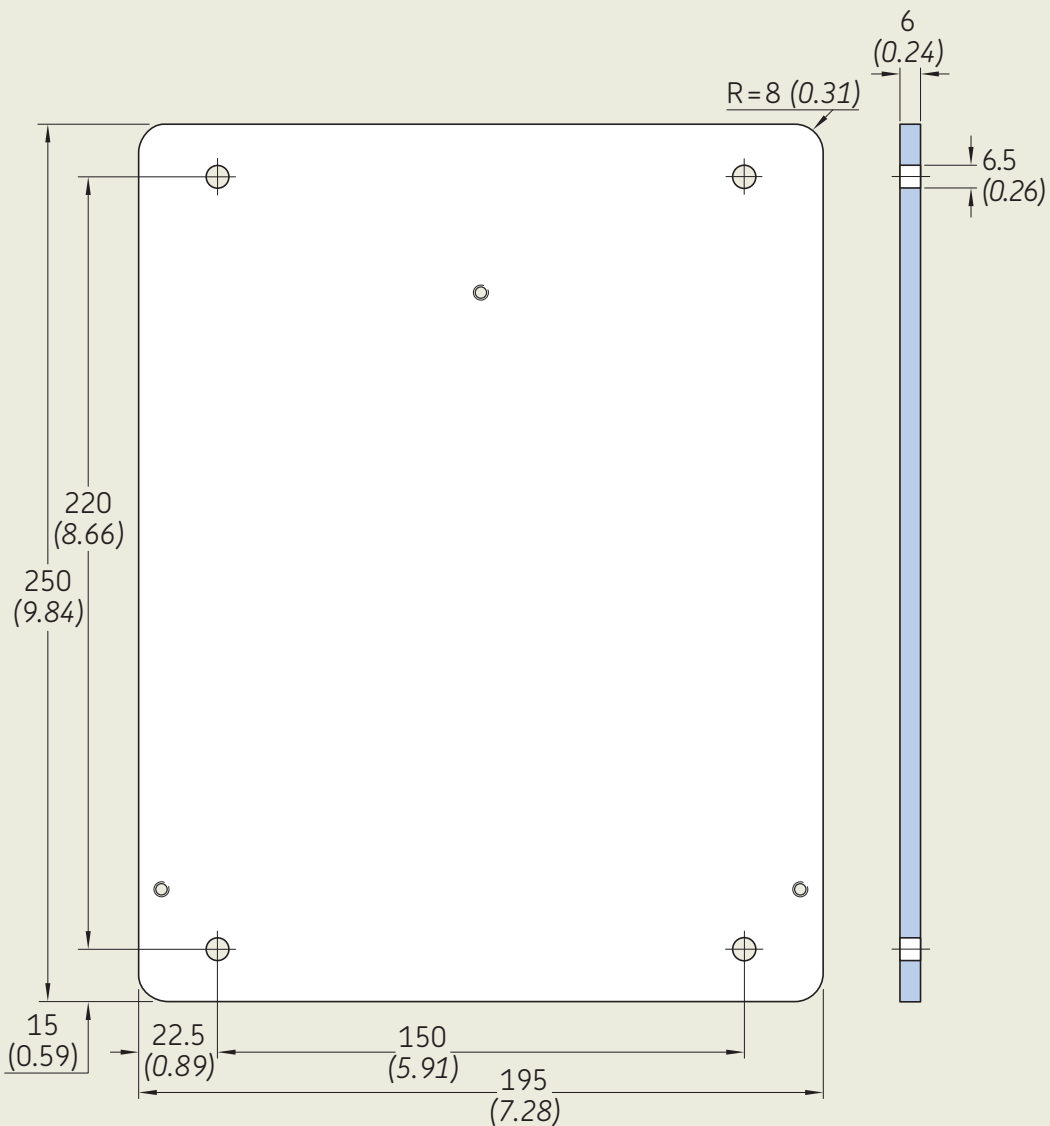
SKF Enlight Collect IMx-1 – Sensor and mounting dimensions



SKF Enlight Collect Gateway CMWA 6600 mounting dimensions

The SKF Enlight Collect Gateway CMWA 6600, 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.

