Operating instructions
mobileIoT gateway
CR3171

GB

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.ifm.com.

1.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	Important note Non-compliance may result in malfunction or interference.
	Information Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:

WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.

CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

1.3 Manufacturer / Distributor

Manufacturer: Proemion GmbH
Distributor: ifm electronic gmbh

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.

WARNING

Overload damage due to malfunctions.

▷ Risk of serious or fatal injuries.

▶ To limit the power in the event of a malfunction, protect the DC power supply circuit with an external fuse with a maximum rating of 2 A during installation.

ATTENTION

Water ingress

▷ Damage to the device

▷ The device has been tested against water jets in accordance with IPxK5 of the ISO 20653 standard. Other loads, e.g. with a high-pressure cleaner or a higher flow rate, do not correspond to the intended use.

▷ Never clean the appliance with a high-pressure cleaner or the like.

Interference with electronic devices due to high-frequency energy.

Do not use the device with damaged cables or connectors. Cables and connectors must always be screened.

Observe all radio regulations. Disconnect the power supply to the device if its use is prohibited or if its operation may cause faults or hazards.

The horizontal distance between the antennas can be calculated for each radio signal. The distance between two antennas should always be greater than 1/4 of the wavelength, but not a multiple of the wavelength. If you use several antennas with different radio signals, the distance of the antenna with the lowest frequency range must be observed.

GNSS:
frequency range 1.559 GHz, wavelength 19.23 cm (1/4 = 4.8 cm)

Bluetooth:
frequency range 2.400 - 2.4835 GHz, wavelength 12.49 cm (1/4 = 3.12 cm)

WiFi:
- frequency range 2.400 - 2.4835 GHz, wavelength 12.49 cm (1/4 = 3.12 cm)
- frequency range 5.150 - 5.725 GHz, wavelength 5.17 cm (1/4 = 1.29 cm)

Example: When using a GNSS antenna and a WiFi antenna, the distance between the two antennas should be at least 4.8 cm. The distances 19.23 cm, 12.49 cm and multiples of these values should be avoided.

2.1 Cyber security

ATTENTION

Operating the machine in an unprotected network environment

▷ Unauthorised read or write access to data is possible.

▷ Unauthorised manipulation of the device function is possible.

▶ Check and restrict access options to the device.

2.2 Air traffic

The device must not be operated on board aircraft.

Using it in an aircraft can affect the navigation and communication systems. An offence can lead to legal action against the offender.

3 Intended use

The device transmits data of a vehicle or machine via Ethernet or wirelessly. It supports 2G, 3G and 4G mobile radio standards.

The device meets the requirements of protection class IP xK5 and is suitable for use in relevant environments. (With mounted connectors or protective caps: IP 6K7).

Only use the unit within the limits of the technical data. → Technical data.

Notes relevant for approval: Package insert of the device and documentation.ifm.com

4 Function

The device enables wireless data transmission in various operating modes.

Function	CR3171
Antenna	external
Mobile communications	4G worldwide (certified countries only)
Real-time mode	●
Cloud logging mode	●
Input/output functions	3/1
Acceleration sensor	●
Gyro sensor	●
Buffer battery for real-time clock (RTC)	>48 h
GNSS	●
ifm e-SIM	●

● = applicable

4.1 WiFi frequencies and channels

The WiFi interface of the features automatic domain detection and supports the following regulatory domains: WORLD, ETSI, FCC. If neither ETSI nor FCC are recognised, the radio module uses WORLD as the standard.

Name	Band	TX Channel
World	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
	U-NII-1	36, 40, 44, 48
	U-NII-2	52, 56, 60, 64
	U-NII-2e	100, 104, 108, 112, 116, 132, 136, 140
	U-NII-3	-
ETSI	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	U-NII-1	36, 40, 44, 48
	U-NII-2	52, 56, 60, 64
	U-NII-2e	100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140
	U-NII-3	149, 153, 157, 161, 165
FCC	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
	U-NII-1	36, 40, 44, 48
	U-NII-2	52, 56, 60, 64
	U-NII-2e	100, 104, 108, 112, 116, 132, 136, 140
	U-NII-3	149, 153, 157, 161, 165

If a WiFi channel is used that is not available in the recognised domain, communication may be disrupted.

