

SKF Multilog On-line System IMx-8/IMx-8Plus



User Manual
Part Number **15V-090-00049-100**
Revision **E – September 2020**



Read this manual carefully before using the 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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1 Product description

1.1 SKF Multilog On-line System IMx-8/IMx-8Plus

The IMx-8/IMx-8Plus supports 8 analogue inputs; typically accelerometers or voltage inputs and 2 digital inputs; typically for tacho signals.

1.2 Differences between the IMx-8 and the IMx-8Plus

Key differences in functionality between the IMx-8 and the IMx-8Plus versions relate to network infrastructure supported 'on-device' and are listed in the table below:

Table 1 Feature comparison IMx-8 and IMx-8Plus

Feature	IMx-8	IMx-8Plus
Mobile data connection	–	Yes
Wi-Fi	–	Yes
Ethernet (RJ45)	Yes	Yes

Simplified overviews of IMx-8 and IMx-8Plus systems are shown in Figures 1 and 2 below, details of the specific features and capabilities follow. Note that in practice @ptitude Observer software will usually be communicating with multiple IMx devices of various types.

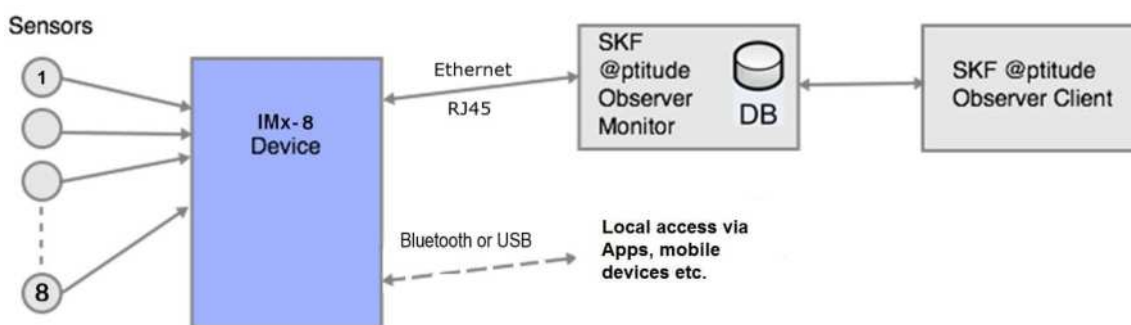


Figure 1 SKF Multilog IMx-8 typical connections overview

Whilst Ethernet is the only infrastructure natively supported by the IMx-8 other network types could be used given appropriate external hardware.

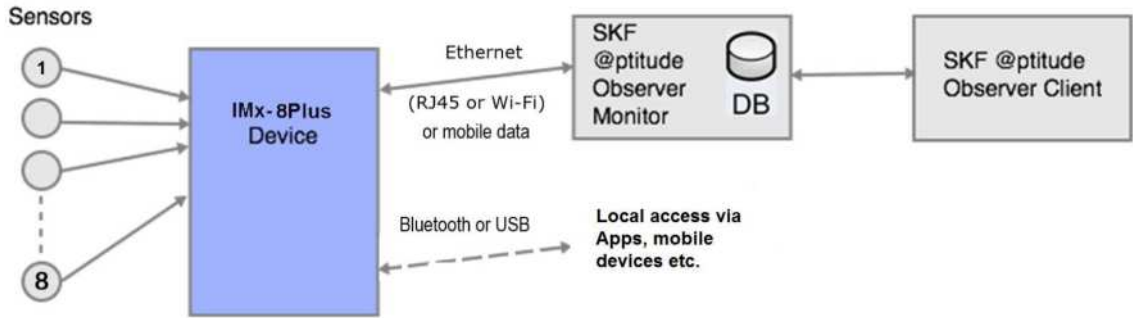


Figure 2 SKF Multilog IMx-8Plus typical connections overview

In addition to the 8 analogue channels, there are two digital inputs for speed and both devices have RS485 and LAN interfaces. As illustrated, for the IMx-8Plus alternative interfaces include Wi-Fi and mobile data. Note that mobile data, RJ45 or Wi-Fi connectivity are all alternative infrastructures to connect the IMx-8Plus to wider networks and cannot be used simultaneously.

Each IMx is supplied with demountable terminals for digital I/O, RS485, analogue sensor wiring, etc. as well as type specific connectors for some of the interfaces and, where applicable, antenna connections. If required, the RS485 link can interface by Modbus RTU to an external, optional, GPS module.

A Bluetooth dongle provides a convenient means of accessing the IMx, from the SKF Multilog IMx Manager app. This app is used for a SAT (Site Acceptance Test), device network configuration and is the companion app if the IMx is used in stand-alone mode. Note that user access must be pre-arranged, refer to section [2.5.12](#).

Optional IP rated cabinets are available, [3.4.2](#).

1.3 System communications

The communications setup or mode determines how the IMx will communicate with the wider system. There are 3 alternative arrangements that can be used:

- Server initiated – @ptitude Observer initiated communication
- Client-Server – the IMx is the initiator of the communication
- Stand-alone – no connection to @ptitude Observer

Whilst the first two are alternatives for @ptitude Observer/IMx communication, illustrated diagrammatically in Figures 1 and 2, the stand-alone option refers to operating the IMx independent of @ptitude Observer software and instead using the companion app, to interact with it. For stand-alone mode, refer also [2.5.13](#).

Whilst the different network possibilities ([1.3.1](#) to [1.3.2](#) below) offer alternative connection methods, there are limitations on the permissible combinations of communication mode and network connection method:

1. Server initiated, requires a server installed on a local network (with RJ45 or, if applicable, Wi-Fi connection).
2. Mobile data connectivity, whether implemented within the IMx-8Plus or external to an IMx-8, is only supported in Client-Server mode (device-initiated communications).

The choice between using a mobile data connection or a LAN connection (RJ45 or Wi-Fi), is part of the IMx-8Plus configuration.

1.3.1 Mobile data

In the IMx-8Plus, a built-in module provides a mobile data connection. It can work world-wide and provides connectivity to @ptitude Observer software. Mobile data functionality requires an activated SIM card or eSIM. An external antenna is required ([1.5](#)); two LTE connectors are provided.

1.3.2 Local network RJ45 or Wi-Fi module


In the IMx-8Plus, a built-in Wi-Fi module provides a Wi-Fi communication interface (2.4 GHz) so that, where available, that can be used as the first stage of connectivity to @ptitude Observer software, rather than a hard-wired LAN (RJ45) or the mobile network. Similarly to mobile data, an external antenna is required for Wi-Fi, the optional antenna offered by SKF ([1.5](#)) fulfils both roles.

An RJ45 Ethernet connection is the only network interface built-in to an IMx-8.

1.3.3 Bluetooth

As supplied, a Bluetooth dongle specifically configured by SKF is already mounted in the IMx USB Type-A port. Bluetooth is used for communication between the IMx and the SKF Multilog IMx Manager app. This is particularly useful when the IMx is in stand-alone and SAT mode but works in all modes.

Important note:



Due to special configuration for its use with the IMx, the specific dongle provided by SKF must be used and this supports only Bluetooth v4.0 Low Energy.

1.3.4 Modbus interfacing to external systems

Modbus communication is a commonly used protocol for exchanging information between systems, often from different suppliers or providers. The IMx-8/IMx-8Plus support both Modbus TCP/IP and Modbus RTU (2-wire RS485 infrastructure), including some simultaneous use, refer [Table 2](#).

Table 2 Allowable Modbus communication combinations

	TCP Master	RTU Master
TCP Slave*	Supported	Supported
RTU Slave	Supported	Not supported
TCP Slave* + RTU Slave	Supported	Not supported

Notes:

*The IMx can be a slave in multiple TCP/IP connections subject to the following limitations:

- A maximum of 4 Modbus connections, master, slave, TCP/IP and RTU in total
 - If the IMx is a Modbus RTU slave on a bus with other slaves, this only counts as one connection towards the above limitation as only one master connects to it.

Master devices typically retrieve data from slave devices, and in the IMx this data is written to 32 Modbus external channels. When configured as a master device, the IMx supports up to 4 slaves. The 32 available channels can be split/allocated to specific slaves and can have different register mapping and byte/word ordering.

Multiple master usage and the writing of data to that IMx in slave mode, are both

PRODUCT DESCRIPTION

Outer cabinet (optional)



disallowed as in the IMx the 32 Modbus external channels are allocated to the single master.

The number of slaves supported is reduced by the number of other Modbus connections, enabled, see earlier note.

When configured specifically as an RTU master to the optional GPS module slave, External Communication type 'GPS50M' rather than 'Modbus', @ptitude Observer creates an appropriate Modbus and Modbus external channel configuration for the GPS data transfer. For more information, refer to the SKF @ptitude Observer User Manual, Revision Q or later.

The Modbus RTU 2-wire interface can only support one operational mode, either Master or Slave.

In an IMx-8Plus, Modbus TCP/IP can only be used if a LAN, rather than mobile data, is being used for connection to @ptitude Observer or cloud systems and must use the same media/interface – RJ45 or Wi-Fi.

For more information regarding Modbus capabilities, refer to "Modbus for SKF Multilog On-line System IMx and SKF @ptitude Observer" and also the application note "General Modbus Protocol Considerations for IMx Devices".

1.4 Outer cabinet (optional)

Where the IMx-8 is not located in an existing cabinet, outer cabinets are available, [3.4.2](#), to house it and any supporting electronics, provide cable gland areas for sensor, antenna, the GPS and other cables.

The glands used with these enclosures should be chosen to maintain the cabinet IP rating and be appropriate for the application and environment, cable type and site practices.

The recommended cable glands sizes for an IMx-8/IMx-8Plus cabinet are M12 x 1.5mm, M20 x 1.5mm and M25 x 1.5mm. The pre-drilled SKF cabinet, [Figure 3](#), has two entries for M25 x 1.5 glands, one entry for a M20 x 1.5mm gland and 14 entries for M12 x 1.5mm glands. As supplied, all 17 cabinet entries are fitted with blind plugs.

It is not easy to make specific recommendations related to cable glands as it depends heavily on the application and the site practices, regulations, sensor type and so on.

In general, from a noise performance perspective it has been seen that noise levels are often better if an EMC type cable gland (normally metal) is used, but then care must be taken to:

- Avoid ground loops via the sensor cables by preferably connecting the shield at the IMx-end.
- Ensure the metal/EMC cable gland has a good connection to the metal box, the nut or washer must penetrate the paint or coating on the box.



Important – To avoid ground loops, SKF recommends connecting the shield only at the IMx-end.

If the application does not allow that type of gland, it is possible to use isolated (normally plastic) cable glands, but then care must be taken to:

- Ensure shield grounding is performed in a way that avoids both EMC noise and ground loops.

What to select for best performance (isolated plastic or EMC metal cable glands), is very application specific and needs to be evaluated in each case by/together with the customer.



Important - All unused cable openings must remain closed with blind plugs.

1.5 External antenna for mobile data/Wi-Fi (optional)

For use with an IMx-8Plus, SKF offer an optional external antenna that supports both Wi-Fi and mobile data connectivity, noting that the mobile data and Wi-Fi interfaces cannot be used simultaneously.

The antenna is designed to be mounted externally on the cabinet and connects to both LTE connections and the Wi-Fi connection. See section [3.6](#).

1.6 GPS module (optional)

An optional GPS module is available, see section [3.7](#). This has an integral antenna, but the module itself must be fitted external to any IMx cabinet.

The IMx can use position data to collate and associate with the condition monitoring measurements. The GPS data is requested by the IMx, acting as a Modbus RTU master on the RS485, two-wire serial interface.

Note that when configured for full GPS support in @ptitude Observer so that position and other measurement data are stored together, only this single Modbus slave is supported, there is no multiple slave support.

Connections for the GPS module are available on the 'top' end cap of the IMx-8/IMx-8Plus, refer section [2.8](#).