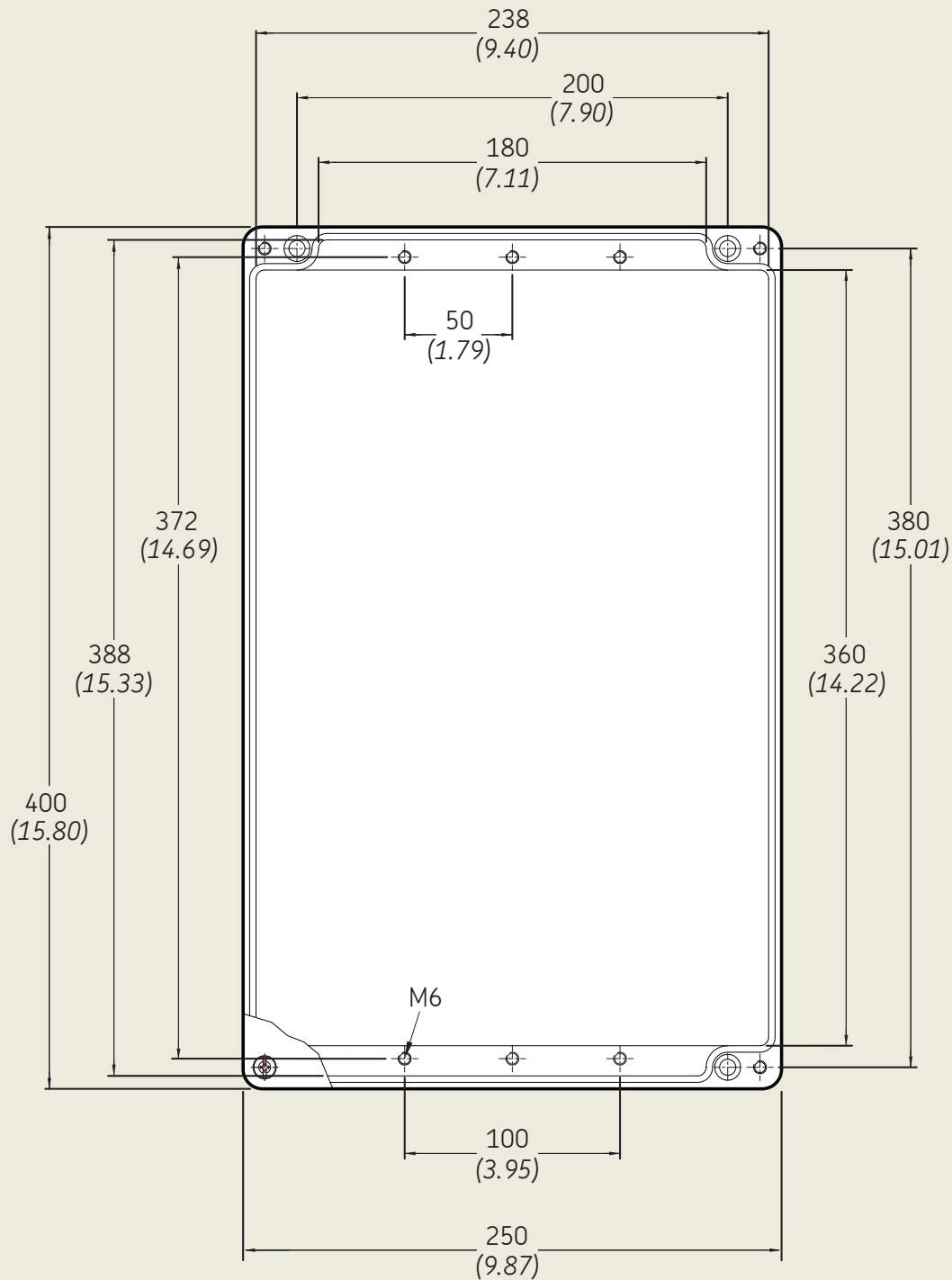
This mounting plate has overall dimensions of 195 mm wide, 250 mm high and is 6 mm thick. It provides for a 4-point mounting and has four 6.5 mm, clearance for M6 screws, holes on a 150 mm by 220 mm pitch.



Primary scale is shown in mm.

SKF Enlight Collect Gateway CMWA 6600-EX mounting dimensions

The SKF Enlight Collect Gateway 6600-EX has overall dimensions of 400 mm high, 250 mm wide and 120 mm deep. The enclosure provides for a 4-point mounting and has four 7 mm clearance for M6 screws and holes on a 200 mm by 380 mm pitch.



Primary scale is shown in mm.

Ordering information

Part Number	Description
CMWA 6100	SKF Enlight Collect IMx-1
CMWA 6100-EX	SKF Enlight Collect IMx-1 Hazardous area variant
CMWA 6600	SKF Enlight Collect Gateway, supplied with power supply cable (1.5 m) and Ethernet cable (1 m), each with mating M12 connector.
CMWA 6600-EX	SKF Enlight Collect Gateway Hazardous area variant, supplied with power supply cable (5m) and Ethernet cable (5m), each with mating M12 connector and flying leads. Separate RJ45 IDC connector is provided for Ethernet cable termination.

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, sns, cementing stud, 1/4-28, Female
CMSS 910M-05 (5-pack)	Acc, sns, 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.

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