



EDGE FCR 3 Operating Instruction



Revision C

MYNXG Manual Product Number: 150016

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Notice

These operating instructions are an integral part of the EDGE FCR 3 system and should always be kept at hand. Observance of the instructions given within this manual is required for proper performance and correct operation of EDGE FCR 3.

The EDGE FCR 3 and its accessories must not be used for any other purpose than described in the accompanying documentation (intended use). Violation will result in loss of warranty.

MYNXG Product GmbH does not accept liability for injury to personnel or damage to equipment that may result from misuse of this equipment, failure to observe the hazard notices contained in this manual, or failure to observe local health and safety regulations.

MYNXG Product GmbH shall be under no circumstances liable for incidental or coincidental damage arising from use of the equipment described in this document.

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1. Safety Regulations

Before installing and using the EDGE FCR 3 Industrial computing device, please read the following safety and handling instructions carefully. Every owner / user of the EDGE FCR 3 should have understood the complete content and be aware of potential direct or indirect hazards of operators, other parties, stationary / mobile equipment, environmental and facilities by disregarding of warnings. This device must be professionally installed.

1.1 Terms Used

NOTICE

IMPORTANT NOTICE

Throughout this User's Guide, hazardous situations or operations are identified by **WARNING**, **CAUTION** and **NOTICE**, where:

Sign	Meaning
 WARNING	is used whenever you or somebody else could be injured if you do not observe the accompanying safety regulation.
CAUTION	is used to address issues related to possible hardware damage.
NOTICE	is used to address operational issues not related to personal injury or hardware damages.

1.2 User Groups

This manual is intended for personnel with the following expertise:

Area	Expertise
Installation	Experts
Start-up, operation and shutdown	Experts Trained personnel
Maintenance	Experts
Troubleshooting	Experts

Trained personnel (DIN EN 60204-1):

Any person who has been trained by experts in the tasks they need to perform, the risks associated with improper use, and the necessary safety equipment and safety precautions.

Experts (DIN EN 60204-1):

Any person who has the necessary specialist training, experience, and knowledge of the relevant standards needed to appraise their work and to recognize the possible dangers.

NOTICE**IMPORTANT NOTICE**

The device cannot be sold via retail to the general public or by mail order; it is sold to authorized dealers or installers only.

NOTICE**IMPORTANT NOTICE**

The device requires professional installation by experts only since one of the approved antennas has a standard type SMA connector to satisfy the requirements of CFR 15.203.

1.3 Product Safety

The appliance described in this manual is technically sophisticated, manufactured using high-quality materials and subject of testing in the factory. It contains the latest technology and comply with recognized technical safety regulations. However, there are still risks involved, even when the appliance is used as intended.

1.4 Responsibility of the Owner

The owner of the appliance:

- is responsible for the flawless condition of the appliance and for its proper operation in accordance with its intended use;
- is responsible for ensuring that persons who are to operate or service the appliance are qualified to do this, have been instructed accordingly and are familiar with the operating instructions at hand;
- must know about the applicable guidelines, requirements and operational safety regulations, and train staff accordingly;
- is responsible for ensuring that unauthorized persons have no access to the appliance;
- is responsible for ensuring that the maintenance plan is adhered to and that maintenance work is carried out properly;
- must ensure that the appliance and its surroundings are kept clean and tidy, for example through corresponding instructions and inspections.

1.5 Intended Use

The EDGE FCR 3 is designed for indoor installations or installations inside an (electrical) enclosure. The device is intended for the following user scenarios (industrial applications):

- Machinery monitoring, linking machines to the cloud.
- Shop floor monitoring, collecting data from the production floor.
- Logistics monitoring, managing C-parts and goods.
- Product monitoring, machines at the customer in-site the field.
- Linking and coupling of data collection points out of machinery or facility electrical cabinets towards the cloud.

WARNING

WARNING

The EDGE FCR 3 is not designed / intended to be used within ATEX areas or hazardous environments.

1.6 Changes and Alterations

No unauthorized changes or alterations may be made to the appliance. No parts may be added or inserted which have not been approved by the manufacturer. Unauthorized modifications or changes result in the CE declaration of conformity losing its validity and the appliance must no longer be operated. The manufacturer is not liable for any damage, danger or injuries that result from unauthorized changes or alterations, or from non-observance of the regulations in this manual.

CAUTION

CAUTION

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

1.7 General Safety Regulations

CAUTION**CAUTION**

Devices on which moisture has developed because of temperature changes must not be used unless they have been completely dried.

CAUTION**CAUTION**

To avoid influences from the mains supply, connect the EDGE FCR 3 and associated electronic to a different supply line compared to equipment like e.g. converters, servo drives, motors.

CAUTION**CAUTION**

Assembly, extension, modification or repair shall be carried out only by MYNXG Product GmbH or by experts who are authorized by MYNXG Product GmbH. Violation of this prescription will result in loss of warranty.

MYNXG Product GmbH cannot be held liable for any damages resulting from the use of accessories or consumables, which are not provided or approved by the manufacturer.

1.8 Certification / Compliance

The MYNXG EDGE FCR 3 is CE certified. CE marking is a certification mark that indicates conformity with standards for products sold within the European Union (EU) and more specific with:

- Article 3.1 (a) Health
- Article 3.1 (a) Safety
- Article 3.1 (b) EMC
- Article 3.2 Radio

The CE marking is also found on products sold outside the EU that are manufactured in, or designed to be sold in, the EU. The CE Mark does not apply to products sold in the U.S. For the certification report please contact MYNXG Product GmbH.

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.

NOTICE**IMPORTANT NOTICE**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.9 Warranty

For details on the MYNXG warranty policy, please visit our website www.mynxg.com.

1.10 Disposal of EDGE FCR 3 – Save the Environment

The EDGE FCR 3 does not contain hazardous materials or need any special handling at the end of its lifetime. Many components of the device can be recycled and should be disposed with respect to the local regulations. Feel free to send the unit back to us after sending a request (contact details given in the next chapter).

1.11 Behavior in Case of Malfunctions and Irregularities

The appliance may only be used in a flawless condition. If you notice irregularities, malfunctions or damage, immediately take the appliance out of service and inform your supervisor (if any).

The user / owner of the EDGE FCR 3 and associated accessories shall report all complaints about the system to any representative of MYNXG Product GmbH or directly to:

MYNXG Technology GmbH
Neumeyerstrasse 28-34
DE-90411 Nürnberg
Germany

Phone: 49 911-990876-0
E-Mail: service@mynxg.com

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2 Construction and Description

The EDGE FCR 3 (Fixed Cloud Regular 3rd Generation) is the Industrial Edge computing device for the Internet of Things (IoT) produced by MYNXG Product GmbH.

The EDGE FCR 3 is more than just a gateway, it's the core of Industrial IoT and links machines into a comprehensive Internet of Things ecosystem. The EDGE FCR 3 Industrial computing device aggregates and processes data, controls devices and reads sensors, making it ideal for Edge Computing. The hardware is designed robust and reliable for the industrial usage. The EDGE FCR 3 Industrial computing device is supporting LTE, WI-FI and Sub-1GHZ networks (ISM 868/915 MHz).

The EDGE FCR 3 is intended for the following user scenarios (applications):

- Machinery monitoring, linking machines to the cloud.
- Shop floor monitoring, collecting data from the production floor.
- Logistics monitoring, managing C-parts and goods.
- Product monitoring, machines at the customer inside the field.
- Linking and coupling of data collection points out of machinery or facility electrical cabinets towards the cloud.

The EDGE FCR 3 is supported through the MYNXG Transformation and MYNXG Service Layer and is fully remote controllable through the MYNXG Cloud.

2.1 Product Number

The Product (Identification) Number (PN) is a unique identifier, assigned to each finished / manufactured product which is ready, to be marketed or for sale. The number is printed together with the serial number (SN) on a MYNXG label (see example given in Figure 1) which is placed on the EDGE FCR 3 device.



Figure 1: EDGE FCR 3 identification label (example)

The EDGE FCR 3 has currently four different variants depending on the area of operation and of the placement. The product numbers of the variants are the following:

- **110011** Operates in EU and has tabletop placement (using fix stands)
- **110021** Operates in EU and has DIN-rail placement (using DIN-rail adapter in the back plate)
- **110012** Operates in North America and has tabletop placement (using fix stands)
- **110022** Operates in North America and has DIN-rail placement (using DIN-rail adapter in the back plate)

2.2 Key Benefits

The key benefits of EDGE FCR 3 to businesses are:

- EDGE FCR 3 is a unique, powerful, multi communication and secure Gateway.
- EDGE FCR 3 supports:
 - LTE / 3G / GSM (3GPP Modem) with push-pull MicroSIM holder
 - Wi-Fi 802.11 b / g / n
 - Sub-1GHz Network (ISM 868/915MHz Bands)
 - Optional second Sub-1GHz Network (ISM 868/915MHz Bands)
 - 2x up to 1000Mbps RJ45 Ethernet ports
 - 1x USB Type 2.0 A (500 mA) for debug purposes
 - RS 232 or RS 485
- EDGE FCR 3 runs on Intel® Atom architecture; CPU version E3815 or higher.
- MYNXG hardware-based security implemented Trusted Platform Module (highest level of security).