2 Installation and operating instructions

2.1 Introduction

Before beginning an installation, it is important to assess and evaluate the location where the system is to be installed and to plan how the installation should look after it has been completed. Make a detailed layout of the equipment and note distances between components and the networks to which it should connect. Specify the configuration requirements of each interface, for example IP addresses and subnet mask for LAN connections or intended Modbus RTU mode (slave or master).

Amongst other things, consider the lengths of all cables, their routing, where electrical power for the unit can be sourced and any interfaces to the plant systems. Good and thorough planning is the basis for a successful installation and system implementation.

Important safety warnings:



In some countries, the installer must be certified to install equipment, such as an IMx.



Observe all site safety requirements including any that may be specific to the machines or areas where the installation work is being carried out.



Make sure that the power is disconnected before the installation begins.

2.2 Mounting the IMx-8/IMx-8Plus

When selecting a location for the IMx, including any outer cabinet, make sure to consider the following aspects:

- Position it to minimise vibration and to keep clear of high voltage equipment.
- Avoid unnecessary exposure to radiant heat or strong magnetic fields.
- Choose a location convenient for cable routing, to and from the cabinet.
- With unobstructed access and clearance for opening the lid.
- Suitable for a cabinet of this size and weight.
- That will accommodate all the required fixing points.

The IMx-8/IMx-8Plus have a blue, painted aluminium enclosure that is IP30 classified. To provide higher environmental protection, they should be mounted inside a cabinet: an IP65 classified cabinet can be provided by SKF. When using any outer cabinet, always use all the recommended fixings to mount and secure it.

For the SKF IP65 classified cabinet all the needed brackets, screws and gaskets are included. Refer section 3.4 for the enclosure and cabinet dimensions and fixing centres. When selecting a type of cable gland, parameters such as IP-classification and cable shielding connection must be carefully considered so as not to compromise the IP65 certification of the cabinet.



Figure 3 An IMx device DIN rail mounted in IP65 cabinet

Mounting the IMx-8/IMx-8Plus

Like the IMx-16 variants, the IMx-8/IMx-8Plus are designed to be DIN rail mounted, **Figure 3** above, shows an IMx device DIN rail mounted in a SKF IP65 classified cabinet.

The IMx is mounted using the DIN rail bracket attached to the rear face of the device, **Figure 4** below.



Figure 4 An IMx device DIN rail mounting bracket

To mount it on the DIN rail, first angle and offer it to the rail so that it is hanging on the upper part of the bracket and then rotate downwards and snap it in place with the lower part of the bracket.

To dismount first remove any connectors/wiring, then snap the lower part of the bracket from the DIN rail and lift it up a little. The IMx is now free to be lifted away from the DIN rail.

Careful attention should be paid to system grounding, earthing, as the IMx inputs are single ended and the common or return signal connections are at the same potential as the immediate IMx casing. This is isolated from the DIN mounting rail by the insulating mounting bracket and a green/yellow case earth lead is provided to enable a single deliberate connection to an instrument quality ground. In Figure 3 this can be seen terminating at the cabinet earth rail which should itself be isolated from the outer enclosure and connected only to an instrument ground, when one is available. The same ground should ideally be used for sensor cable screens so that the IMx system is grounded at only that one point.

In all cases avoid situations where the IMx ground connects to multiple ground planes as it is likely there will be differences in potential that could affect sensor signals. Similarly avoid sharing a ground used by machinery or other non-instrument grade equipment as their operation is likely to cause disturbances in the potential of that ground plane and if occurring would directly impact the IMx vibration readings and/or bias voltage measurements. Be aware that by their nature issues caused by non-ideal grounding schemes may be inconsistent and may only occur intermittently due to changes and operations elsewhere.

Where the IMx receives a signal from another system, for example load, speed or trigger signal, that other system will usually have a different ground reference and if its signals are not isolated at source, then a ground loop is created when the connection is made. To prevent this a signal isolator is needed between the external system and the IMx.

2.3 Power requirements

The SKF Multilog IMx-8/IMx-8Plus are designed to be powered from a 22 to 50 V DC supply, typical power consumption 10 W or lower. The supply to the device should be fused at 2 A, slow-blow, refer [3.2.2](#).

The incoming DC supply is isolated from GND (chassis).

Refer also to the important safety warnings on the following page.

SKF can supply a DIN rail mounting power supply under part number reference CMON 4137. This provides a 24V DC output suitable for an IMx-8/IMx-8Plus or an IMx-16/IMx-16Plus device and has a wide-ranging AC/DC input, see [3.2.2](#).

Note that the IMx-8/IMx-8Plus also support PoE (Power over Ethernet). This can be used as either a single or as a redundant power source, refer [2.5.3](#) and [3.2.2](#).

Important safety warnings:



To connect the IMx to the DC power supply, use cable of the following standard or better:

FKLK 3 x 1.5 mm² (16 AWG) or EKLK 3 x 1.5 mm² (16 AWG) or corresponding, with minimum voltage requirement 300 V and temperature range of -40 to +70 °C (-40 to +158 °F).



The power supply cable must be properly fixed to prevent strain, twist or movement. Always use an appropriate cable gland at entry to any outer enclosure and cable trunking or similar within it.



The system power supply must be provided with an appropriately positioned, clearly labelled full pole isolator or switch that can be used to isolate and lock-out power from the IMx unit during installation, maintenance or modification work. The switch must be labelled with an appropriate name, with clear identification of which IMx if multiple units are deployed. The On/Off position must be clearly marked.

The supply scheme should also incorporate suitable fusing or circuit breakers.



To prevent a hazardous event, power cable return and positive wires must be secured together with a cable tie (for example, a nylon cable tie CV-100K) close to the power connections, at the IMx.

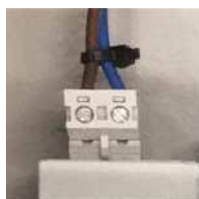


Figure 5 Example of securing positive and return wires with a cable tie

2.4 Site cabling considerations

When routing cabling to the IMx or the protective cabinet:

- Route and secure them at regular intervals, to minimise cable vibration
- Keep clear of high voltage equipment, their cables or strong magnetic fields
- Avoid exposure to or protect against radiant heat
- Choose a cable routing, that doesn't obstruct access to the IMx
- Avoid cable and sensor locations that interfere with routine maintenance

For cable/wire ends, bootlace ferrules or cord end terminals are recommended. The wire end should have a maximum cross section/gauge of 1.5 mm² / 16 AWG and an insertion length of approximately 10 mm.

Important safety warnings and guidance:



Only remove any cabinet blind plugs where it is necessary to accommodate a cable, an appropriate cable gland must then be used. Any unused cable entries must remain closed off.



Refer also to the instruction manual: 'Attaching Sensors for SKF Multilog On-Line Systems'. This provides examples of monitoring scenarios (typical number and location of sensors) as well as important guidance regarding the fitting of sensors.

2.4.1 Sensor cabling

An IMx-8/IMx-8Plus can connect to the following sensor types:

- Accelerometers, 2-wire, constant current
- Voltage output sensors, 2-wire, including externally powered accelerometers
- 4-20 mA outputs, 2-wire, load resistor must be fitted at IMx input terminals
- Speed sensors, 2- or 3-wire

If not otherwise specified, by a sensor supplier or similar, signal wiring to the IMx should use shielded, twisted pair 2 x 0.5 mm² (FKAR-PG 1 x 2 x 0.50 DUE 4002 or equivalent), with minimum voltage requirement of 300 V.

2.4.2 Ethernet cabling

It is recommended to use CAT5e/6 Ethernet cable, preferably SFTP (shielded and foiled, twisted pair). For grounding of shielded Ethernet cables, a single-point ground of the shield at the hub/switch end of the cable is recommended. Do not connect the Ethernet cable shield at the IMx.

Note that a CAT5e/6 twisted pair Ethernet cable has a maximum working distance of 100 m. If longer cable lengths are needed, fibre optic cables may be used along with appropriate media converters, (fibre optic to CAT5e Ethernet and vice versa).

When using fibre optics or PoE, suitable network hardware must be in place.

2.4.3 RS485 Modbus cabling

It is recommended to use a shielded twisted pair cable for the RS485 link, preferably with a characteristic impedance in the range 100 to 120 Ω . Many suppliers can provide cables specifically for RS485 and serial communications links.

2.5 SKF Multilog On-line System IMx-8/IMx-8Plus

2.5.1 Introduction

An overview of the capabilities of the IMx-8 and IMx-8Plus was given in section 1 and details of those follow.

2.5.2 Network configuration

Network configuration applies to the connection between the IMx device and @ptitude Observer. In general, this can be either via local LAN (Wi-Fi or hard-wired) and user network infrastructure or a mobile data connection, noting though that only the IMx-8Plus has all three connection possibilities, built-in.

All relevant parameters such as IP address/mode, IMx identification number, etc. are stored in a configuration file, then transferred to the IMx device local memory through the Online Device Configurator or the SKF Multilog IMx Manager mobile application.

All IMx devices must have a unique identification number between 1 and 9 999: unique within the database to which it is connected. In addition, the IP address and the port number for the server where the @ptitude Observer Monitor Service runs, will need to be specified.

'Out of the box', the IMx is configured as a DHCP-client to obtain its IP address automatically, if there is a DHCP-server available on the network to which it connects.

For detailed information, refer to the @ptitude Observer On-line Device Configurator User Manual. Help on using the various functionality of the SKF Multilog IMx Manager app is available in-app.

2.5.3 Ethernet connection

The IMx-8/IMx-8Plus have one 10/100 Mbit Ethernet port for connection to a local area network (LAN). The port has auto cable detection (crossover or straight through connection) and is available at an RJ-45 connector, **Figure 6**. Note that for the IMx-8Plus, the Wi-Fi and RJ45 interfaces share the same MAC address, as multiple network interfaces, **Figure 2**, cannot be enabled at the same time.

If the system is correctly connected to another network device, the green LED will illuminate and the yellow LED will flicker when there is traffic on the network.

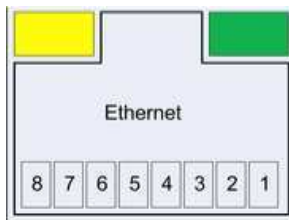


Figure 6 IMx RJ45 Ethernet connector

Both the IMx-8 and the IMx-8Plus support Power over Ethernet, PoE, <13 W. PoE can be used instead of or redundantly with the 'normal' 24 to 48 V DC supply.

- Note: The Ethernet switch/router used, must also support PoE.
- When using PoE, SKF recommends using a high-quality switch

As powered devices (PD), the IMx-8/IMx-8Plus support both mode A (power and data on same pairs) and mode B (power on spare pairs), connections in active or passive PoE installations. Refer to the relevant standards, IEEE 802.3af or IEEE 802.3at for further information.

2.5.4 Mobile data configuration

On an IMx-8Plus, the option to use mobile data instead of a LAN connection is, as discussed in **2.5.2**, a part of the function of the configuration file. The mobile data module supports auto switching between the various network types (2G/3G/4G). The module can work world-wide and provide connectivity to the @ptitude Observer software service, via a TCP connection. DNS lookup of server name and NTP time synchronisation, are supported.

Mobile data functionality requires an activated SIM card or eSIM. Wi-Fi and mobile data functionality require an external antenna to be provided. Note that when inserting a physical micro-SIM into the SIM card slot the orientation must be as follows:

- Contacts down and with the card notch across the right and outer edges, **Figure 7**.
- For orientation purposes, note the slot identification lettering 'SIM' is above the slot, 'Sys' is below the slot.
- Push the card in, by hand or by using tweezers, until a click is heard.



Figure 7 SIM card orientation

2.5.5 RS485 Modbus connections

The IMx-8/IMx-8Plus both have one, 2-wire, RS485 port. For this there are considerations related to grounding and bus termination, [Figure 8](#).