4.2 Mobile radio interface

The device has a mobile radio interface for mobile data transmission.

The device supports the 2G, 3G and 4G mobile networks.

The device detects the mobile network with the best transmission speed and automatically switches to it. The mobile radio interface supports bidirectional data exchange in the mobile network.

4.3 eSIM card

The unit is equipped with an embedded SIM (eSIM) card. The eSIM card is delivered with an eSIM profile that contains all the necessary communication settings.

The eSIM card of the unit is not activated on delivery. After registering the unit, activation of the eSIM card can take up to 4 hours.

4.4 Connection modes

The device can be operated in the following connection modes:

- Remote access
- Cloud connection

4.4.1 Remote access

This function allows remote access to the CR3171 and other devices on the Ethernet network, for example for troubleshooting or maintenance purposes.

The remote access function has the following features:

- Secure remote connection: The established connection has robust encryption and secure authentication mechanisms that protect data in transit and allow only authorised users to interact with the machine or application.
- Troubleshooting and support: Remote access enables efficient problem diagnosis and troubleshooting without the need to be physically present at the machine site.
- Remote desktop and management: Administrators and maintenance technicians are given the ability to remotely manage machines from a central location. They can display and control the visualisations embedded in the machine’s HMI interface.

4.4.2 Cloud connection

The device can be integrated into ifm’s mobile machine cloud. This connection is used for the bidirectional transfer of data between the cloud and the machine.

The cloud connection includes the following functionalities:

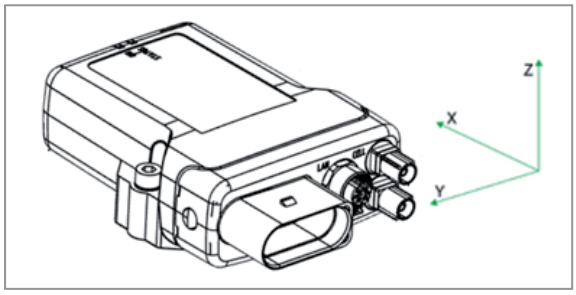
- Data acquisition: machine data and process information are transferred to the cloud. The data is processed and stored so that it can be made available to authorised persons or users via an online connection.
- Machine management: cloud connectivity allows users to perform comprehensive machine management tasks, such as configuration and provision of software or firmware updates.

4.5 Input/output functions

The device has additional input/output functions (3 analogue inputs, 1 digital output). For example, the input function can be used to collect device or machine status information or to directly detect and monitor switch states. The data determined via the input/output functions can be visualised or transferred via the CAN bus.

4.6 Accelerometers and gyro sensors

The accelerometers measure acceleration along the X, Y and Z axes. The 3-axis gyro sensor determines the angular velocity on the X, Y and Z axes. This data is evaluated and can be forwarded to the controller via CAN bus.



4.7 GNSS (global navigation satellite system)

The device has a GNSS receiver. The device can transmit position data determined by the GNSS receiver to the cloud via Ethernet, WLAN or the mobile network.

The device can evaluate signals from GPS, GLONASS, Galileo and BeiDou satellites. Data from two navigation systems can be evaluated simultaneously. This enhances the accuracy.

GNSS configuration: Device configuration via the web interface (→ 🗋 15)

4.7.1 GNSS multicast

The GNSS position data is sent from the device using multicasting. To receive this position data, the multicast stream must be monitored. The GNSS position data is transmitted using the NMEA standard. This data contains the NMEA data sets GPGGA and GPRMC.