The MYNXG Gateway Operating System is powering the EDGE FCR 3:

- MYNXG Edge computing and Android applications.
- EDGE FCR 3 supports image processing, predictive tools & advanced data aggregation.
- MYNXG Operating System based on Android Linux 6.0 or higher.
 - Rich collection of MYNXG Android APIs optimized for highest performance.
 - Access to largest application development community.
 - Any Android programmer can develop MYNXG applications within minutes.
- MYNXG Middleware and application interfaces.
- MYNXG Over-The-Air (OTA) service support from the cloud including wide-listing of the entire based software (secure signing).

2.3 User Group

The designated user group of the MYNXG EDGE FCR 3 are professionals and technicians, whose are familiar with the handling of radio devices and electrical equipment (low voltage devices). The device is designed for light industrial use.

2.4 Industrial Usage

The MYNXG EDGE FCR 3 Gateway shall be installed with a minimum distance of 250cm between ground floor and lowest edge of the housing by using stands as shown in Figure 2 or a DIN-rail fixture as shown in Figure 3,. Alternatively, it can be installed inside an electrical switching cabinet (not made of metal to avoid Faraday cage shielding effects).

NOTICE

IMPORTANT NOTICE

Shall the device be installed inside a metallic cabinet; external antennas are required for communication (not included).



Figure 2: Desk placement of the MYNXG EDGE FCR 3



Figure 3: DIN Rail implementation at the MYNXG EDGE FCR 3.

2.5 Industrial Design

The industrial design is based on the MYNXG customized UCS 145-125 housing from Phoenix Contact and does have the following characteristics:

Parameter	Value
Dimensions (without antennas)	125mm x 145mm x 56mm (H x W x D)
Antenna length	160mm
Weight (with antennas)	550g
IP Class	20



Figure 4: MYNXG EDGE FCR 3 with antennas

2.6 Interfaces on the MYNXG EDGE FCR 3

The MYNXG Edge FRC 3 contains on two sides connector and terminal bars, whose are:

- EDGE FCR 3 POWER sidewall with the mandatory connectors (Figure 5):
 - Power (24VDC),
 - D-Sub (COM1),
 - RJ45 for Gigabit Ethernet or ProfiNet (LAN1 / LAN2)

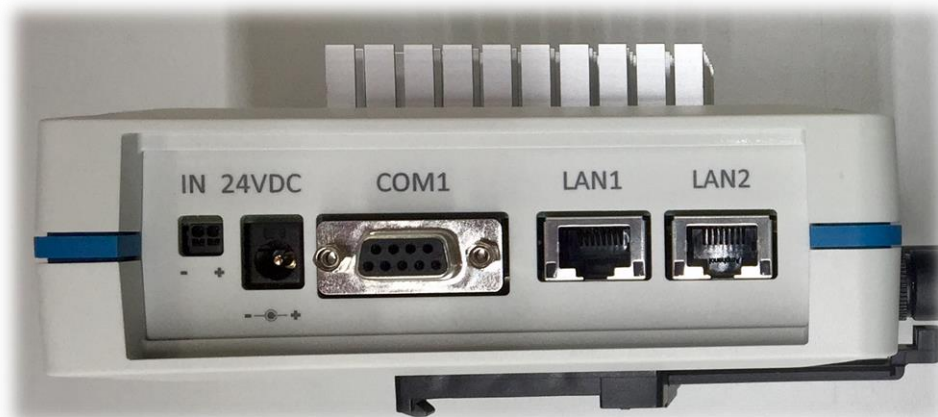


Figure 5: Side Wall 145, (UCS SW 145 F MYNXG POWER)

- EDGE FCR 3.1 DATA sidewall (Figure 6) which includes:
 - Micro SIM card slot,
 - USB 2.0 A connector,
 - DisplayPort,
 - Terminal block with 8 positions, push-in spring connection for HART or Current Loop;
 - Terminal block with 8 positions, push-in spring connection for Analog input (2x) and external power supply to external sensors of 3.3V, 5V and 12V;
 - Terminal block with 4 positions, push-in spring connection for I²C interface to connect external Sensors with 3.3V external power supply



Figure 6: Side Wall 145, (UCS SW 145-F MYOMEGA DATA D31)

2.7 EMC and ESD concept

The MYNXG EDGE FCR 3 is designed to be compliant with the EU and North America regulations when installed per MYNXG EDGE FCR 3 instructions.

The following components are shielded by itself:

- The M.2 Modem is shielded, fully type approved and certified.
- The Half Mini PCIe WI-FI cards are shielded, fully type approved and certified.
- The Extension Cards are shielded and certified as part of the EDGE FCR 3 design.
- All Cards are in line with the EMC Immunity and EMC Emission.

Furthermore, the PCB board design is done per the following principles:

- On Board EMC and ESD protection components per interface.
- Connectors are selected in line with the consortiums (USB, Gigabit Ethernet, ProfiNet).
- All boards are in line with EMC Immunity Class B EN 61000-6-2.
- All boards are in line with Emission Class A EN 61000-6-3.
- All boards and all components are REACH and RoHS compliant with the respective EU regulations.

2.8 MYNXG CTRL EDGE FCR 3 Security

Security is anchored inside the MYNXG CTRL via the Trusted Platform Module (TPM). The TPM is a special designed and crypto logical hardened HW, able to store secrets.

The communication between the MYNXG controller and

- the MYNXG Service and Transformation Layer is secured with TLS means,
- in addition, the data are additionally encrypted with TLS means to protect the data always,
- the MYNXG communication with the sensors is protected through DTLS / TLS means.

Through the MYNXG public key infrastructure (PKI) the following functions are provided:

- Provisioning of Certificates
- Provisioning of permanently changing TLS secrets
- Provisioning of permanently changing DTLS secrets
- Secure SW Over The Air (OTA) downloads towards the gateway
- Secure SW Over The Air (OTA) downloads to the sensor

NOTICE

IMPORTANT NOTICE

The EDGE FCR 3 is designed in line with the methods defined under ISO 27001. Security hardened boot sequence according to CC-EAL, and CC-EAL based security analysis and counteractions. Every cloud or WAN / LAN communications is encrypted at any time.

MYNXG development processes and the MYNXG products are designed in line with the methods defined under ISO 27001, MYNXG is audited through the TÜV Rheinland. MYNXG Digital Products and Digital Services are developed within a secured ISO 27001 compliant development environment.

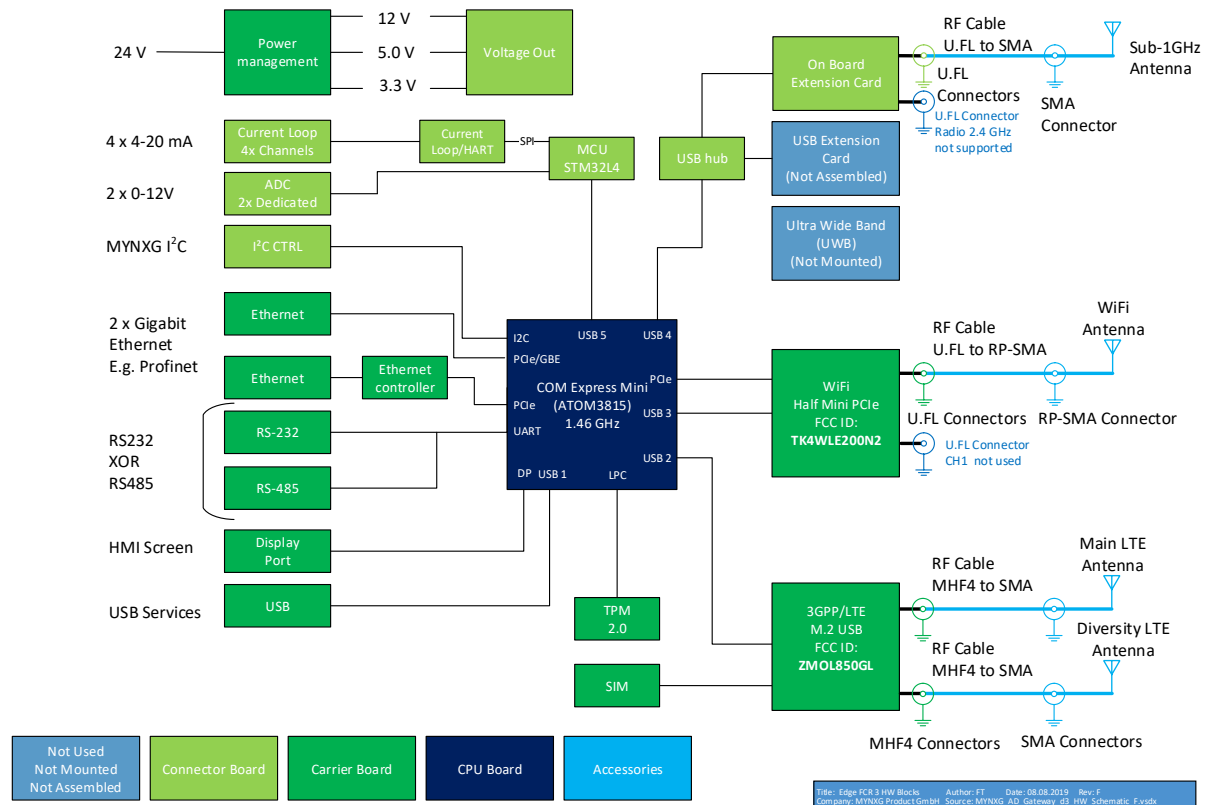
MYNXG has implemented and is provisioning the entire needed infrastructure including:

- Certification Authority (CA) and PKI for the generation and distribution of secrets.
- Production environment for Gateways and Sensors.
- R&D environment to produce software and hardware in line with the ISO 27001.