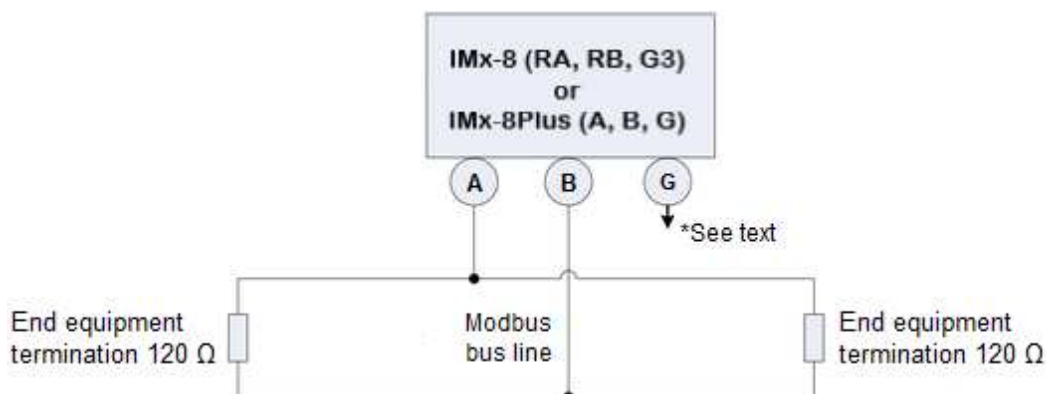


Figure 8 Modbus Bus Connection and End Termination

*G/G3 (Ground): Devices connected to the bus must have the same ground potential. When 'floating' equipment is connected to the IMx bus, the G/G3 connection can be used to ensure the same ground potential. Normally, all devices are connected to the same ground connection.



Important - To avoid ground loops, ensure that there is only one ground connection. The IMx device's G/G3 (Ground) connector can be used in cases where the connected equipment bus is floating.

If the IMx device is placed first or last in the bus chain, then an external bus termination resistor must be connected to it. Note that there is no built-in termination that can be activated by configuration.

An external resistor of 120 ohms is provided by SKF as well as double deck terminals to facilitate its installation. This resistor is colour-coded black, **Figure 9**.



Figure 9 120-ohm resistor for RS485, bus termination

For more information regarding RS485 and Modbus, refer to "Modbus for SKF Multilog On-line System IMx and SKF @ptitude Observer" and also the application note "General Modbus Protocol Considerations for IMx Devices". Also, refer to the tables and pictures in chapter 3.3, for a complete list of connections and their location on the device.

Note that the IMx does not provide fail-safe bias to the bus.

2.5.6 LED indicators

The IMx-8/IMx-8Plus have two LED indicators on their top end cap – so only visible when any outer cabinet is opened – a green LED for Power and a red LED for System, **Figure 10**:



Figure 10 IMx LED Indicators

While the main software is reading the configuration and setting up the system, the SYS LED is fast flashing at approximately four times per second. When the system configuration is complete, the SYS LED will be off, if it remains solid on, this indicates that the IMx is in an error state. In the latter case, contact TSG for advice and further information.

Note that there is a thirty second delay after the configuration period before the measurement results are provided, to ensure that the system is producing valid data.

The SYS LED also has a slow flash rate, at approximately once per second, the functionality of which is software configurable. By default this is turned off, but for example, it may be used to indicate sensor cable fault or cable fault from an external communication source (e.g. Modbus). For configuration details refer to the @ptitude Observer User Manual.

2.5.7 Connecting accelerometers (A1 to A8)

The SKF Multilog IMx-8/IMx-8Plus support 2-wire accelerometers on all 8 channels. The standard accelerometer power can be enabled/disabled by software configuration. Refer to the @ptitude Observer User Manual for further information.

Connect each accelerometer to the relevant input terminals on the appropriate analogue connector located on the bottom end cap of the IMx, refer [IMx-8](#) or [IMx-8Plus](#).

For example, [Figure 11](#), if using analogue channel A1, connect sensor output 1 (signal) to input A1 and sensor output 2 (common/return) to input G1.

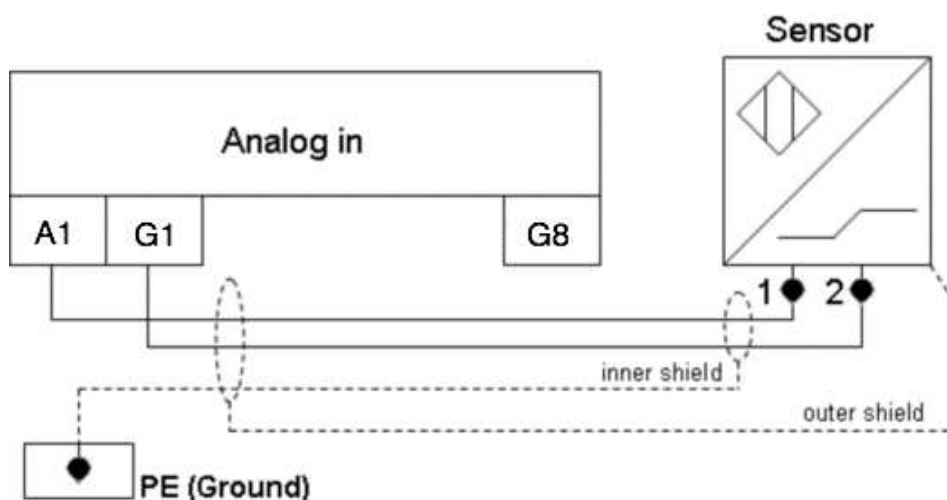


Figure 11 Example connection of an accelerometer to analogue input 1

Above, [Figure 11](#), illustrates a typical example where the accelerometer has an inner screen or shield (isolated from the sensor body – to be grounded at the IMx) and an outer braid, armour or shield (connected to the sensor body and grounded at the machine – to be left floating at the IMx).

2.5.8 Connecting voltage sources (A1 to A8)

For voltage sources, 2-wire unpowered sensors or 3-wire accelerometers that are externally powered, follow the guidance for accelerometers, in [2.5.7](#), to connect the signal and common/return lines but in this case, configure the sensor power off.

2.5.9 Connecting 4–20 mA signals (A1 to A8)

To connect 2-wire 4-20 mA signals, configure the sensor supply off: note the IMx does not power the loop. To convert the current value to a voltage that the IMx can measure, a load resistor must be used on the input to each channel that a 4-20 mA signal is connected to.

SKF provide 250-ohm load resistors for this purpose and double deck connectors to facilitate the installation. These SKF provided resistors must be used and are colour-coded blue, refer [Figure 12](#).

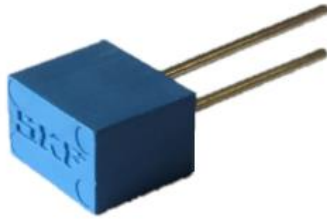


Figure 12 250-ohm resistor for a 4-20 mA signal

Note: All ground terminals (G1 – G8) of the analogue inputs are connected to each other, to secure a common ground level. As all channels are referenced to chassis/enclosure ground, take care to avoid ground loops!

2.5.10 Connecting tacho/speed signals (D1 to D2)

Connecting a tacho signal to the IMx allows an assessment of rotational speed of the monitored shaft and the operational state of the machine or train. Often a multi-event target is used as this enables a faster update of speed, but if needed, both vibration phase and speed data can be obtained by using a single event per rev target.

The tacho sensor will normally be mounted to detect the changing presence of a target. For example, a single event per rev target can often be arranged using either, an existing key or a key-way.

A sensor with suitable sensing range must be selected and gapped appropriately to accommodate any movement between sensor and target, that might occur. The IMx-8/IMx-8Plus support two-wire, three-wire PNP and pulse sources*.


*The digital input and trigger characteristics are specified in [3.2.4](#). Suitable pulse sources include, for example, a TTL like signal of 0 to 5 V and 50% duty cycle or other positive pulse sources up to 24 V. To ensure reliable triggering when using sensor/target systems that tend to produce shorter duration pulses with slower rise times, ensure that the pulse signal available at the IMx input comfortably crosses the trigger threshold and aim for pulse heights of 12 to 24 V, where possible.

The digital input connectors are located on the top end cap of the IMx, refer [3.3.1](#) or [3.3.3](#).

For each tacho input, 3-terminals are available:

- P Power for the sensor, refer [3.2.4](#)
- D Digital signal in
- G Common or return connection

By design, the IMx-8/IMx-8Plus supply power to both digital input channels, on terminals P1 and P2.

 *Sensor power at P1 and P2 is always enabled and cannot be controlled or configured by hardware or software. Trigger level and hysteresis are also fixed, refer specifications, [3.2.4](#).*

The sensor can be connected to the relevant digital input terminals as illustrated in the following diagrams, [Figure 13](#) to [Figure 15](#). Connect appropriately to the type of sensor being used.

Note that the different sensor types illustrated in these figures, are supported by all digital input channels; the channel shown in any particular figure is only an example.

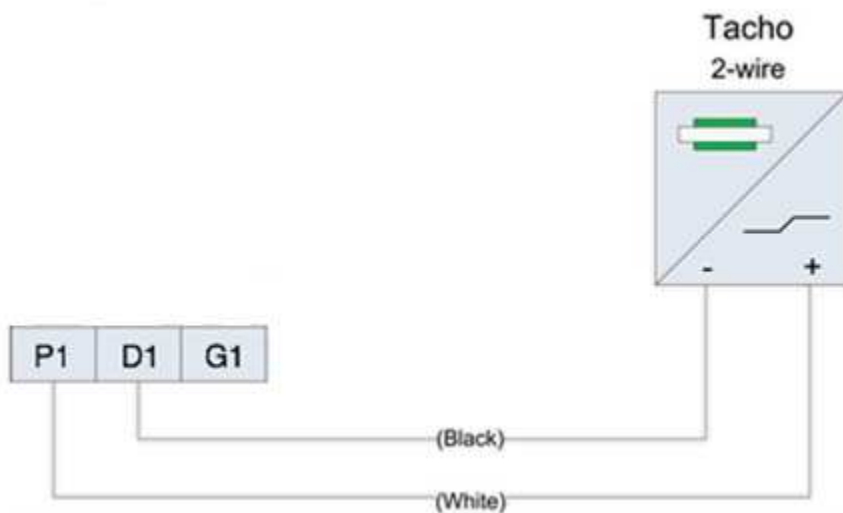


Figure 13 IMx powered, 2-wire sensor connected to digital input 1

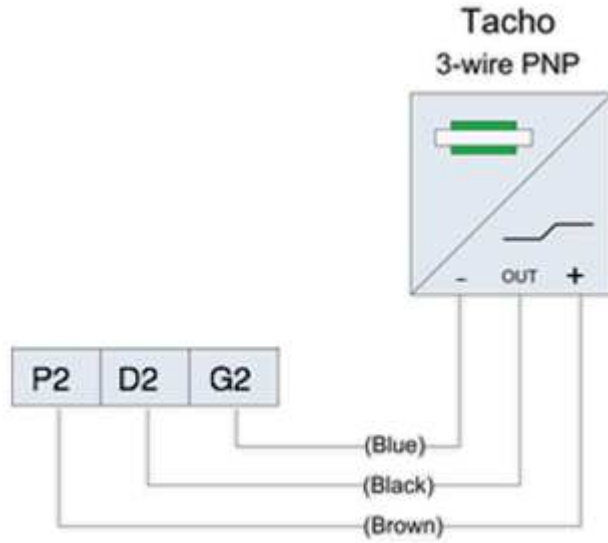


Figure 14 IMx powered, 3-wire PNP sensor connected to digital input 2

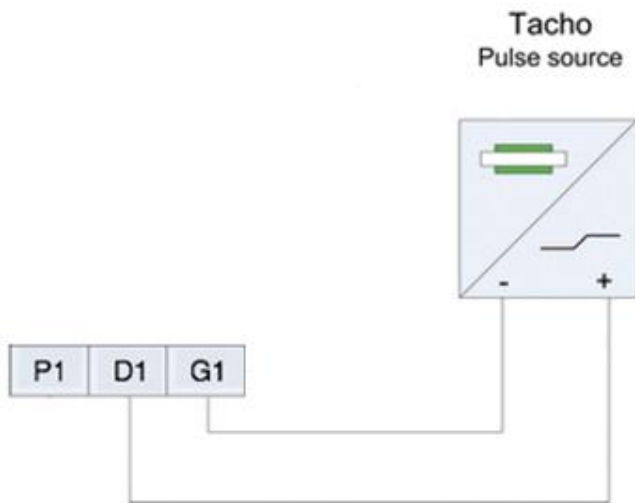


Figure 15 Unpowered or externally powered pulse source, 2-wire, connected to digital input 1

Table 3 Summary of typical connection arrangements for digital inputs and sensors

Sensor type	Wire colour	Wire function	Digital input
2-wire	White	+	P
IMx powered	Black	–	D
			G
3-wire PNP	Brown	+	P
IMx powered	Black	Output	D
	Blue	–	G
Pulse source			P
or TTL	(no standard)	+	D
External power		–	G

Note: Where it is required to cascade a single sensor signal to multiple digital inputs on the IMx, connect the appropriate D terminals, together.