Default settings for GNSS multicast on the gateway:

Multicast IP address: 239.255.46.9
Multicast Port: 31514

Examples of NMEA data:

- GPGGA
  `$GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47`

Content	Field	Description
$GPGGA,	Data set name (GPGGA)	Indicates that this is a data set with GPS fix data.
123519,	UTC time	Time of the recorded GPS fix (HHMMSS.SS).
4807.038,	Latitude	Latitude of the position (DDMM.MMMM).
N,	N/S Indicator	North (N) or south (S) of the equator.
01131.000,	Longitude	Longitude of the position (DDDMM.MMMM).
E,	E/W Indicator	East (E) or west (W) of the prime meridian.
1,	GPS fix quality	Quality of the GPS fix (0, 1 or 2).
08,	Number of satellites	Number of satellites used for the GPS fix.
0.9,	Horizontal deviation	Measure of horizontal accuracy (HDOP – Horizontal Dilution of Precision).
545.4,	Height	Height above sea level (in metres).
M,	Unit for the height	Unit for the height (M for metre).
46.9,	Geoidal separation	Height difference between ellipsoid and geoid (in metres).
M,	Unit for geoidal separation	Unit for geoidal separation (M for metre).
,	Age of the DGPS data set	Age of the differential GPS data (if available).

Content	Field	Description
,	DGPS reference station	ID of the station providing differential corrections.
*	End of data set marker	Marks the end of the data set. Separates the data set from the checksum.
47	Checksum	Checksum for data security.

- GPRMC
  `$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A`

Content	Field	Description
$GPRMC,	Data set name (GPRMC)	Indicates that these are recommended minimum specific GPS/transit data.
123519,	UTC time	Time of the recorded GPS fix (HHMMSS.SS).
A,	Status	A: valid data V: invalid data
4807.038,	Latitude	Latitude of the position (DDMM.MMMM).
N,	N/S Indicator	North (N) or south (S) of the equator.
01131.000,	Longitude	Longitude of the position (DDDMM.MMMM).
E,	E/W Indicator	East (E) or west (W) of the prime meridian.
022.4,	Speed over ground	Speed over ground (in knots).
084.4,	Course over ground	Course or direction of movement (in degrees).
230394,	UTC date	Date in DDMMYY format.
003.1,	Magnetic variation	Magnetic variation (in degrees, positive for east, negative for west).
W	E/W Indicator for magnetic variation	Indicates whether there is an easterly (E) or westerly (W) magnetic variation.
*	End of data set marker	Marks the end of the data set. Separates the data set from the checksum.
6A	Checksum	Checksum for data security.

Each NMEA data set ends with the character string `\r\n` (0x0A, 0x0D).

5 Installation

▶ Disconnect the power of the machine before installation.

The device must be installed in a horizontal position. Installation with the connectors facing upwards or downwards is not permitted.

The device must be fixed with the rear facing the mounting surface.

ATTENTION

Higher impact stress > IK07

▷ Damage possible

▷ Protection rating and electrical protection might be impaired

▷ Risk of injury possible

▶ If necessary, the system creator must take external measures to protect the device depending on the requirements of the corresponding application.

▶ Replace damaged devices, otherwise the technical data and safety will be impaired.

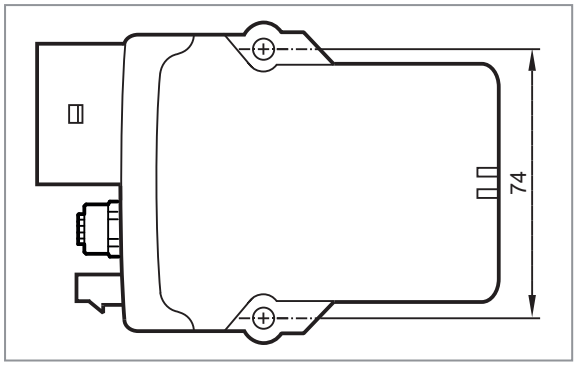


Fig. 1: Holes for mounting

▶ Use 2 M5x30 cylinder head bolts to fix the device on an even surface.
Tightening torque: 2.2 Nm

5.1 Mounting the antennas

▶ When mounting the antennas in vehicles avoid the vicinity of fuel tanks, vessels with explosives or insufficiently screened electronic components (→ 2 Safety instructions).