The MYNXG architecture is compliant with the BSI recommended "Protection Profile for the Gateway of a Smart Metering System". The gateways are not security certified as they are delivered but contain all functions and features for the security.

2.9 Functional Block Diagram

The EDGE FCR 3 industrial gateway is assembled by three electronic boards – the CPU board, the Carrier Board, and the Connector Board with interfaces to external electronic components and sensorics. Further, there are different antenna combinations possible as well as modem boards for radio communication. A global overview of the EDGE FCR 3 electronic is given in Figure 7 below, whereas some of the presented features are optional.



2.10 Typical Application

The EDGE FCR 3 is fully controlled and configured from the cloud from trained users. The following steps are performed at first usage of the EDGE FCR 3:

1. Trained technician installs the external sensors on the EDGE FCR3
2. The trained technician powers up the device
3. The device connects automatically to the cloud over LTE and receives the configuration file depending on its serial number
4. The device performs a Secure SW Over The Air (OTA) if applicable
5. The device reads the data from the sensor
6. The device reports the data to the cloud over LTE

3 Installation

3.1 Delivery and Unpacking

The EDGE FCR 3 is delivered in a carton enclosure (Figure 8) which also includes the (optional) accessories (e.g. standings, power supply). The device is already pre-assembled and personalized, i.e. ready for use after powering.



Figure 8: EDGE FCR 3 packaging

NOTICE

IMPORTANT NOTICE

Please check packaging and delivery immediately after receipt regarding damages and completeness. Do not throw away the packaging – it can be used for storage or sending the device back to MYNXG in case of service needed.

CAUTION

CAUTION

Devices on which moisture has developed because of temperature changes must not be used unless they have been completely dried.

CAUTION

CAUTION

The EDGE FCR 3 and accessories shall not be used when damages or technical defects are visible or recognized.

3.2 Device Support by Standings

3.2.1 Mounting the Standings

There are two standings required to place the EDGE FCR 3 on a vertical or horizontal surface. The standings need to be clipped on the housing only and can be removed easily on demand.

7. Put the standing at the lower EDGE FCR 3 housing edge as shown in Figure 9.



Figure 9: Mounting the standing step 1

8. Push from below the standing against the EDGE FCR 3 housing until the mechanic snaps in with a click-sound (Figure 10).

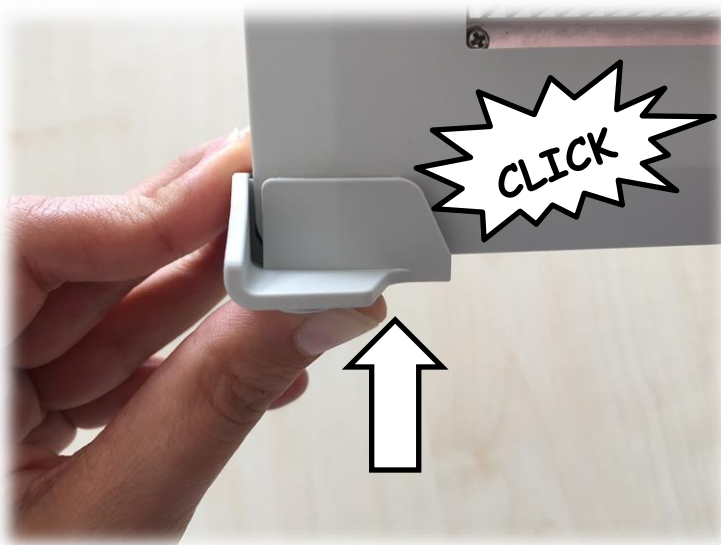


Figure 10: Mounting the standing step 2

9. Remove the standing by pressing the plastic downwards from the EDGE FCR 3 housing (Figure 11)

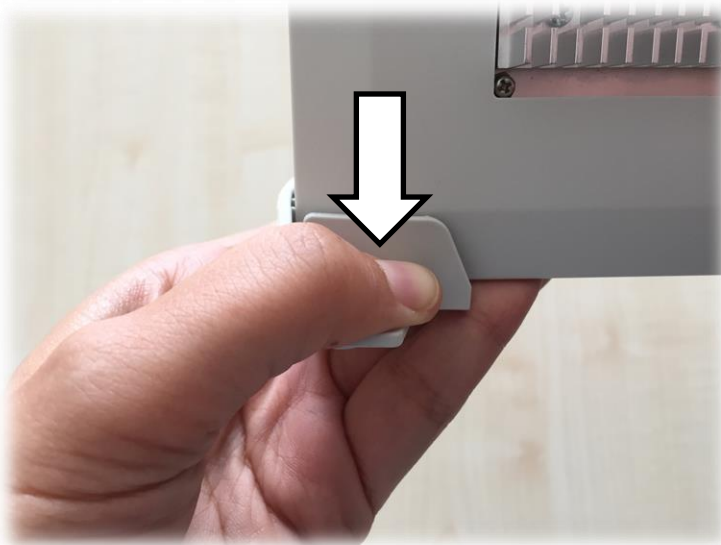


Figure 11: Removing the standing step 1

10. Increase the force carefully until the standing is released (Figure 12).



Figure 12: Removing the standing step 2

NOTICE

IMPORTANT NOTICE

Please do not place the EDGE FCR 3 on a horizontal area without fixation to avoid that it falls accidentally down on the ground floor.

3.2.2 Fastening the EDGE FCR 3 Standings

To ensure that the EDGE FCR 3 stays on place, or for a vertical installation, the standings do have holes for fastening the device with screws. The drilling plan / distances are shown in Figure 13 below. Recommended are lens head screws with a shaft diameter of 3.5mm.