2.5.11 Connecting relays

The IMx-8/IMx-8Plus each have three relay driver outputs that can be used for remote indication of System status, Warning (Alert) and Alarm (Danger), conditions. The output terminals for these are situated on the bottom end cap of the IMx, refer section 3.3. The general arrangement for connecting a relay is shown below, **Figure 16**.



Figure 16 Connecting a relay to the Status, RS, relay driver output

For each relay driver output, a relay coil can be connected across the relevant 24V and R'x' terminals. These R'x' terminals RS, R1 and R2 are low side drivers known as open collectors and when energised they 'complete the circuit' and power the coil.

The IMx-8/IMx-8Plus relay driver outputs make available +24 V DC power for this purpose up to a maximum current of 70 mA, shared across all relays connected. Ensure then, that any relays used have a coil resistance compatible with the minimums indicated below:

Table 4 Minimum relay coil resistances depend on the number of relay drivers in use

No. relays	Minimum coil resistance for 70 mA maximum demand
1	345 Ω
2	690 Ω
3	1 035 Ω

In operation, the system relay driver is energised only when the system status is OK, also indicated by the red SYS led being off. The system relay driver will be de-energised during power loss and when internal system faults have been detected: failsafe behaviour. The output will also be de-energised in case of a sensor cable fault or a cable fault from an external communication source, such as Modbus, if this behaviour is enabled in the system database.

Note that the system relay will ignore the Monitor connection and any time synchronisation errors and focus on errors that could disrupt alarms or warning detection.

The R1 and R2 outputs have a, fixed, non-failsafe behaviour, energised on alarm.

2.5.12 System commissioning and security

System commissioning and troubleshooting is supported by the SKF Multilog IMx Manager, software. This is an SKF app for both Android and iOS devices and is available from the relevant app store. The app provides features to manage and configure the IMx system and to visualise measurement data:

- Perform network configuration tasks.
- Select and download site specific machine templates.
- Create stand-alone measurement configurations. See also [2.5.13](#).
- Viewer; shows live data with bar charts, trends, time waveform and FFT.
Note: Viewer works in stand-alone mode only.

- View measurement configuration, as made via the @ptitude Observer client.
- Run a SAT (Site Acceptance Test) based on the installed sensors by using live charts and plots and generate a SAT Report with the relevant information.
- Generate a report that shows general IMx information, current IMx network and Modbus configuration including the company and user details.

- Update the IMx firmware.

To login to the app and access an IMx system, potential users must be invited to be users for that specific company*, (*in practice this may mean company, operating division, location/site, etc., depending on how registration is organised).

When a company first uses an IMx system, SKF will provide one or more user admin accounts to that company. Such admins will have sufficient rights, be aware of the procedure and be responsible for onboarding further company users via the SKF Enlight Centre, user management system. When onboarded in this way, an invitation email will be sent to allow the user to set up a password for their new account. If the invitation is received on a mobile phone where the SKF Multilog IMx Manager app is already installed it will open so as to complete the process, in-app.

In the first instance therefore, responsibility for providing new users with system access lies with the company's designated user admins. In case of difficulty or to initially setup a company user admin account, companies should contact their local SKF sales office or SKF Application Engineer, for assistance.

2.5.13 IMx-8/IMx-8Plus Stand-alone mode

The IMx-8/IMx-8Plus can be configured to be used in stand-alone mode. In this scenario, a connection to the @ptitude Observer Monitor Service is not required as data is not transferred for trending and analysis by the @ptitude Observer Client. Instead, measurement data and alarms are displayed in the SKF Multilog IMx Manager app.

Help on using the various functionality of the SKF Multilog IMx Manager app. Is available in-app.

2.5.14 Time synchronisation

Each IMx-8/IMx-8Plus device has a backup power capacitor which will maintain the time setting for approximately one week if the device is disconnected from power.

To correct or set/reset the time, use one of the following methods:

- Automatic time synchronisation

This method is preferable since the IMx will continuously synchronise the time with the computer that has @ptitude Observer Monitor Service running.

IMx devices use a standard (S)NTP time synchronisation protocol supported by the Windows Time service.

To activate time synchronisation, refer to the Time Synchronisation chapter in the "@ptitude Observer Installation Manual".

- Set time manually

Use the "Set time" function in @ptitude Observer which is found under the menu item "On-line", then "IMx/MasCon devices".

For IMx devices in stand-alone mode, the IMx Manager app will check and update the time to the time on the mobile device being used, whenever it connects.

2.5.15 Network data transfer

In operation, the IMx-8/IMx-8Plus is continuously monitoring the incoming sensor signals and, where available, can have access to GPS data and measurements shared by other systems via Modbus. It is connected to an @ptitude Observer Monitor Service and data is stored in that remote database as specified by predefined operating and storage conditions. These can include:

- Trend and dynamic data stored at fixed time intervals.
- Modified storage intervals while the measurement point is in alarm or based on detected differences between the last two measurements.

The amount of the data transferred across the network is normally small but is dependent on the configuration of the IMx. In case of temporary loss of the network connection, data is still measured and stored locally so that when the connection is re-established, collected data is transferred to the database.

The following are some examples of network load from an example configuration.

Trend data for 1 measurement point:

- Vibration measurement point 160 bytes per trend value
- Other measurement point, for example digital 50 bytes per trend value

FFT spectra for 1 measurement point:

- Number of lines x 2 bytes (2 bytes if FFT spectra include only amplitude, but 4 bytes if FFT spectra include both amplitude and phase)

Time waveform storage:

- Number of lines x 5.12 bytes per measurement point (2 bytes per sample)

For an 8-channel setup, the data rates can be illustrated as follows:

Setup:

- 8 vibration measurement points (3200 lines)
- With time waveform
- 1 speed (tacho) measurement point
- Store FFT spectra with time waveform 1 per day, trend data every 10 minutes and digital data every 10 minutes.

Calculation for data per day would be:

FFT spectra + time waveform + trend data + digital data

$$= (8 \times 3200 \times 2) + (8 \times 3200 \times 5.12) + (8 \times 160 \times 6 \times 24) + (50 \times 6 \times 24)$$

$$= 51200 + 133120 + 184320 + 7200$$

$$= 375840 \text{ bytes per day or } 375.8 \text{ KB per day}$$

$$= 11.3 \text{ MB/month (average of 30 days per month)}$$

In systems comprising large numbers of IMx devices, sharing network infrastructure, it can be advantageous to offset their storage times such that, where possible, their uploads are staggered.

2.5.16 Storage capacity

As noted in the specifications, each IMx-8/IMx-8Plus device has 4 GB effective flash, non-volatile, storage used for the following:

- 1 GB for trend and dynamic data:
 - Depending on the measurement configurations and data storage schedule configured, the data could be buffered for weeks up to years.
 - When the buffer gets full the oldest data is discarded – first in first out.
 - Speed and temperature data use half the space of vibration data.
- 1 GB for event capture and run cycle data:

- The number of events that can be stored depends on the number of channels used, number of samples per channel, number of speed pulses, internal flash sector alignment of data and additional data provided with the capture.
 - For a maximum sized capture, i.e. 8 channels, 10 kHz, 60 seconds, the buffer is capable to hold at least 30 captures. This scales with the number of samples in a capture, i.e. if number of channels or samples/channel is halved then the capacity for the number of captures stored is doubled.
 - When the buffer is full, no new captures will be triggered until there is enough space to store a new capture (when at least one capture has been uploaded to the server).
- 2 GB reserved for future development/needs

2.6 Hardware Maintenance

The IMx-8/IMx-8Plus hardware, i.e. IMx device and its associated sensors, are virtually maintenance free, though a yearly inspection of all installed equipment is advised.

The IMx device does not need to be opened for hardware maintenance or inspection, in case of suspected hardware failure; replace the faulty device (unit replacement).

Good practice is to use the IMx Manager app to generate and compare annual SAT (Site Acceptance Test) reports.

2.6.1 Performance over Time

No significant performance degradation over time, is expected for the IMx hardware.

2.7 Mobile data/Wi-Fi antenna (optional)

For an IMx-8Plus, this combined mobile / Wi-Fi antenna is suitable for mounting on/through an outer enclosure or cabinet.

It has a circular footprint and the integral cable is pre-terminated in appropriate connectors for the LTE 1, LTE 2 and Wi-Fi connections on the IMx-8Plus, top end cap, refer section [3.3.3](#).

Further technical details of this antenna can be found in [3.6](#).

2.8 GPS module (optional)

An external GPS module is available as an option. When fitted, GPS data can be requested by the IMx-8/IMx-8Plus, via Modbus RTU, over the RS485 2-wire connection. On this interface the IMx is the master device and the GPS module, the slave device.

The GPS module is connected to the IMx, top end cap, refer Table 4 below and section [3.3.1](#) or [3.3.3](#).

Table 5 GPS module connections to the IMx-8/IMx-8Plus

Wire colour	Description	IMx terminal
Brown	GPS module power	Use any available 'P'
Black	RS485 A	RA or A
White	RS485 B	RB or B
Blue	Module 0V	G3 or G
Grey	Not used	–

GPS module green flashing LED: power on, amber flashing: Modbus activity

The IMx to GPS module RS485 link, doesn't requires a termination resistor.

Refer also to [2.5.5](#), for general information on RS485 Modbus connections.

2.9 Troubleshooting

2.9.1 Introduction

This section is intended as an aid to fault finding, on an IMx-8/IMx-8Plus system. It is designed for instrumentation engineers and others with sufficient knowledge of electrical troubleshooting including safe working procedures, in electronic systems powered by 22 to 50 V DC*. Be aware that invasive troubleshooting may cause changes in alarm or channel status in the IMx and any interconnected systems.

*Note that the power supply to the system, for example where an optional CMON 4137 power supply is being used, may be higher.

Whilst striving to provide information that is as accurate as possible, SKF cannot be held responsible for any injury or damage to persons or material that occur in the interpretation of or due to actions taken based on, information in this document.



The product warranty will be invalidated if the IMx device warranty seals are broken, if that unit has been opened or if incorrect connections have been made that expose any sub-system/circuit to voltages above their operational rating.

Installation errors that require the involvement of SKF personnel to rectify, may incur additional charges.

2.9.2 Rescue Button

The IMx-8/IMx-8Plus have a rescue button that sets the device temporarily in maintenance mode without a measurement configuration. This mode is used to support troubleshooting and testing without the need to erase configuration and data.

The rescue button is designated 'Sw' and is accessible via the hole in the top end cap, refer [3.3.1](#) or [3.3.3](#).