▶ Position the antennas so that a permanent distance of min. 0.2 m from people is ensured during operation.

▶ Do not install the antennas in closed metal constructions such as the driver's cab.

▶ To reliably receive the GPS signals, position the GPS antenna with unrestricted access to the sky.

▶ Please observe the antenna manufacturer's notes.

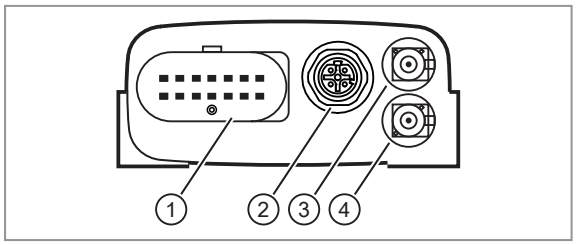
Stable data transmission requires a good antenna signal. In case of problems change the position of the antennas or the mobile equipment if necessary.

A loosely tightened antenna connector also causes signal loss.

6 Electrical connection

6.1 Connectors

Use only IP 6K7 rated connectors to ensure protection class IP 6K7.



1: Micro Timer II connector, 14 pins (CAN, supply, inputs, outputs)
2: M12 Ethernet socket, D-coded
3: FAKRA connector, D-coded
4: FAKRA connector, C-coded

6.1.1 Operating voltage, CAN interface, inputs and outputs

The analogue inputs operate in a range of 0…15 V. Optionally, the input can be used as a digital input with a maximum voltage of 36 V DC.

The digital output switches the supply voltage on terminal 30. The maximum load is 500 mA. If this limit value is not guaranteed by the external power supply of terminal 30, external protection must be provided.

The input terminal 15 detects a high signal from a voltage of 5.5 V and a low signal at a voltage < 2.3 V.

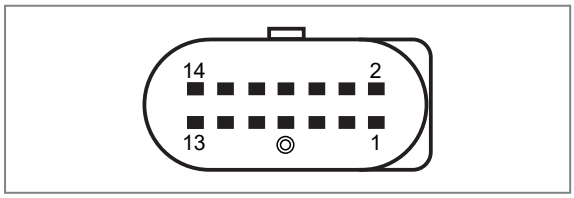


Fig. 2: Micro Timer II connector, 14-pin

1: VCC / terminal 30 (supply)
2: CAN3_L (CAN interface 3 (low) bidirectional)
3: GND / terminal 31 (supply)
4: Analogue input 1
5: Analogue input 2
6: Analogue input 3
7: Digital output
8: Digital input / terminal 15 (input, ignition signal)
9: CAN3_H (CAN interface 3 (high) bidirectional)
10: CAN2_GND
11: CAN2_H (CAN interface 2 (high) bidirectional)
12: CAN2_L (CAN interface 2 (low) bidirectional)
13: CAN1_H (CAN interface 1 (high) bidirectional)
14: CAN1_L (CAN interface 1 (low) bidirectional)

6.1.2 GNSS antenna connection

The GNSS antenna connection is supplied with a voltage of approx. 3.3 V and can supply active antennas with a maximum current of 40 mA. The connection is short-circuit-proof and detects that an antenna is present when the current is greater than approx. 2 mA.

Make sure that the unit is switched off during installation.