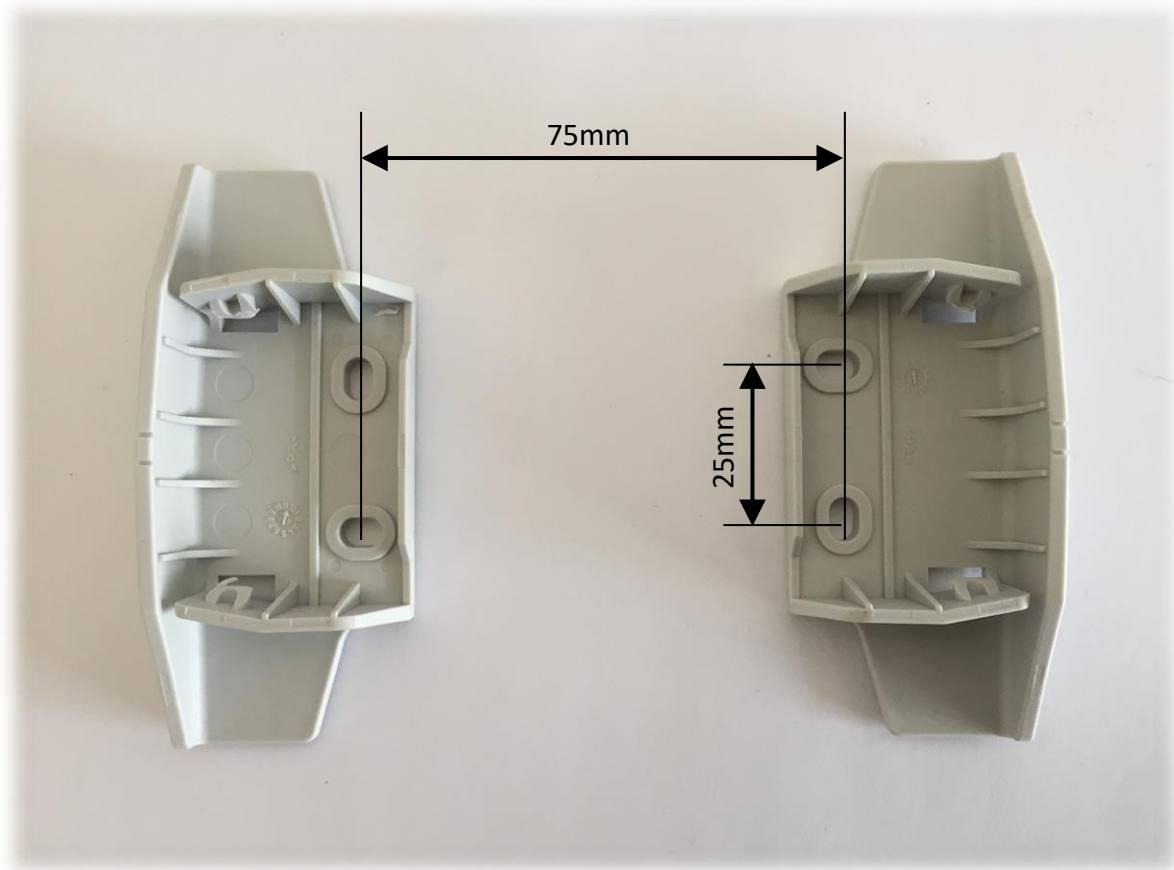


Figure 13: Drilling distances for the EDGE FCR 3 standings

3.3 Device Support by DIN-rail Fixture (Option)

The EDGE FCR 3 can optionally be ordered / delivered with a pre-installed DIN-rail fixture (Figure 14). This facilitates an installation of the device (inside electronic switch cabinets) on DIN-rails.

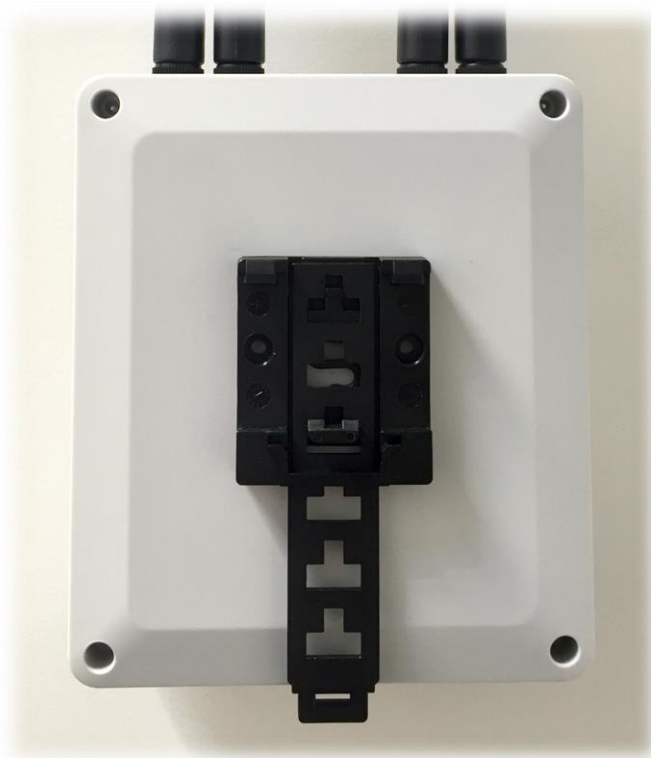


Figure 14: DIN-rail fixture

The device can be clipped on the DIN rail by placing the hinging from the top on the rail and moving it carefully downwards until the fixture snaps in.

To release / dismount the EDGE FCR 3 from the DIN-rail, the black strap needs to be pushed downwards carefully until the spring mechanism releases the device (Figure 15).



Figure 15: Releasing the DIN-rail fixture

3.4 Placing the EDGE FCR 3

The EDGE FCR 3 industrial gateway is designed for indoor applications and should be placed with a minimum distance of 250cm between ground floor and lower device corner for a good radio performance (Figure 16). It can also be placed inside an electrical switch cabinet (without metal housing).

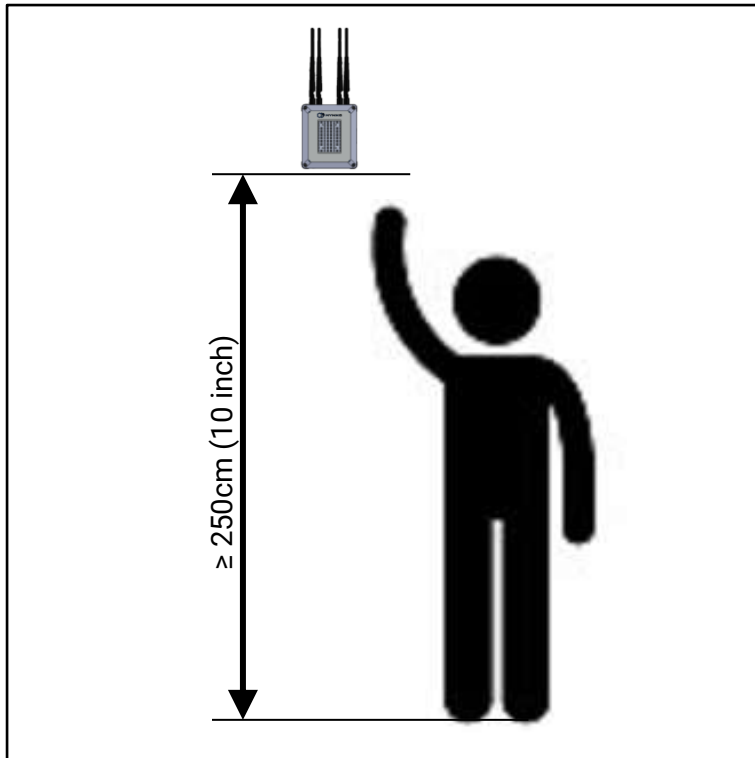


Figure 16: Mounting height of MYNXG EDGE FCR 3

⚠ WARNING

WARNING

The EDGE FCR 3 is not designed / intended to be used within ATEX areas or hazardous environments.

⚠ WARNING

WARNING

The EDGE FCR 3 is not designed / intended to be installed outside buildings, in dusty environments and / or areas with high humidity / temperature changes.

CAUTION

CAUTION

The EDGE FCR 3 shall not be installed on a place where it might be penetrated by mechanical stress.

CAUTION**CAUTION**

Ensure that the location where the device is placed meets the specified environmental conditions concerning temperature and humidity. Do not cover the device and keep at least 20cm space around for air circulation.

CAUTION**CAUTION**

The antennas of this device, under normal use condition, must be at least 20cm away from the body of the user and must not be co-located or operating with any other antenna or transmitter.

NOTICE**IMPORTANT NOTICE**

- Do not place the device close to high power / high frequency cable tacks that might have an influence on the device – minimum distance 50cm.
- Do not place the device inside metal cabinets (Faraday cage effect) or close to metal walls / housings – minimum distance 50cm.
- Do not install the device close to switched power supplies, frequency converters, servo / motor drives or other high-power electronics.
- Do not place the device below ground level or inside rooms with concrete walls (bunker like environments).

Rating the cellular radio network and Wi-Fi quality prior placing the EDGE FCR 3 is recommended to avoid bad signal qualities and transmission issues. Appropriate test software for mobile devices like shown in Figure 17 can be found in the internet.



Figure 17: Wi-Fi Analyzer App

3.5 Antennas

Per default the MYNXG EDGE FCR 3 Industrial Gateway is delivered with already pre-assembled antennas. Nevertheless, it might be necessary to dismount and remount the antennas during the hardware installation for some reasons. This can be done by turning the ring on the antenna socket counterclockwise, installation of the antenna is done in the opposite way. The EDGE FCR 3 is equipped by two different antenna types as shown below.



Figure 18: Antennas for LTE and Sub-1GHz networks with SMA Male connector



Figure 19: Wi-Fi "Rowing Stick" antenna with RP-SMA female connector

CAUTION

CAUTION

Please note: The LTE antennas have a SMA MALE connector and shall not be place on MALE sockets (Figure 18).

CAUTION

CAUTION

Please note: The Wi-Fi antennas have a RP-SMA FEMALE MALE connector and shall not be place on FEMALE sockets (Figure 19).

CAUTION

CAUTION

Due to the high-power output of the sub-1GHz antennas (up to +19dpm), the respective sensors should be placed at a certain distance (> 2m) from the EDGE FCR 3 to ensure a proper operation until the output power has been reduced.

3.6 Electrical Power

The EDGE FCR 3 does have two power inlets whose are bridged inside. For standalone applications, a switched power supply is used, whereas for installations inside an electrical cabinet either two push-in spring connections or a DC output plug can be used.