To enter maintenance mode, gently press and hold the rescue button as follows:

- During IMx start-up, press and hold for about 15 seconds
- During IMx normal operation, press and hold for about 2 seconds

During maintenance mode, the user can:

- Update IMx-8/IMx-8Plus network settings
- Delete a configuration that is causing problems for software/firmware
- Delete the configuration to discard buffered data after rebooting
- Update firmware

Notes:

1. The Online device configurator (OLDC) and the IMx Manager App can still access the IMx via serial cable and Bluetooth respectively, regardless of IMx network settings.
2. During maintenance mode, no measurement data is recorded and the upload of unsent data stored before entering this mode will resume after restart.
3. If troubleshooting TCP communication note that after the IMx has rebooted into maintenance mode, it will listen for an incoming connection on port 1000 using the existing IMx network settings but whilst in this mode it will neither initiate a connection to nor get a connection from, the @ptitude Observer monitor, server.

If there is no activity for 60 seconds, the IMx will automatically exit maintenance mode and reboot using the stored measurement configuration.

2.9.3 Sensor circuits

The IMx Manager SAT test functionality can be utilised for basic sensor and cable troubleshooting, by observing the available measured values and comparing to expected results for that sensor type and current operating condition. If the machine is stopped, it may be possible to tap an accelerometer, for example, to test for a response. If such troubleshooting steps are inadequate, a full measurement or output circuit, loop test may be required. Note that it may be necessary to temporarily disable the cable check function for the channel under investigation, to get a measurement value during tests.

Possible causes for a 'non-responsive' sensor include:

- Cable damage, with an open or short circuit in the sensor cable
- Miswiring
- Incorrect configuration, for example: analogue sensor power enable
- Sensor fault
- Hardware fault in IMx device
- 4-20 mA only: Incorrect fitting of load resistor
- Tacho only: Speed signal 'too weak'/impedance too high for the IMx

In addition to, most of, the above, where the sensor generates a higher than expected or widely varying signal, consider also the following possible causes:

- Incorrectly mounted or loose sensor
- Excitation of sensor mounted resonance
- Signal disturbance due to external noise, for example RFI
- A grounding issue

Deeper troubleshooting requires the use of suitable test equipment, minimum being a digital multimeter (DMM).



When using test equipment to measure within 'electronic control circuits' such as sensor wiring, be aware that even 'simple' equipment such as a DMM measuring DCV can in some circumstances significantly alter the circuit behaviour. Be particularly cautious of using instruments that have a 'low impedance measurement function to simultaneously test for voltage or continuity' and ensure the DCV measurement is being made in a high impedance mode.

2.9.3.1 Checking vibration channels

The following flow steps can generally be used to troubleshoot a 2-wire accelerometer that is non-responsive. It is based on checking for the presence of a Bias Output Voltage (BOV) in an acceptable or expected range.

1. Identify the input terminals where the channel in question is connected to the IMx and measure the DC voltage between the sensor wires at the terminal block using a digital voltmeter.
2. Is the measured voltage within the expected normal working range? For a typical accelerometer this would be 8 to 12 V DC.

NO: Skip to step **3**.

YES: The cabling to the sensor is probably OK and the sensor interface to the IMx is normal. If the sensor output signal is still perceived as incorrect, then check the transducer mounting and try substituting the sensor.

- a. Did the fault remain after checking the mounting and changing the sensor?

NO: If substituting the sensor cleared the fault then the sensor was defective and should be replaced.

YES: The fault may be in the analogue input section of the IMx device. Contact TSG for advice and further information.

3. Is the voltage close to zero, typically $< \pm 0.5$ V?

NO: Skip to step **4**.

YES: Now, verify that the voltage rises to normal open circuit voltage, about 24 V DC, when one of the sensor wires is disconnected from the terminal block of the IMx device.

- a. Did the voltage rise to normal open circuit voltage?

NO: The IMx is not providing sensor power. Check that the IMx is correctly configured to supply sensor power for this channel. If

properly configured, then the IMx device may be damaged. Contact TSG.

YES: Continue.

- b. The fault is in the sensor or its cable. Go to the sensor and disconnect the cable at this end. Reconnect the cable on the IMx terminal block and again measure the voltage across the two terminals. Does the short circuit remain, with the voltage close to zero?

NO: The sensor is defective. Replace the sensor.

YES: The sensor cable or contact/connector, has a short circuit and requires repair/replacement.

4. Is the voltage close to the open circuit voltage?

YES: There is an open circuit in the cable or the sensor is damaged. Skip to step [5](#).

NO: If the voltage appears to be neither within the normal working range, close to zero nor close to the open circuit voltage, then the fault is an unusual one. First, recheck that the DCV measurement was correctly carried out, then contact TSG for advice.

Remaining faults can be due to a damaged sensor or a damaged IMx input circuit. First, disconnect one pole of the sensor cable and measure the open circuit voltage to verify whether the open circuit voltage is normal (about 24 V DC). If it is normal, then the fault is probably in the sensor, otherwise the fault is likely in the IMx.

5. Disconnect the connector from the sensor and short circuit the pins in the sensor contact, then re-measure the voltage on the IMx terminal block. Did the voltage sink to close to zero (<0.5 V)?

NO: There is an open circuit in the cable. Repair/replace the cabling.

YES: There is an internal open circuit in the sensor or there is a bad/oxidised contact. First, try cleaning the contact before replacing the sensor connector and checking again.

2.9.3.2 Checking 4-20 mA channels

In case of unexpected measurement values, check the channel configuration especially scale, zero level and choice of engineering units.

Confirm that the signal applied is a 4-20 mA and not for example 0 to 20 mA. Also, be aware that some 4-20 mA devices will set their outputs low (typically 2.9 mA) or high (typically 21 mA) to signal a sensor/circuit failure. In such circumstances the output current will be different to the source, measurement value.

Channels where the input signal is 4-20 mA, should have an SKF provided, 250-ohm load resistor fitted, refer section [2.5.9](#).

1. Identify the input terminals where the channel in question is connected to the IMx and verify that the correct resistor is installed. If all appears OK, measure the DC voltage (V) across the channel input using a digital voltmeter. Is the voltage within the range 0.5 to 5.5 V DC?

NO: If the correct resistor is being used, the current is outside the expected range for a 4-20 mA signal.

If the measured voltage is below the voltage range, continue to step **2**.

If the measured voltage is above the voltage range, replace with another load resistor and recheck. If there is no change, check that it is a 4-20 mA current signal that is being applied to the input, as a problem external to the IMx is most likely indicated.

YES: The current is reasonably within the expected range for a 4-20 mA signal. Estimate the equivalent current by calculating as follows:

$$\text{Equivalent current (mA)} = (V * 1000) / 250$$

Does this agree, approximately, with the mA value it is believed the external circuit is transmitting?

NO: Continue to step **2**.

YES: The circuit and connections appear OK, double check the channel assignment and its configuration and if no reason for the measurement error is found, contact TSG for advice.

2. Disconnect one signal wire from the terminal/connector and recomplete the circuit using a DMM set in current measurement mode.

Does the measured mA current reasonably agree with the expected value?

YES: Problem appears to be related to the IMx (hardware, installation or configuration). If on rechecking the aspects advised above, no reason for the measurement error is found, contact TSG for advice.

NO: Problem appears to be related to the signal loop connected to the IMx input. Continue with further checks on the source equipment and the integrity of the interconnecting cables.

2.9.3.3 Checking analogue input channels

Analogue inputs refer to 'other voltage inputs', not accelerometers or 4-20 mA signals. In case of unexpected measurement values, check the channel configuration especially scale, zero level and choice of engineering units. Ensure that the cable check function enable/disable setting is appropriate for the signal applied.

1. Identify the input terminals where the channel in question is connected to the IMx and verify that the connections are correct. If all appears OK, measure the DC voltage (V) across the channel input using a digital voltmeter. Is the voltage as expected, for the connected signal, type?

NO: Continue to step **2**.

YES: The sensor circuit and cabling appear essentially OK, double check the channel assignment and its configuration. If the measurement is DC and no reason for the measurement error is found, contact TSG for advice.

If the measurement is AC, it may be necessary to substitute another sensor or simulate a signal, to effectively test the loop.

2. Disconnect both signal wires from the terminals/connectors and recheck the DC voltage across them. Is the voltage now as expected, for the connected signal, type?

NO: Problem appears to be related to the signal loop connected to the IMx input. Continue with further checks on the source equipment and the integrity of the interconnecting cables.

YES: Problem appears to be related to the IMx (hardware, installation or configuration) or to a compatibility issue with the sensor. If on rechecking the aspects advised above, no reason for the measurement error is found, contact TSG for advice.

2.9.3.4 Checking digital channels

Effective troubleshooting for tacho signals will likely require a handheld/portable oscilloscope or DMM with oscilloscope capabilities noting that a battery powered unit is preferred. It will be hindered if the IMx cannot be accessed when the speed signal is active.

1. Check the sensor installation, the security of the mounting, the gap to the target and the differential gap between target and no target, conditions. Ensure these are acceptable for the sensor being used and that the sensor output will cross the trigger threshold specified in [3.2.4](#).
2. Identify the digital input terminals where the channel in question is connected to the IMx. Confirm that the wiring is correct for the sensor type in use, see also [2.5.10](#).
3. Is sensor power, supposed to be, supplied by the IMx?

NO: Skip to step [4](#), dynamic, oscilloscope, checks

YES: Measure the DC voltage between the P (power) and G (ground) terminals using a digital voltmeter.

- a. Is the measured voltage as expected, typically, 24 V DC?

YES: Skip to step [4](#), dynamic, oscilloscope, checks

NO: Disconnect the sensor cable from the P (power) terminal and recheck the voltage.

- b. Is the measured voltage now as expected, typically 24 V DC?

YES: Double check that the sensor is compatible, especially that the sensor current requirement is within the capability of the IMx.

To confirm a sensor/cable fault: if available try substituting an alternative sensor or confirm that in a known working installation the same type of sensor does not 'load' the IMx sensor power in this way.

NO: The test suggests a fault in the IMx device, contact TSG for further advice.

4. When a speed signal is expected to be present, observe the signal at the D (digital) and G (ground) terminals on an oscilloscope. Is the expected pulsed waveform present?

NO: Cable, sensor or installation issue. If practicable replace the sensor by a signal source to test most of the measurement chain (excluding sensor/target) and to verify the cable integrity.

YES: Verify that the signal has an appropriate voltage range and pulse height to allow the IMx to trigger, refer [3.2.4](#). Check the software is correctly configured for this digital input. If no root cause is identified, contact TSG for further advice.

In verifying the signal be sure to also examine it at a sufficiently high sample rate such that the detail of an individual pulse can be checked. In particular look for any indication of a 'double pulse' where a second trigger occurs in quick succession to the first as this would likely cause it to be rejected as being an invalid speed signal. Where the sensor is powered by the IMx, this has been known to occur if the sensor initially tries to draw excessive current on the leading edge of the event, i.e. the maximum peak demand of the sensor is too high. In such a case the reaction of the IMx power supply protection circuitry may result in the sensor pulse momentarily dropping below the trigger threshold before recovering, so generating a double pulse. If this is suspected, to confirm and correct the situation, power the sensor from an external source of sufficient capacity.

If a speed channel 'works' but gives an incorrect speed, check that the correct pulses (number of pulses per rev) have been configured, in the software.

2.9.4 Relay driver outputs

1. Identify which relay driver output of which IMx, is being used for the alarm under investigation, the expected alarm state and consequently whether it is expected that the relay coil is being energised or not.
2. Is it expected that the coil be energised?

NO: Skip to step [4](#).

YES: Measure the DC voltage at the relay coil terminals, using a digital voltmeter.

- a. Is the measured voltage as expected, approximately 24 V DC?

YES: Skip to step [3](#).

NO: Disconnect the relay wiring at the IMx and recheck the voltage, across those terminals.