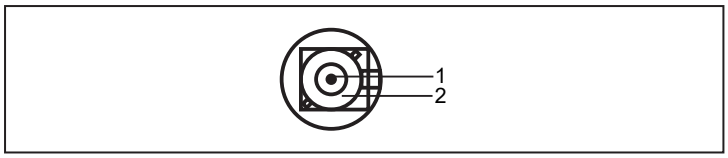


Fig. 3: FAKRA connector, C-coded

1: Signal — GNSS signal, supply voltage 3.3 V
2: GND — shielding / housing

6.1.3 GSM antenna connection

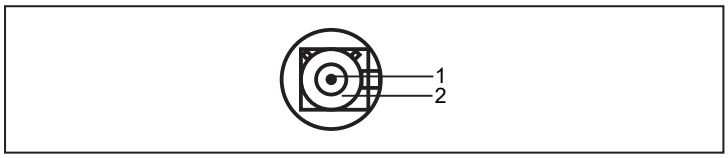


Fig. 4: FAKRA connector, D-coded

1: Signal — mobile radio
2: GND — shielding / housing

The unit detects an antenna if it has a built-in diagnostic resistor (10 kΩ).

6.1.4 Ethernet port

The device is connected to the network via the Ethernet port.

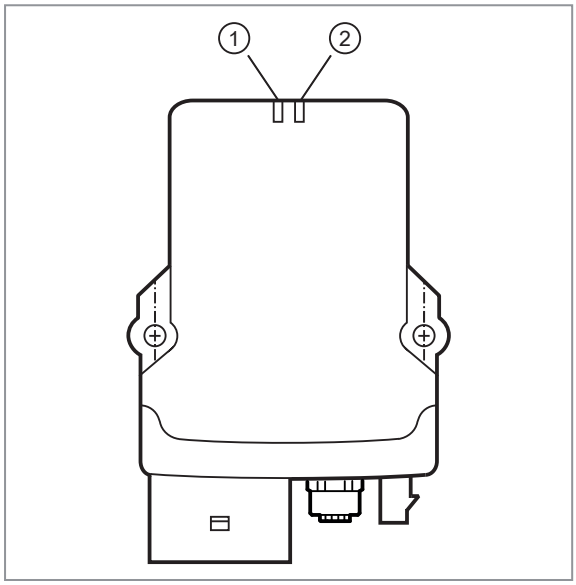
1: TxD+
2: RxD+
3: TxD-
4: RxD-

On the device side, the screen must be connected to the metal thread of the M12 connector. On the other side, the screen must be connected to GND.

The threaded connections in the device correspond to the M12 standard. To ensure compliance with the specified protection rating, only cables that comply with this standard may be used. In the case of self-assembled cables, the system manufacturer is responsible for the protection rating.

- ▶ During installation, place the connectors vertically so that the coupling nut will not damage the thread.
- ▶ Observe the coding of the connectors during installation.
- ▶ Tighten the cable plug using 0.6 Nm.

7 Light indicators



1: ON LED
2: STATUS LED

7.1 ON LED

The ON LED indicates the status of the power supply.

Colour	State	Meaning
-	Off	Device switched off or in sleep mode
White	On	Device starts (e.g. after applying the supply voltage)
Blue	Flashing	Device booting
Green	On	Device switched on, terminal 30 voltage in permissible range
Green	Flashing	The device performs an update while it is supplied with voltage via terminal 30.
Yellow	Flashing	The device performs an update while it is supplied with voltage via the internal battery.

Tab. 1: ON LED

7.2 STATUS LED

The STATUS LED indicates the operating status of the active connections. The different colours are displayed according to priority, from 5 (low) to 1 (high). If several operating states are active at the same time, the STATUS LED always indicates the state with the highest priority.

Colour	State	Priority	Meaning
-	Off	0	If the ON LED is also off: The devices is switched off.
White	On	0	Device starts (e.g. after applying the supply voltage)
Green	Flashing	1	The device initialises the interfaces and services.
Red	Flashing	2	Error
Blue	On	3	The device performs diagnostics.
Green	On	4	Device in normal operating mode.