⚠ WARNING

WARNING

The EDGE FCR 3 electricity supply must comply to IEC 60449 / DIN EN 61140.

3.6.1 Power Supply

The power supply used is the GST36E24-P1J from Meanwell (Figure 20). This power supply is a Class II power unit, equipped with a 2-pin standard European AC power plug. It delivers 36W with an output voltage of 24VDC and has input range from 85VAC to 264 VAC.

The power supply utilizes the UL94V-0 flame retardant plastic case, providing the double insulation that effectively prevents electrical shock. The GST36E24-P1J is certified for the international safety regulations.



Figure 20: Power Supply Meanwell GST36E24

3.6.2 Standard DC Output Plug

The DC plug should have outer diameter $11\pm0.5\text{mm}$ and inner diameter 2.1mm and the positive side on the center as shown in Figure 21.

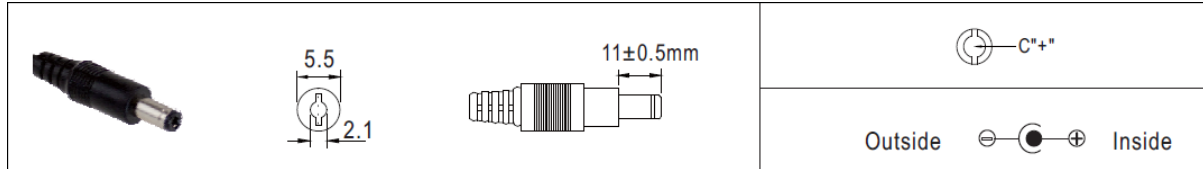


Figure 21: Standard DC output plug

3.6.3 Push-In Spring Power Connector

The push-in spring connector for electrical power cables is place close to the standard DC input socket. This socket is designed for solid and flexible cables with a diameter between $0.2\text{...}0.5\text{mm}^2$ (Figure 22)



Figure 22: Connectors for 24VDC input power

Table 1: Push-in spring connector characteristics

Characteristic	Value
Pitch	2.5 mm
Rated surge voltage (III / 2)	2.5 KV
Rated voltage (III / 2)	160 V
Nominal current I _N	6A
Conductor cross section AWG min.	26
Conductor cross section AWG max.	20

Installing the cables at the push-in spring connector:

1. Strip cable to a length of 6mm. Please use ferrules without plastic sleeves only.
2. Push the cable gently into the push-in spring socket (Figure 23).

*Figure 23: Inserting cable into push-in spring socket*

Releasing the cables from the push-in spring connector:

1. Take a flat-head screw driver size 0.30 x 1.8mm.
2. Push the screw driver gently into the release slot below the cable.
3. Simultaneously, pull carefully the cable without too much force out of the socket (Figure 24).

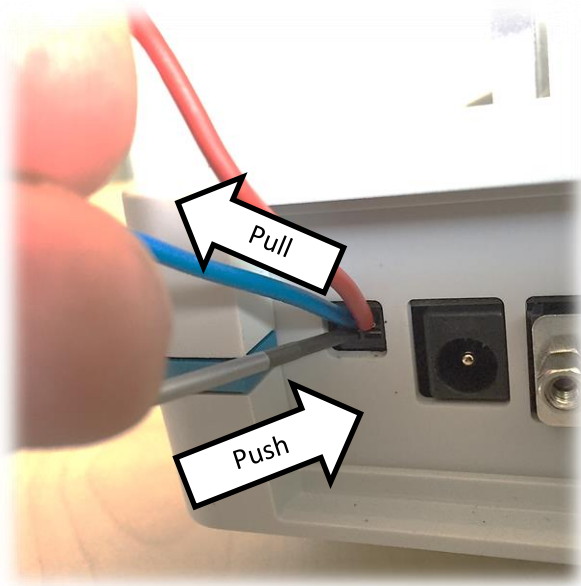


Figure 24: Releasing the cable from the push-in spring socket

CAUTION**CAUTION**

The release slot is quite tiny and sensitive, thus, using a too big tool or pushing with force may easily cause serious damages. Avoid strong jerking at the cable during the release procedure, too.

4 Electronic Interfaces

CAUTION

CAUTION

As a rule of thumb, never plug or unplug cables / connectors or other equipment onto the EDGE FCR 3 when the device is powered. Always switch power off prior any other activity on the EDGE FCR 3 to avoid damages / malfunctions on the electronic.

4.1 The EDGE FCR 3 Power Side

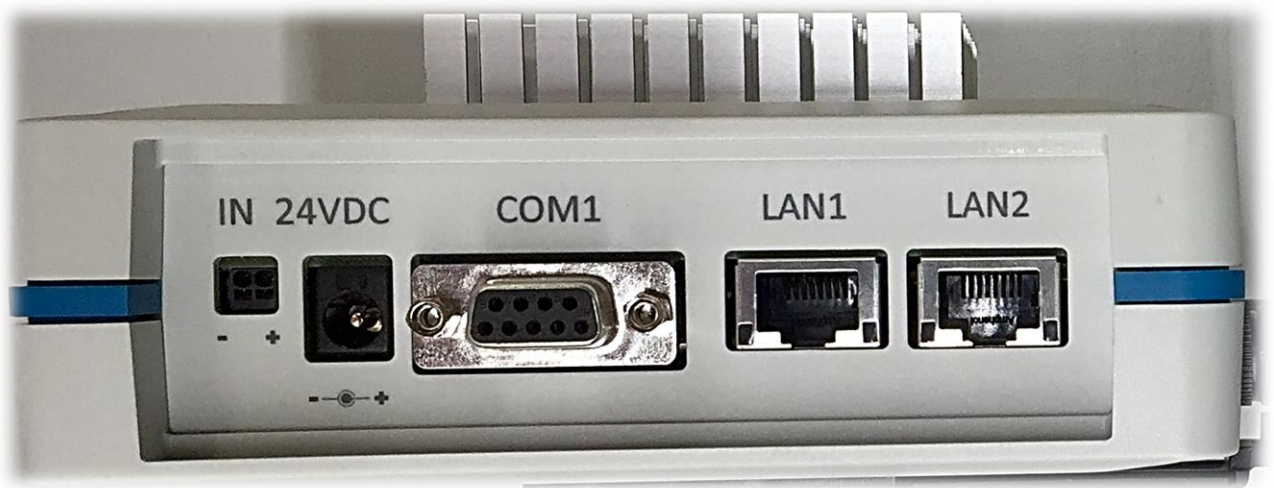


Figure 25: EDGE FCR 3 power site

The power side supports the following interfaces:

- Terminal block power connector (IN 24VDC)
- DC Jack power connector (IN 24VDC)
- DB-9 connector female for RS232 / RS485 (COM1)
- Gigabit Ethernet port (LAN1)
- Gigabit Ethernet port (LAN2)

4.1.1 Power Connectors

Functions and handling of the power connectors are described in chapter Electrical Power

4.1.2 Db-9 Connector

The DB-9 connector can be used either as RS-232 (flow control is not supported) or as RS-485 (half or full duplex). The selection is made from the software and one protocol can be used each time only. Figure 26 shows the pin number on the connector and Table 2 shows the signals that are going to the DB-9 connector.

CAUTION

CAUTION

Always fasten the Db-9 connector with screw to avoid loose contacts causing malfunctions or blackouts in the communication.

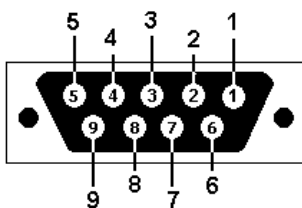


Figure 26: DB-9 socket female pins

Table 2: Serial DB-9 connector for RS-232 or RS-485 (half / full duplex)

Pin	Signal name for RS-232	Signal name for RS-485 (Full Duplex)	Signal name for RS-485 (Half Duplex)
1	Not Connected	Not Connected	Not Connected
2	RXD (input to EDGE FCR 3)	RX+ (input to EDGE FCR 3)	Not Connected
3	TXD (output from EDGE FCR 3)	TO- (output from EDGE FCR 3)	D-
4	Not Connected	Not Connected	Not Connected
5	GND	GND	GND
6	Not Connected	Not Connected	Not Connected
7	Not Connected	TO+ (output from EDGE FCR 3)	D+
8	Not Connected	RX- (input to EDGE FCR 3)	Not Connected
9	Not Connected	Not Connected	Not Connected

4.1.3 Ethernet Ports

There are two Ethernet ports, indicated as LAN1 and LAN2, designed as RJ45 sockets, and able to communicate with transfer rates up to 1Gbps. The communication status is displayed by LEDs at the LAN ports as demonstrated in Table 3.

The ports are working independent and do have fixed TCPIP addresses:

- LAN1: IP 192.168.10.10 / Subnet mask 255.255.255.0
- LAN2: IP 192.168.11.10 / Subnet mask 255.255.255.0

Table 3: LEDs on Ethernet ports.