- b. Is the measured voltage now as expected, approximately 24 V DC?

YES: Double check that the relay is compatible with the IMx, especially that the relay current requirement is within its capability.

Otherwise, a relay or cable fault is indicated.

NO: Check again that the correct relay output is being tested and that the configuration is correct. If so, the test suggests a fault in the IMx device, contact TSG for further advice.

3. Disconnect the relay output wiring and using a DMM, measure resistance across the relay output terminals. Observe the reading and disconnect either of the connections to the relay coil. Has the reading changed, from an open to a low resistance or vice versa?

NO: A relay fault is indicated.

YES: The IMx and relay sub-system seems as expected. Check the downstream system components: that the correct relay output contacts are being used, the power supply on the relay contact side, the 'detecting' device, etc.

4. Measure the DC voltage at the relay coil terminals, using a digital voltmeter. Is it approximately 24 V DC?

YES: Check again that the correct relay output is being tested and that the configuration is correct. Check also that this relay is wired to the correct IMx, relay driver output.

If so, the test suggests a fault in the IMx device, contact TSG for further advice.

NO: The IMx relay driver output seems as expected.

Check the downstream system components: that the correct relay output contacts are being used, the power supply on the relay contact side, the 'detecting' device, etc.

2.9.5 RS485 Modbus RTU communications

Communications can be affected either by physical, typically wiring, issues for the RS485 bus and/or configuration issues related to the Modbus RTU protocol.

Physically these are, differential, 2-wire interfaces with the two wires marked as A and B. Whilst it is normal to connect 'A to A' and 'B to B' it is not unheard of, to have inconsistent marking on different manufacturer's equipment. So, when interfacing to 'new' equipment and experiencing problems it is worthwhile to test with the connections swapped, as no damage will be done by operating with swapped RS485 connections. Bear in mind if there are multiple issues, say a configuration problem and an incorrect connection, all issues will have to be solved before a

communications test will be successful. Pay attention also to bus termination and grounding, as described in section [2.5.5](#).

When using the interface, the connection will be between a single master and one – or sometimes more – slave devices and each slave must have a unique address in the range 1 to 247. The master device initiates all communications and the slave device only ever responds, if asked to send a reply. Incorrect addressing, a mismatch between the address at which the master understands the slave resides and that actual address, will result in unanswered messages.

The Modbus RTU protocol exchanges binary data across the bus. Detection of message start and message end rely on certain bit state combinations and inter-message minimum pauses during which there is no communications traffic. For each device on the bus to correctly interpret these from the electrical patterns on the bus requires an equal understanding of the bit allocations and the bit rate or baud rate, being used. Commonly an arrangement known as 8-N-1 (eight data bits, no parity bit and one stop bit) transmitted at 9 600 or 19 200 bits per second are used. If devices are differently set, by configuration or otherwise, communications will fail.

For further information on RS485 and Modbus RTU, [refer to](#) the documents listed.

2.9.6 Connections to Monitor

The status of the connection to the @ptitude Observer Monitor server (connected or not) is reflected by bit 14 of the Modbus register 30029 (refer to the Modbus for SKF IMx and @ptitude Observer user manual, part number 15V-090-00051-100). This can be especially useful to verify current connection status in any applications, such as mobile or marine, where a continuously available connection is not expected.

In troubleshooting connections to Monitor, especially a loss of connection rather than initial commissioning, consider first the following aspects:

- That the PC hosting the Monitor service is currently operational
- It can access and write to the database
- If the status of the Monitor software is uncertain, try restarting the PC
- Check for issues on the network infrastructure, from IMx to that PC
- Any recent IT changes that may have impacted the system such as modifications to a firewall, security, etc.

In a multi-IMx system indications of where the fault may lie can be inferred from knowing how many and which IMx have problems connecting.

3 Product specifications

3.1 Product labelling

On the front face of the case a manufacturing data label, [Figure 17](#) or [Figure 18](#), confirms product and company information, CE marking, WEEE marking and RoHS compliance. The QR code contains the product information shown alongside it.

Note that for the IMx-8Plus, the same MAC address applies to whichever of the local network interfaces is enabled, RJ45 or Wi-Fi.

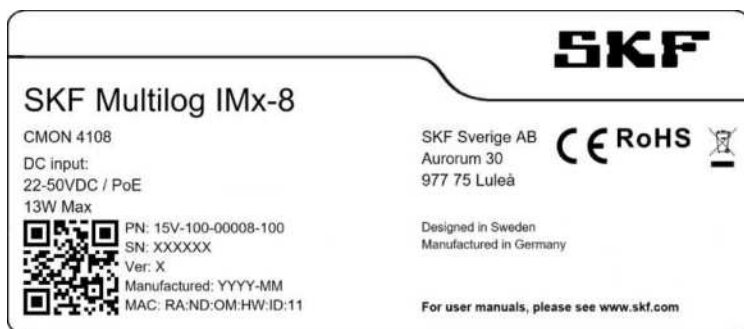


Figure 17 Manufacturing data label – IMx-8 example

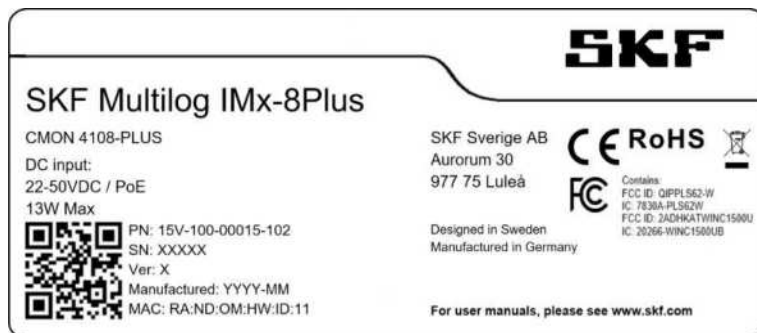


Figure 18 Manufacturing data label – IMx-8Plus example

Refer to the detailed product specifications, [3.2.12](#) and [3.2.13](#), for a complete listing of compliances and certifications.

3.2 SKF Multilog On-line System IMx-8/IMx-8Plus

3.2.1 Environmental

- DIN rail mounting (35 mm x 7.5 mm 'top hat' DIN rail)
- Size (H x W x D): 172 x 104 x 40 mm (6.8 x 4.1 x 1.6 in.)
 - Height (H) across, width (W) along and depth (D) above the rail
 - Height does not include terminal connectors and Bluetooth dongle
 - Depth does not include the DIN rail mounting bracket
- Device weights: IMx-8: 465 g (1.03 lb) and IMx-8Plus: 580 g (1.28 lb)
- IP ratings:
 - IP30, for the DIN rail mounted enclosure
 - IP65, for the wall mounted SKF cabinets
 - IP67, IP69K and IK09 for the optional mobile data/Wi-Fi antenna
 - IP69K for the optional GPS module
- Temperature ranges
 - Operating: IMx-8: -40 to +70 °C (-40 to +158 °F)
IMx-8Plus: -40 to +65 °C (-40 to +149 °F)
 - Storage: -50 to +85 °C (-58 to +185 °F)
- Humidity: 95% (relative) non-condensing
- Measurement category II
- Pollution degree 2
- Maximum altitude: 2 000 m (6 562 feet)
- Vibration tolerance:

4 – 13.2 Hz	1 mm
13.2 – 100 Hz	0.7 g

 Number of axes: 3 mutually perpendicular

3.2.2 Power

- 10 W or less typical, 13 W maximum
 - Power over Ethernet (PoE) max 13 W (nominal voltage 48 V) or
 - 24 to 48 V DC nominal (range 22 to 50 V DC)
 - Supply fuse rating: T2AL (2 A slow blow)
 - PoE and 24 to 48 V DC can be used redundantly
- Optional CMON 4137: DIN rail mounted power supply, suitable for all IMx-8/IMx-16 devices including 'Plus' versions
 - Universal AC input: 100 to 240 V AC (nominal)
 - DC input range: 120 to 370 V DC
 - Dimensions: 74 x 54 mm (2.91 x 2.13 in.) across/along the rail

3.2.3 Analogue inputs

- 8 analogue single ended inputs referenced to chassis/enclosure ground
 - Input range ± 25 V
 - Supports 2-wire constant current sensors and/or voltage signals
 - 4-20 mA signals accepted (required load resistor to be fitted at input)
- Software controlled power supply for standard accelerometers

- 4 mA constant current
 - On/off control, individual per channel
- Impedance >100 k Ω
- Analogue input voltage range without damage to the IMx is ± 28 V

3.2.4 Digital inputs

- Two digital inputs, non-isolated, referenced to chassis/enclosure ground
 - Accepts positive voltages: up to 24V
 - Contact SKF for advice if the digital signal may exceed +27 V
 - Trigger level: 2.9 V, Hysteresis 0.1 V, Impedance 1.6 k Ω
- Can interface to:
 - Common 2- or 3-wire speed sensors
 - On-line oil debris sensor (Gastops MetalSCAN)
- 24 V DC sensor supply, maximum, peak demand up to 30 mA per channel
 - Peak current demand from the sensor should be no greater than the limit stated, even if the average demand (e.g. per shaft rotation period) is less

3.2.5 Digital outputs

- Three relay driver outputs
- System status (RS), Warning and Alarm (R1 and R2)
- 24 V DC at 70 mA maximum, available (all, not per relay)
- Minimum individual coil resistances: 345 Ω (1 relay), 690 Ω (2 relays) and 1035 Ω (if 3 relays are in use)

3.2.6 Analogue measurement

- 24-bit A/D conversion
 - Enables continuous data capture without gain or AC/DC switching
- One A/D converter for each channel
 - Simultaneous measurements of all 8 channels (no multiplexing)
 - Different channels can operate at different sampling rates
- Maximum sampling frequency: 102.4 kHz (though lower for event capture)
- Frequency range: from DC to 40 kHz
- Dynamic range: 120 dB
- Signal to noise ratio: 90 dB
- Crosstalk rejection: -110 dB (at 1 kHz)
- Amplitude accuracy: $\pm 2\%$ (up to 20 kHz), $\pm 5\%$ (20 to 40 kHz)
- Phase accuracy: $\pm 3^\circ$ (up to 100 Hz)
- Automatic detection of sensor fault and cable fault (software configurable)

3.2.7 Digital measurement

- Frequency range: 0.016 Hz to 20 kHz (*1 cpm to 1.2 Mcpm*)
 - Note that when used for order tracking, the maximum pulse frequency is 2.5 kHz
- Frequency accuracy: 0.05% of measurement value

(typically, 0.01% up to 2.5 kHz)

- Pulse counting
- Configurable pulses per rev.
 - The product of pulses per rev and rotational speed is subject to the maximum frequency range, limitation

3.2.8 Signal processing

- Event capture mode
 - Data storage on time, associated measurement value or alarm state
 - Run cycle mode (repeated or cyclic captures)
- Time waveform
- Vector analysis with circular alarms
- SKF enveloping filters I, II, III, IV
- FFT: 100 to 6 400 lines
 - Integration/Differentiation in the frequency domain
 - Window function: Hanning
- Customer formulated mathematical equations
- Dynamic alarm levels, active range determined on multiple parameters
- Data storage on time, event or alarm condition
- Detection of sensor and cable fault
- Watchdog and self-testing

3.2.9 Interfaces

- The IMx-8 incorporates only an Ethernet, RJ45, interface. For the IMx-8Plus, the mobile data and Ethernet interfaces are alternatives and cannot be used concurrently
- Mobile data (IMx-8Plus only)
 - LTE (4G) and legacy 2G/3G networks
 - Refer to [3.6](#) for details of the frequencies/standards supported
 - Auto switching between network types
 - Dedicated antenna connections provided
 - LTE 1/2 SMA female
 - DNS lookup and NTP time synchronisation are supported
 - Firmware configurable support for micro-SIM or eSIM
 - Micro-SIM card holder (top end cap)
- Ethernet:
 - RJ45
 - 10/100 Mbit/s TCP/IP (one port)
 - Auto MDI-X cable detection
 - Support for PoE, refer [3.2.2](#) and [2.5.3](#)
 - Wi-Fi (IMx-8Plus only)
 - 802.11n
 - 2.4 GHz band, channels 1 to 11
 - Open or secured networks, WPA2-PSK
 - Dedicated antenna connection provided: Wi-Fi SMA female
 - Refer also to [3.6](#) for antenna specifics