Tab. 2: STATUS LED

8 Set-up

8.1 Necessary components

The following components are needed to configure and set up the device:

- Hardware
  - CR3171
  - suitable antenna / combined antenna for navigation and radio (art. no.: EC3158)
  - Connection cable (art. no.: EC3146 or EC3148)
  - voltage supply 8…32 V DC
  - PC
  - for further configuration (optional):

    Ethernet connection cable with M12/RJ45 connector (e.g. art. no: EVF549)
- ifm *mobile*IoT Suite
  To register and activate the device, access to the mobileIoT suite is required. You will receive the access data from your local ifm contact. The documentation for the *mobile*IoT Suite and for activating the device can be found in the *mobile*IoT Suite.
  After you have activated the device, a *mobile*IoT data contract is concluded.
  After successful registration and activation, the device establishes a connection to the ifm *mobile*IoT data portal and enables bidirectional data transfer.

8.2 Connect the unit

▶ Connect the GNSS and radio antennas to the device.

▶ Connect the Ethernet connection cable with the M12/RJ45 connector to the device and then connect it to the PC.

▶ Apply the supply voltage.

8.3 Device configuration via the web interface

The device has a local web server with a web interface that allows remote maintenance to configure the network interface and device settings via the HTTP(S) protocol.

The default IP address of the device is as follows: 192.168.82.1

▶ Ensure that the device is accessible in the network.
A connection is possible either via the Ethernet port or via WLAN.

▶ Ensure that a PC or similar device with a browser installed is available in the same network.

▶ Start the browser on a device (e.g. PC) in the corresponding network and call up the following URL: https://192.168.82.1

▶ Enter user name and password in the login dialogue.
User name: admin
The initial password is the MAC address of the device which is indicated on the type label of the device.

▷ The browser displays the web interface.

▶ Change the password in the [Security] section.

▶ Adjust the network configuration in the [Network] section.

The GNSS configuration is made in the [Location] section:

▶ Activate [Positioning service (GNSS)] to start the position determination.

▷ [GLONASS service], [BeiDou service] and [Galileo service] are configurable.

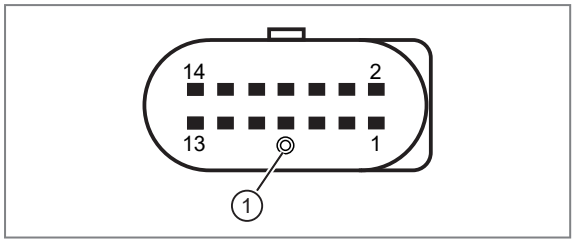
▶ Activate the required GNSS services.

If GNSS data is to be transmitted via Ethernet/IP:

▶ Activate [Multicasting preferences] and configure the corresponding IP address.

8.4 Factory reset

A reset button is located under pin 7 in the 14-pin Micro Timer II connector.



1: Reset button

▶ Press and hold the reset button for > 30 seconds.

▷ All settings are reset to the factory settings.

9 Repair, maintenance and disposal

The unit is maintenance-free.

- ▶ Contact ifm in case of malfunction.
- ▶ Do not open the housing as the unit does not contain any components which can be maintained by the user. The unit must only be repaired by the manufacturer.
- ▶ Clean the device using a dry cloth.
- ▶ Dispose of the unit in accordance with the national environmental regulations.

Glossary

GNSS

Global navigation satellite system, system for location tracking and navigation

mobileIoT data contract

Contract required for the mobile radio connection between the mobileIoT gateway and the mobileIoT server

mobileIoT data portal

Portal that processes/applies the data

mobileIoT platform

The complete cloud solution including backend (mobileIoT server), infrastructure, frontend for the machine management portal (mobileIoT suite) and data processing portal (mobileIoT data portal)

mobileIoT server

Cloud server on which the metrics are stored and to which the mobileIoT gateways connect

mobileIoT suite

Machine management portal