LED	Color	Meaning
LED 1	Green	Link Activity
LED 2	Off	10 Mbps Link
LED 2	Green	100 Mbps Link
LED 2	Orange	1000 Mbps Link

4.2 The EDGE FCR 3 Data Site



Figure 27: EDGE FCR 3.data site labeling connector

The data side supports the following interfaces:

- Sim Card
- USB
- Current Loop 4 -20 mA with Hart interface
- 2x Analog Inputs 0-12 V
- 4 x Power supply Outputs (3.3V, 5V, 12V)
- I²C interface with power supply Output 3.3V

4.2.1 SIM-Card

A Micro SIM card is needed for the operation of the LTE modem. Push the Micro SIM card into the slot until you hear the click. To remove the Micro SIM card push it and it will pop out.

4.2.2 USB and Display Port

The Display port and the USB port are used for debug purposes.

4.2.3 HART and Current Loop Interface

The EDGE FCR 3 does have four analogue input channels, marked as CH0- to CH3+ (Figure 28). This interface can work either as current input channel (4...20mA) or HART¹ analogue input channel. The way how the interface is working is pre-defined in the software in context with the device order (specification).

CAUTION

CAUTION

The channels do have a common grounding and no galvanic barrier to the 24VDC supply voltage of the EDGE FCR 3.

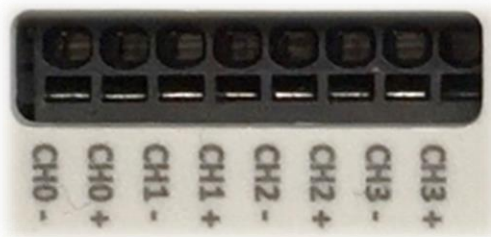


Figure 28: HART and current loop interface

NOTICE

IMPORTANT NOTICE

Please follow the instructions in chapter **3.6.3 Push-In Spring Power Connector** (p.32) to connect / disconnect cables from this interface (similar handling).

¹ The HART Communication Protocol (Highway Addressable Remote Transducer) is an open hybrid analogue & digital industrial automation protocol. Its most notable advantage is that it can communicate over legacy 4–20mA analogue instrumentation current loops, sharing the pair of wires used by the analogue-only host systems. HART is widely used in process and instrumentation systems ranging from small automation applications up to the highly sophisticated industrial applications.

4.2.4 Analog Input Interface

The EDGE FCR 3 supports 2 Analog Inputs (AI) channels (Figure 29) rating up to 12 V and shown in the housing as AI10..12V and AI10..12V. The two channels do have power outputs for sensors with a rating of 3.3V, 5V and 12V for each channel.

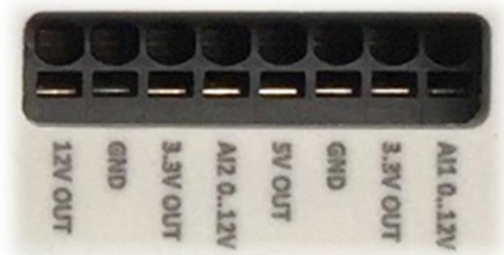


Figure 29: Analog input interface

NOTICE

IMPORTANT NOTICE

Please follow the instructions in chapter **3.6.3 Push-In Spring Power Connector** (p.32) to connect / disconnect cables from this interface (similar handling).

4.2.5 I²C Interface

The EDGE FCR 3 supports I²C sensors operating at 3.3V. The I²C interface (Figure 30) provides 3.3V for the sensor and does has an integrated 4.7 kΩ pull-up resistor.



Figure 30: I²C interface

NOTICE

IMPORTANT NOTICE

Please follow the instructions in chapter **3.6.3 Push-In Spring Power Connector** (p.32) to connect / disconnect cables from this interface (similar handling).

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5 RF Interfaces

In the EDGE FCR 3 edge computing device four configurable external antennas for Wi-Fi, LTE and sub-1GHz networks are pre-installed.

The device is using national roaming and all available 3GPP technologies to guarantee the best possible network connections. The Quality of Service is measured by indicators and the quality is reported towards the cloud to analyse potential conflicts at mitigation paths.

5.1 Wi-Fi Interfaces

Wi-Fi antenna for HOST communication (for Wi-Fi HOST interface) or for primary user equipment (UE) communication (for Wi-Fi UE interface):

- Antenna is optimized for 2.4GHz Wi-Fi operations.
- Main Wi-Fi - RX / TX antenna is pre-assembled.
- Optionally auxiliary antenna (diversity RX) can be assembled by MYNXG upon ordering.

NOTICE

IMPORTANT NOTICE

- The Wi-Fi HOST interface is used to connect the EDGE FCR 3 to an external Wi-Fi hotspot for WLAN and Internet connectivity towards host systems.
- The Wi-Fi UE enables mobile phones and tablets to directly connect to and interact with the EDGE FCR 3 as part of the MYNXG BYOD² / CYOD³ concept.

5.2 LTE Interfaces

Two LTE external antennas are pre-assembled to the main and the diversity antenna connectors of the 3GPP 4G / 3G modem.

- LTE MAIN: main antenna (main RX / TX).
- LTE AUX: auxiliary antenna + GPS (supports receive diversity and GPS simultaneously).

5.3 Sub-1GHZ Network Interfaces

Sub-1GHz radio technologies are currently using single antennas for RX / TX without diversity:

- One external antenna is used for Sub-1GHz technology.

² Bring Your Own Device

³ Choose Your Own Device

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6 Electrical Standards and Specifications

NOTICE

IMPORTANT NOTICE

Absolute Maximum Ratings are those values within damages on the device will not occur. Any operation outside these maximum ratings may cause damages on the device. Recommended Operating Conditions are conditions under which operations of the device are intended to be functional. Typically values corresponds to temperature $T_J = 25\text{ }^{\circ}\text{C}$. Unless otherwise stated, the following conditions apply for supply voltage: $V_{in} = 24\text{ VDC}$.

6.1 Absolute Maximum Ratings

Exposure to absolute maximum rating conditions for permanent periods of time might also affect reliability. Each condition is applied with all other values kept within the recommended operating conditions (Table 4).

Table 4: Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
V_{in}	Input Voltage on the DC Jack or on the PCB terminal blocks	16	42	V
T_{stg}	Storage Temperature	-40	85	$^{\circ}\text{C}$

6.2 Recommended Operating Conditions

The recommended operating conditions specify the values under which the device operationally meets the specifications (Table 5). The power supply should be at least 20W at 24VDC.

Table 5: Recommended operating conditions.

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{in}	Input Voltage on the DC Jack or on the PCB terminal blocks	18	24	32	V
T _{operation horizontal}	The mounting must allow free air circulation around the heatsink. DIN-rail is installed vertical causing EDGE FCR 3 heat sink rips to be horizontal	0	-	40	°C
T _{operation vertical}	The mounting must allow free air circulation around the heatsink. Table Top (Standfuss) is used or the DIN-rail is installed horizontal causing EDGE FCR 3 heat sink rips to be vertical (recommended operation mode)	0	-	60	°C

6.3 Power consumption

The power consumptions of the different elements according to the datasheets are listed in Table 6.

Table 6: Power consumption according to datasheets

Hardware	Min.	Typ.	Max.	Unit	Conditions
Intel Atom E3815 CPU or derivative CPU	-	4	6.5	W	@1.46 GHz
WI-FI Module	-	1.2	1.9	W	-
GSM Operation	-	1.8	8.25	W	Peak current 2.5 A @GSM, this mode shall be avoided.
LTE / 3G Operation	-	1.8	4	W	The typical EDGE FCR 3 operation is with LTE / 3G data transfer.
Internal Extension Cards	-	0.6	1.1	W	@868 MHz
All other EDGE FCR 3 Electronics together	-	2	3	W	-
Peak Use Case	-	16.5	(20)	W	The EDGE FCR 3 software measures the temperature and regulate the maximum ratings.
Average Allowed Ratings	-	9.6	16.5	W	-
Current measured @24VDC	-	400	700	mA	-

Peak use cases are defined by a high activity CPU and an intensive edge computing inside the EDGE FCR 3. Furthermore, to achieve peak values, all communication interfaces must operate at maximum rates. This combination of usage is only possible with the LTE / 3G HSUPA operation with bit rates of 42Mbps or higher. Hence, the GSM modem case is irrelevant for the peak use case and is shown for theoretical completeness only.

The 3GPP Modem may reach a transient peak current 2.5 A (average current 1.1 A), when the module works at GSM mode (the module transmits at the maximum power) and the power consume may reach for extreme short times a peak value of 8.25W.

6.4 LTE / 3G / GSM (3GPP) Module Specifications

The LTE / 3G / GSM (3GPP) module, further reference as LTE module, supports two RF connectors used for external antenna connection. "M" is for Main antenna, used to receive and transmit RF signals; "D / G" is for Diversity antenna, used to receive the diversity RF signals.