- IMx-8Plus: RJ45 and Wi-Fi share a MAC address, not for simultaneous use
- Support for Modbus TCP/IP (master and /or multiple slave instances)
- Support for IEC 61850 (communications networks in a sub-station environment)
- GPS location data provided by an external GPS module (optional)
 - Communication by Modbus RTU (see RS485 below)
 - GPS with support for Satellite-Based Augmentation Systems
 - Antenna is integral to the GPS module
- RS485 2-wire serial interface, Modbus RTU
 - 'RS485' (top end cap) for Modbus sensor, GPS module, etc.
- USB Type-A (host interface) – fitted with an SKF Bluetooth dongle
 - Bluetooth v4.0 Low Energy
- USB Mini-B (device service interface)
 - Always use an isolated USB cable, CMON 4133 Mini USB cable (isolated), to avoid ground loops when connecting to mains powered equipment

3.2.10 Storage capacity

- 4 GB effective flash memory configured for pSLC (pseudo single level cell) mode for higher reliability than normal MLC (multi-level cell) mode

3.2.11 Data processing memory

- 64 MB RAM for data processing

3.2.12 IMx-8 certifications

- Calibration traceable to BIPM
- CE certified in compliance with 2014/30/EU
- EMC immunity in compliance with EN 61000-6-2:2005
- EMC emission in compliance with EN 61000-6-4:2007/A1:2011
- DNV GL Renewables certificate – valid only when the IMx-8 DIN rail version is mounted in an IP65 cabinet in a wind turbine that is built according to the DNV GL wind turbine type approval
- DNV GL Marine type approval
- ABS Marine type approval
- Lloyd's Register Marine type approval

3.2.13 IMx-8Plus certifications

Note that all IMx-8Plus certifications are pending.

- Calibration traceable to BIPM
- EMC, when the IMx-8 or IMx-8Plus is placed inside a metal outer enclosure:
 - EN/IEC 61000-6-4, EN 50121-3-2, ETSI EN 301 489-1, -17
- CE certified:
 - 2014/53/EU (RED) including ETSI EN 300 328, ETSI EN 301 908-1
- FCC certified (North America):

- FCC Part 15B 107/109, ICES-003, FCC Part 15C 15.247 (d), RSS-447 sect. 5.55.5
- FCC Part 22H 917/RSS-132 sect. 5.5, FCC Part 24E 328/RSS-133, FCC Part 25.53(h)/RSS-139

FCC compliance statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference in an industrial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and uses in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Certification detail for the cellular module

FCC Identifier: QIPPLS62-W

Industry Canada Certification Number: 7830A-PLS62W

Granted to Gemalto M2M GmbH

* The integration is limited to fixed or mobile categorized host devices, where a separation distance between the antenna and any person of min. 20 cm can be assured during normal operating conditions.

Certification detail for the Wi-Fi module

ATWINC1500-MR210UB

United States/FCC ID: 2ADHKATWINC1500U

PRODUCT SPECIFICATIONS

SKF Multilog On-line System IMx-8/IMx-8Plus



Canada:

IC: 20266-WINC1500UB
HVIN: ATWINC1500-MR210UB
PMN: ATWINC1500-MR210UB

*The antenna used with this transmitter must be installed to provide a separation distance of at least 6.5 cm from all persons.

Scan region: channels 1-11 are supported.

- DNV GL Renewables certificate – valid only when the IMx-8Plus DIN rail version is mounted in an IP65 cabinet in a wind turbine that is built according to the DNV GL wind turbine type approval
- Marine type approvals
 - DNV GL
 - ABS
 - Lloyd's Register

BIPM: International Bureau of Weights and Measures

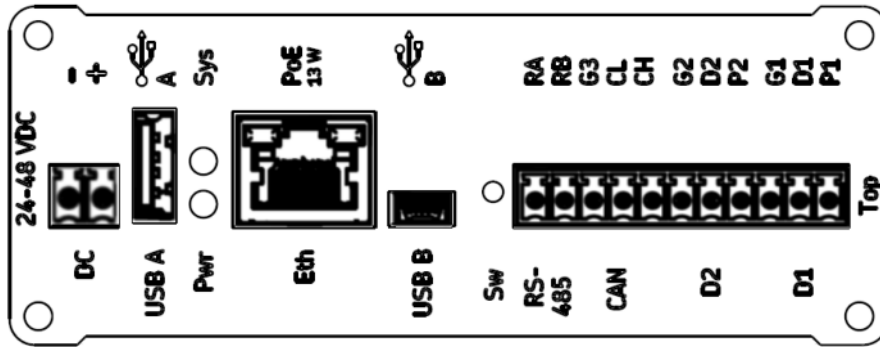
3.2.14 Quality control

- SKF Sverige AB, Luleå is ISO 9001:2015 certified

3.3 Connector details

3.3.1 IMx-8 top end cap

Table 6 IMx-8 top end cap connections



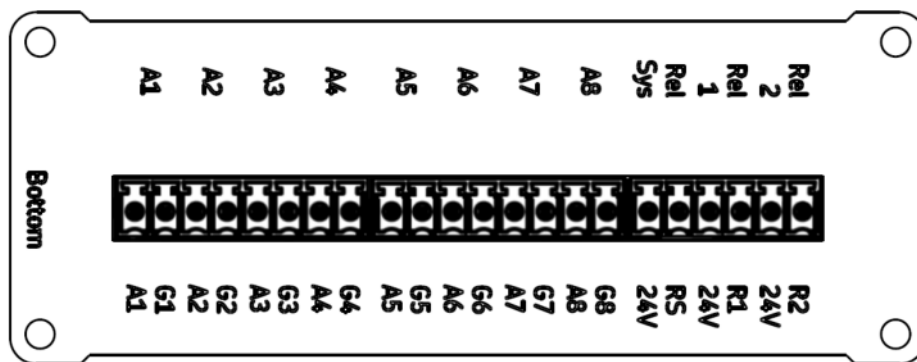
Terminal	Description
DC	± for 24–48 V DC supply
USB A	USB A, host interface, Bluetooth dongle normally fitted here
Eth	RJ45 Ethernet connector with support for Power over Ethernet
USB B	USB mini-B connector, service interface
485 RA/RB	RS485 2-wire A and B terminals
G3	Ground connection for use as required by RS485 and/or CAN
CAN CL/CH	CAN bus for vehicle systems – no current firmware support
D1 – D2	2 digital inputs (G round, D igital, P ower terminals for each)
LEDs	Pwr – Power (green, normal: on), Sys – System (red, normal: off)
Sw	Switch/push button – rescue button (enters maintenance mode)

Demountable terminal connectors

For the top connectors, one 11-way and one 2-way are provided.

3.3.2 IMx-8 bottom end cap

Table 7 IMx-8 bottom end cap connections



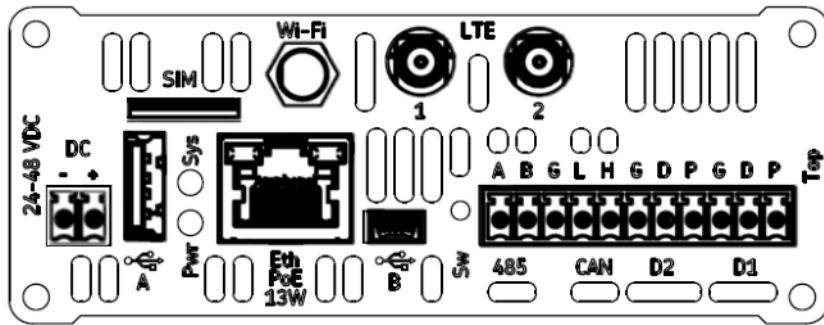
Terminal	Description
A1–A8	Analogue inputs 1 to 8 (A nalogue, G round terminals for each) Connect signal to A
R2	Relay 2, relay driver output (open collector)
24V	24 V DC power for relay coil
R1	Relay 1, relay driver output (open collector)
24V	24 V DC power for relay coil
RS	System relay, relay driver output (open collector)
24V	24 V DC power for relay coil

Demountable terminal connectors

For the bottom connectors, two 8-way (A1 to A8) and one 6-way are provided.

3.3.3 IMx-8Plus top end cap

Table 8 IMx-8Plus top end cap connections



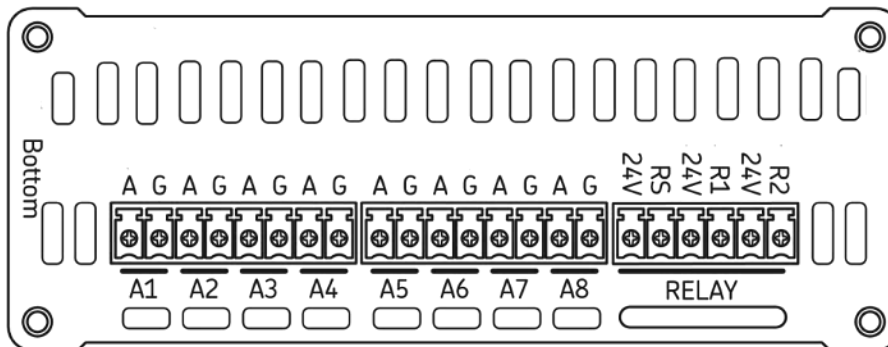
Terminal	Description
DC	± for 24–48 V DC supply
SIM	Micro-SIM card slot – refer 2.5.4 for SIM card orientation
A	USB A, host interface, Bluetooth dongle normally fitted here
Eth	RJ45 Ethernet connector with support for Power over Ethernet
Wi-Fi	Connector for an external antenna, where Wi-Fi is used
B	USB mini-B connector, service interface
LTE 1/2	Mobile data connectors for external antenna, where LTE is used
485 A/B	RS485 2-wire A and B terminals
G	Ground connection for use as required by RS485 and/or CAN
CAN L/H	CAN bus for vehicle systems (No current firmware support)
D1 – D2	2 digital inputs (G round, D igital, P ower terminals for each)
LEDs	Pwr – Power (green, normal: on), Sys – System (red, normal: off)
Sw	Switch/push button – rescue button, enters maintenance mode

Demountable terminal connectors

For the top connectors, one 11-way and one 2-way are provided.

3.3.4 IMx-8Plus bottom end cap

Table 9 IMx-8Plus bottom end cap connections



Terminal	Description
A1–A8	Analogue inputs 1 to 8 (A nalogue, G round terminals for each) Connect signal to A
R2	Relay 2, relay driver output (open collector)
24V	24 V DC power for relay coil
R1	Relay 1, relay driver output (open collector)
24V	24 V DC power for relay coil
RS	System relay, relay driver output (open collector)
24V	24 V DC power for relay coil

Demountable terminal connectors

For the bottom connectors, two 8-way (A1 to A8) and one 6-way are provided.

3.4 Enclosure and cabinet mechanical drawings

3.4.1 IMx-8/IMx-8Plus enclosure

The immediate IP30 enclosure for the SKF Multilog IMx-8/IMx-8Plus is shown in [Figure 19](#), below.

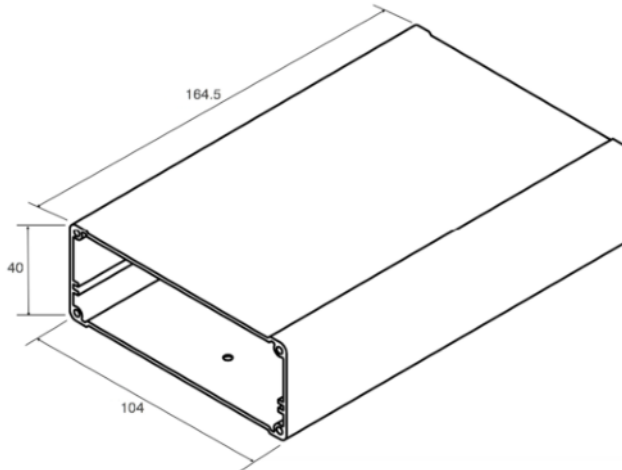


Figure 19 IMx enclosure drawing

Note that the height dimension shown here (164.5 mm), excludes end caps and their mounting screws, as also connectors, dongle, etc. Refer also to product specifications, section [3.2.1](#), for overall dimensions and further notes.

3.4.2 IMx-8/IMx-8Plus IP65 cabinets (optional)


The SKF Multilog IMx-8/IMx-8Plus is usually housed within an IP65 cabinet. Two basic versions of these optional, painted steel cabinets are available from SKF:

CMON 4150: with a pre-drilled gland area

CMON 4151: without a pre-drilled gland area

In the pre-drilled cabinet, the lower, short, wall is predrilled for 17 glands: refer to [Figure 20](#) for the drilling pattern/arrangement. One entry for a M25 x 1.5 mm gland (shown as drawing item 14/15) and sixteen entries for M12 x 1.5 glands (typified by drawing item 16/17), are provided. All (17) cable entries are supplied with blind plugs fitted, only remove those that will be actively used for cabling and cable glands.

Important safety warning for IP rated cabinets:

 *Always utilise all provided fixing points to secure the cabinet to the mounting surface.*

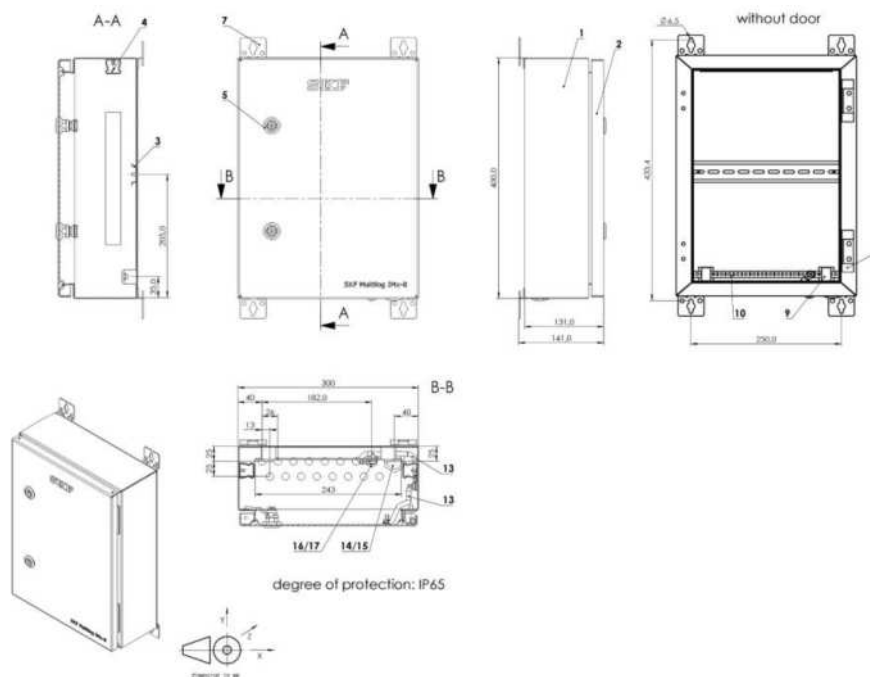


Figure 20 CMON 4150 cabinet with pre-drilled gland area

Figure 21 below, illustrates the IP65 cabinet, without pre-drilling.

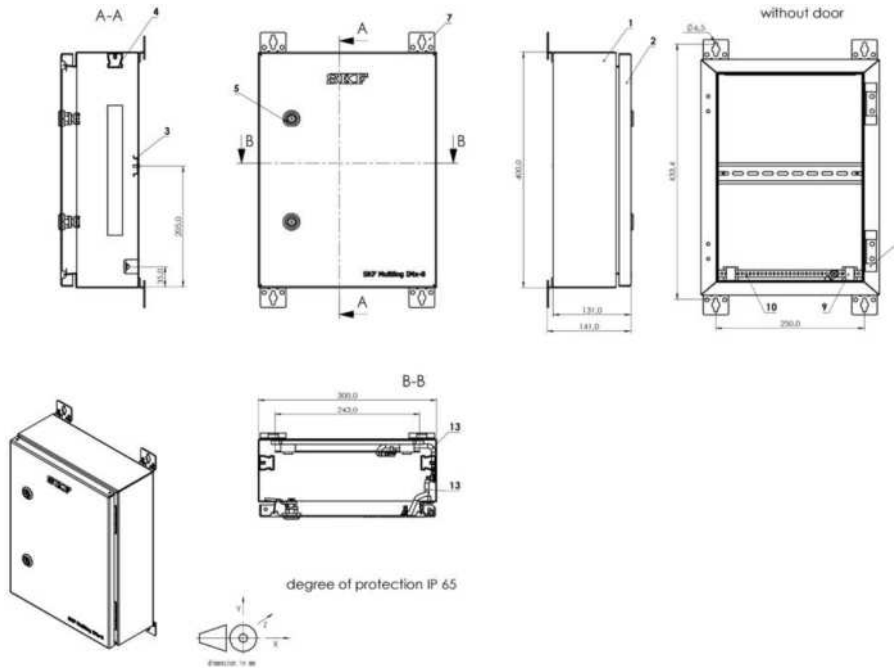


Figure 21 CMON 4151 cabinet without pre-drilled gland area

3.5 HMI display (optional)

An HMI display that can be integrated into existing cabinets is available to order under the SKF reference CMON 4146. The HMI display is used for visualization of monitored machine health such as warning/alarm status and includes both Ethernet and serial communications capabilities.



Figure 22 HMI display CMON 4146

It is 24 V DC powered (less than 10 W), provides a 7" (diagonal sized) screen and the external face has an IP65 rating. Overall dimensions are 192 x 146 x 52 mm and it requires a cut out sized at 186 x 136 mm.

Note that 'iX Developer' software is required to build the HMI screens and configure the display. This software is not included in CMON 4146 and if not already available should be separately purchased from Beijer Electronics.

3.6 Mobile data / Wi-Fi antenna (optional)

For the IMx-8Plus, an optional antenna is available under SKF part number CMON 4142. This is the same type of mobile data / Wi-Fi antenna used in the SKF Multilog IMx-Rail and the images shown in the figure below, show its usage there.

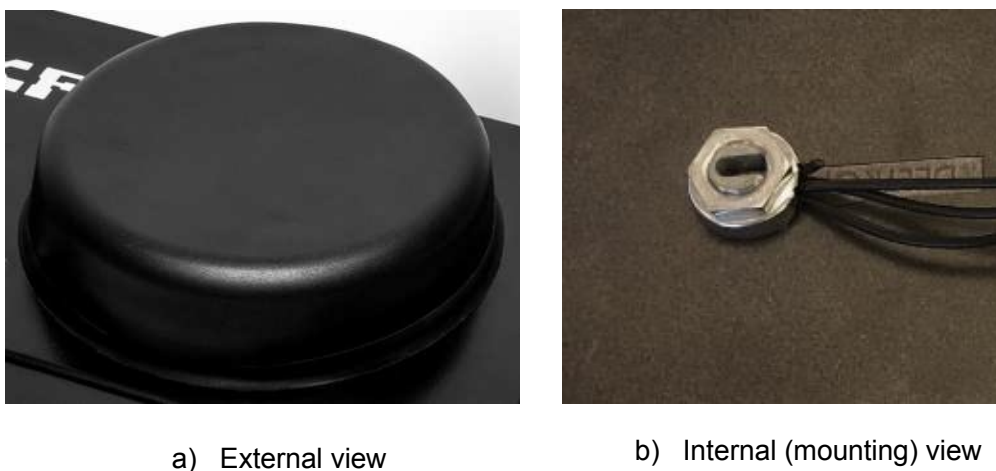


Figure 23 IMx-8Plus mobile data / Wi-Fi antenna (optional)

It has a single, central, anti-rotation mounting that requires a 15 by 15 mm square entry through the enclosure wall (maximum corner radius of 1 mm). Externally the maximum installed dimensions of the circular antenna and gasket part are 146 mm in diameter by 32 mm high.

The 0.5 m integral cable has SMA male connectors for the LTE 1, LTE 2 and Wi-Fi connections on the IMx-8Plus. This antenna / IMx-8Plus combination supports the following frequencies/standards:

- AMPS 850 MHz
- GSM 900 MHz
- 3G UMTS 2.1 GHz
- Wi-Fi 2.4 GHz, channels 1 to 11
- DCS 1800 MHz
- PCS 1900 MHz
- LTE 2.6 GHz
- 4G/LTE 791-960, 1710-2690 MHz

Notes:

- The 699 to 791 MHz range (typically North American LTE) is not supported by this antenna.
- Refer also to [3.2.13](#) for important certification information and minimum antenna-personnel separation distances.
- The antenna used is a 2j-antennae, type 2J6547Ba (equivalent to 2J6550Ba but without GPS). If using an alternative, select an antenna with similar specifications and the same or lower gains.
- Bluetooth support in the IMx-8Plus remains via the USB Bluetooth dongle and not the antenna.

3.7 GPS module (optional)

The GPS module, CMON 4139, is connected to the IMx-8/IMx-8Plus via a 5-metre integral cable and should be fitted externally to the cabinet in a location that allows satellite tracking. An M12 cable gland is included. The overall dimensions and fixing centres are shown in the figure below.

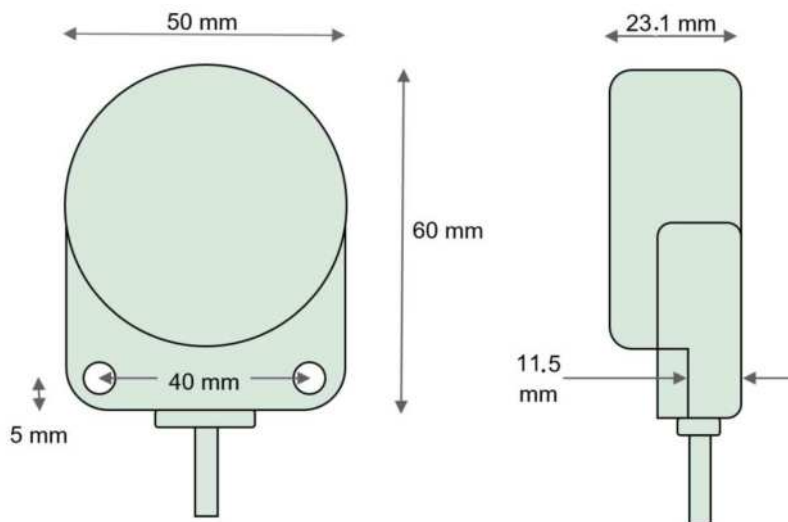


Figure 24 GPS module dimensions

The GPS module is designed to be fitted to a flat mounting surface and has two clearance holes for M5 fixings, 40 mm pitch, which straddle the cable exit.

4 Electrical waste



Electrical waste and electrical equipment should be recycled as specified by the WEEE-directive and not be placed in the general refuse. Product should be sent to an approved recycling centre for safe recycling, recovery, reuse or sent to SKF Sverige AB for proper recycling.

SKF Sverige AB
Aurorum 30
977 75 Luleå
Sweden

Appendix A Limited Warranty

SKF – Limited Warranty

Download the latest version from
skf.com.