The LTE module adopts standard M.2 module RF connectors and uses MHF4 connector.

6.4.1 LTE / 3G / GSM Operating Bands

The following LTE / 3G / GSM bands might be used for the operation of the EDGE FCR 3. Some of the bands are optional, other will be supported always. Mandatory bands are marked **BOLD** in Table 7:

Table 7: Operating bands.

Operating Band	Description	Mode	Tx (MHz)	Rx (MHz)
Band 1	2100MHz	LTE FDD / WCDMA	1920 - 1980	2110 - 2170
Band 2	1900MHz	LTE FDD / WCDMA / GSM	1850 - 1910	1930 - 1990
Band 3	1800MHz	LTE FDD / GSM	1710 - 1785	1805 - 1880
Band 4	1700MHz	LTE FDD / WCDMA	1710 - 1755	2110 - 2155
Band 5	850MHz	LTE FDD / WCDMA / GSM	824 - 849	869 - 894
Band 7	2600MHz	LTE FDD	2500 - 2570	2620 - 2690
Band 8	900MHz	LTE FDD / WCDMA / GSM	880 - 915	925 - 960
Band 11	1500MHz	LTE FDD	1427.9 - 1447.9	1475.9 - 1495.9
Band 12	700MHz	LTE FDD	699 - 716	729 - 746
Band 13	700MHz	LTE FDD	777 - 787	746 - 756
Band 17	700MHz	LTE FDD	704 - 716	734 - 746
Band 18	800MHz	LTE FDD	815 - 830	860 - 875
Band 19	800MHz	LTE FDD	830 - 845	875 - 890
Band 20	800MHz	LTE FDD	832 - 862	791 - 821
Band 21	1500MHz	LTE FDD	1447.9 - 1462.9	1495.9 - 1510.9
Band 26	850MHz	LTE FDD	814 - 849	859 - 894
Band 28	700MHz	LTE FDD	703 - 748	758 - 803
Band 29	700MHz	LTE FDD	N / A	716 - 728
Band 30	2300MHz	LTE FDD	2305 - 2315	2350 - 2360
Band 66	1700MHz	LTE FDD	1710 - 1780	2110 - 2200
Band 38	2600MHz	LTE TDD	2570 - 2620	
Band 39	1900MHz	LTE TDD	1880 - 1920	
Band 40	2300MHz	LTE TDD	2300 - 2400	
Band 41	2500MHz	LTE TDD	2496 - 2690	
GPS L1	-	-	-	1575.42±1.023
GLONASS L1	-	-	-	1602.5625±4
Beidu	-	-	-	1561.098±2.046

6.4.3 LTE and WCDMA Receiver Sensitivity

For the receiver performance of the LTE Module are the conducted receive sensitivity and the conducted transmit power important parameters. Receiver sensitivity is the lowest power level at which the receiver can detect an RF signal and demodulate data. The typical values are listed below in Table 8.

Table 8: Conducted Rx sensitivity.

Mode	Band	3GPP Requirement (dBm)	Rx Sensitivity (dBm) Typical	Note
WCDMA	Band 1	-106.7	-109.5	BER<0.1%
	Band 2	-104.7	-110	BER<0.1%
	Band 4	-106.7	-109.5	BER<0.1%
	Band 5	-104.7	-111	BER<0.1%
	Band 8	-103.7	-110	BER<0.1%
LTE FDD	Band 1	-96.3	-101.5	10MHz Bandwidth
	Band 2	-94.3	-101.5	10MHz Bandwidth
	Band 3	-93.3	-101.5	10MHz Bandwidth
	Band 4	-96.3	-101.5	10MHz Bandwidth
	Band 5	-94.3	-102.5	10MHz Bandwidth
	Band 7	-94.3	-101	10MHz Bandwidth
	Band 8	-93.3	-102.5	10MHz Bandwidth
	Band 11	-96.3	-99	10MHz Bandwidth
	Band 12	-93.3	-100.5	10MHz Bandwidth
	Band 13	-93.3	-102.5	10MHz Bandwidth
	Band 17	-93.3	-102.5	10MHz Bandwidth
	Band 18	-96.3	-102.5	10MHz Bandwidth
	Band 19	-96.3	-103	10MHz Bandwidth
	Band 20	-93.3	-102.5	10MHz Bandwidth
	Band 21	-96.3	-99	10MHz Bandwidth
	Band 26	-93.8	-103	10MHz Bandwidth
	Band 28	-94.8	-103	10MHz Bandwidth
	Band 29	-93.3	-101	10MHz Bandwidth
	Band 30	-95.3	-100.5	10MHz Bandwidth
	Band 66	-95.8	-101	10MHz Bandwidth
LTE TDD	Band 38	-96.3	-101	10MHz Bandwidth
	Band 39	-96.3	-101.5	10MHz Bandwidth
	Band 40	-96.3	-100.5	10MHz Bandwidth
	Band 41	-94.3	-100	10MHz Bandwidth



6.4.5 LTE and WCDMA Transmit Power

The conducted transmit power is the maximum power that the module, tested at the antenna port, can transmit. The 3GPP protocol requires different transmit power levels for each power class. Table 9 lists the required and the tested values of the transmit power.

Table 9: Conducted Tx power specifications.

Mode	Band	3GPP Requirement (dBm)	Rx Sensitivity (dBm) Typical	Note
WCDMA	Band 1	24+1.7 / -3.7	23.5±1	-
	Band 2	24+1.7 / -3.7	23.5±1	-
	Band 4	24+1.7 / -3.7	23.5±1	-
	Band 5	24+1.7 / -3.7	23.5±1	-
	Band 8	24+1.7 / -3.7	23.5±1	-
LTE FDD	Band 1	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 2	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 3	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 4	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 5	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 7	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 8	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 11	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 12	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 13	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 17	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 18	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 19	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 20	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 21	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 26	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 28	23±2.7 / -3.2	23±1	10MHz Bandwidth, 1 RB
	Band 30	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 66	23±2.7	23±1	10MHz Bandwidth, 1 RB
LTE TDD	Band 38	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 39	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 40	23±2.7	23±1	10MHz Bandwidth, 1 RB
	Band 41	23±2.7	23±1	10MHz Bandwidth, 1 RB

6.5 Wi-Fi Specifications

The output power and the receive sensitivity for the different wireless-networking standards, the available data rates for each used IEEE 802.11 network PHY standard and the modulation techniques are listed in the Table 10.

Table 10: WS-FS specifications.

Technical Specifications										
Output power	802.11b: 16dBm ± 1.5dBm @ 11Mbps 802.11g: 11dBm ± 1.5dBm @ 54Mbps 802.11gn HT20: 12dBm ± 1.5dBm @ MCS7 802.11gn HT40: 11dBm ± 1.5dBm @ MCS7									
Receive Sensitivity	802.11b: -88dBm ± 2dBm @ 11Mbps 802.11g: -70dBm ± 2dBm @ 54Mbps 802.11gn HT20: -67dBm ± 2dBm @ MCS7 802.11gn HT40: -65dBm ± 2dBm @ MCS7									
Standards	IEEE 802.11b	11 Mbps	5.5 Mbps	2 Mbps	1 Mbps					
	IEEE 802.11g	54 Mbps	48 Mbps	36 Mbps	24 Mbps	18 Mbps	12 Mbps	9 Mbps	6 Mbps	Auto.
		Fallback to 5.5Mbps, 2Mbps, 1Mbps								
	IEEE 802.11n	20MHz	1Nss: 65Mbps 20MHZ @ 800GI, 72.2Mbps @ 400GI (Max.)							
			2Nss: 130Mbps @ 800GI, 144.4Mbps @ 400GI (Max.)							
		40MHz	1Nss: 135Mbps @ 800GI, 150Mbps @ 400GI (Max.)							
			2Nss: 270Mbps @ 800GI, 300Mbps @ 400GI (Max.)							
Modulation Techniques	OFDM: BPSK, QPSK, 16 QAM, 64QAM DSSS: DBPSK, DQPSK, CCK									

6.6 ISM Sub-1GHz Band

For the ISM band signal generation and transmission, a low-power, high-performance RF Transceiver from Texas Instruments (CC1200) is used. The transmitted and the received signal are amplified with an RF Front End also from Texas Instruments, which can be operated at 850 – 950 MHz (CC1190).

To get an increased ISM output power of 14 dBm, a transmitted power of -10 dBm is amplified with an analog front end in the output amplifier stage. With a gain of 22 dB (High Gain Mode) and a noise figure of 2,9 dB the required power level is achieved in consideration of the board losses (approximately 1.1 dB). The input power must be 5 dBm to transmit the maximum output power of 19 dBm.

Table 11 shows the transmit power levels, receiver sensitivity and current consumption for each used frequency (868 MHz and 915 MHz).

Table 11: RF specifications

Parameter	Min	Typ.	Max	Unit	Conditions
Transmit Power	3	14	19	dBm	
Receiver Sensitivity EUROPE	-	-115	-	dBm	100-kbps 2-GFSK, DEV=50 kHz, CHF=208.333 kHz ⁴
Receiver Sensitivity NORTH AMERICA		-108			250-kbps 2-GFSK, DEV=174.56 kHz, CHF=555.556 kHz
Current Consumption	-	210	-	mA	Output power of 19 dBm
Current Consumption	-	150	-	mA	Output power of 14 dBm

6.6.1 ISM Sub-1GHz Band (Extension Card Frequencies Europe)

The EU Directive 2014 / 53 / EU for the Sub-1GHz Band for the frequency range 25-1000 MHz for the usage of Non-Specific Radio Equipment (previously known as ISM Band) are used at the MYNXG products in the following way:

Hardware compliance: According to the above directive in:

- Compliance statement of used frequencies, we utilize radio chipsets which are specified in alignment with EN 300-220-2 V3.1.1 Directive 2014 / 53 / EU 25-1000 MHz for Non-Specific Radio Equipment.
- The FCR3 is utilizing the 863-870 MHz Bands.

Software or system compliance: EDGE FCR 3 is utilizing the following network assignment technologies in line with the above directive:

- Polite Spectrum Entrance / or LBT, we listen before we transmit in the spectrum.
- CCA / AFA, we apply methods to analyses the spectrum quality with RSSI and Bit Error Rate (BER) measurements which are used to identify spectrum validation / conflicts. In case that such a conflict is detected, we have implemented means inside the cloud to reconfigure the radio frequency channels of the EDGE FCR 3 used spectrum.
- MYNXG sensors managed by the EDGE FCR 3 are always below the duty cycle due to limited usage to safe power for the sensor.
- The Gateway duty cycle for ACKs (acknowledgements) towards the MYNXG sensors managed is below the duty cycle requirement of the spectrum used and / or in addition LBT is used to avoid spectrum conflicts with other devices.

⁴ GFSK is short for the frequency modulation Gaussian Frequency Shift Keying, DEV is short for deviation, CHF is short for Channel Filter Bandwidth

The frequencies used for EDGE FCR 3 at the integrated “Extension Card” and the inserted “Extension Card” module for the Europe ISM Band variant are shown in Table 12:

Table 12: RF channels for Europe

Channel Number	Frequency (MHz)	Tx Power (dBm)	Duty Cycle (%) or methods applied	Occupied Bandwidth (kHz)
1	865.000	14	0.1 or LBT / AFA	100
2	865.400	14	1.0 or LBT / AFA	100
3	866.000	14	1.0 or LBT / AFA	100
4	866.600	14	1.0 or LBT / AFA	100
5	867.200	14	1.0 or LBT / AFA	100
6	867.900	14	1.0 or LBT / AFA	100
7	868.300	14	1.0 or LBT / AFA	100
8	868.950	14	0.1 or LBT / AFA	100
9	869.900	14	1.0 or LBT / AFA	100
10	869.525	19	<10.0 or LBT / AFA	100
11	863.400	14	0.1 or LBT / AFA	100
12	863.800	14	0.1 or LBT / AFA	100
13	864.200	14	0.1 or LBT / AFA	100
14	864.600	14	0.1 or LBT / AFA	100

6.6.2 ISM Sub-1GHz Band (Extension Card Frequencies North America)

The frequencies used for EDGE FCR 3 at the integrated “Extension Card” and the inserted “Extension Card” module for the North America ISM Band variant are shown in Table 13:

Table 13: RF channels for North America

Channel Number	Frequency (MHz)	Tx Power (dBm)	Duty Cycle (%)	Occupied Bandwidth (kHz)
1	913.000	19	36	526.8
2	914.000	19	36	526.8
3	915.000	19	36	526.8
4	916.000	19	36	526.8
5	917.000	19	36	526.8

6.7 HART and Current Loop Specifications

The HART interface is exposed at the terminal block with 8 positions to host a maximum of four HART interfaces. The HART interfaces are integrated in line with the FieldCom-Group specifications. MYNXG is certified member of the FieldCom-Group. The AD5755-1 provides output voltages and currents with different ranges, which can be configured through the software (see Table 14):

Table 14: Current Loop Specifications

Parameter	Min	Typ.	Max	Unit
Output Voltage Ranges	0	-	5	V
	0	-	10	V
	-10	-	+10	V
	0	-	6	V
	0	-	12	V
	-6	-	+6	V
	-12	-	+12	V
Output Current Ranges	0	-	24	mA
	0	-	20	mA
	4	-	20	mA
Resolution	16	-	-	Bits

In this case the 4-20 mA and the 0-12V ranges are used. The current loop sensors are connected to a HART (AD5700). The used HART chip allows a signal generation, filtering, detection, a frequency shift keyed modulation (FSK) and demodulation of the signal. Four channels (A..D equal to 0..3) are available in the AD5755-1. Only one channel can be activated each time. These 4 channels are connected to the HART through a multiplexer, whereby one channel can be selected only.

6.8 Analog Input / Output Specifications

The analog inputs / outputs are exposed at the terminal block “Analog Input / Output” to host analog sensors. The analog input signals are specified according to Table 15 below:

Table 15: Analog Input voltages

Parameter	Min	Typ.	Max	Unit	Conditions
Analog Input Voltage	0		12	V	-
Ground Signal GND	-	0	-	V	Ground potential
Voltage OUT	-	3.3	-	V	Supply voltage for analogue sensor
Voltage OUT	-	5	-	V	Supply voltage for analogue sensor
Voltage OUT	-	12	-	V	Supply voltage for analogue sensor

6.9 Digital I²C Interface Specifications

The I²C bus is exposed at the terminal block “I²C Interface” can be used to host MYNXG digital sensors. The I²C interface is specified according to Table 16 below and does have an internal 4.7kohm pull-up resistor:

Table 16: I²C specifications

Parameter	Min	Typ.	Max	Unit	Conditions
I ² C clock rate range	10	-	400	kHz	-
I ² C bus input H-level	1.3	-	3.6	V	VDD is 3.3V
I ² C bus input L-level	-	-	0.5	V	VDD is 3.3V
I ² C CLK	-	-	3.6	V	I ² C bus specification H- / L-Level
I ² C DAT	-	-	3.6	V	I ² C bus specification H- / L-Level
3.3V OUT	-	3.3	-	V	-
GND	-	0	-	V	I ² C ground

6.11 LTE / 3G / GSM and ISM Band Antenna Specifications

The main LTE antenna, the diversity LTE antenna and the ISM band antennas are identical. They are already pre-mounted to avoid a mismatch of the connectors with the Wi-Fi antennas. The GSM spectrum of 900MHz is close to the ISM spectrum of 868MHz, hence the RF mismatch for the ISM band is reasonable small to enable the usage of the antenna for the ISM band (see Table 17).

NOTICE

IMPORTANT NOTICE

The LTE / 3G / GSM and ISM band antenna have a male antenna connector, they connect to the female antenna port at the EDGE FCR 3.

Table 17: LTE and Sub-1GHz antenna specifications

Parameter	Value	Unit
Connector	SMA Male	-
Frequency	700 - 2600	MHz
V.S.W.R.	< 1:2.0	BW
Gain (Zenith)	5	dBi
Impedance	50	Ω
Polarization	Vertical	-
Max Power	50	W
Plastic Housing	Black	-
Height	157	mm
Width	21	mm
Max Diameter	13	Mm
Operating Temperature	-10 - +60	°C
Vibration	10 – 55Hz with 1.5mm amplitude 2 hours	-
Environmentally Friendly	ROHS Compliant	-

6.13 Wi-Fi Antenna Specifications

The diversity Wi-Fi antenna, which is optional, can be implemented in case that the ISM band antenna is not used at the EDGE FCR 3, this is an assembly option in case Wi-Fi functionality is prioritized over ISM bands (Table 18).

NOTICE

IMPORTANT NOTICE

The Wi-Fi antenna have a female antenna connector, they connect to the male antenna port at the EDGE FCR 3.

Table 18: Wi-Fi antenna specifications

Parameter	Value	Unit
Connector	RP-SMA Female	-
Frequency	2.4 – 2.4835 / 5.15 – 5.85	GHz
V.S.W.R.	< 1:2.0	BW
Gain (Zenith)	5	dBi
Impedance	50	Ω
Polarization	Linear	-
Max Power	50	W
Plastic Housing	Black	-
Height	157	mm
Width	17.6	mm
Max Diameter	13	Mm
Operating Temperature	-10 - +60	°C
Vibration	10 – 55Hz with 1.5mm amplitude 2 hours	-
Environmentally Friendly	ROHS Compliant	-

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7 Annex: Troubleshooting

Symptom	Solution
The EDGE FCR 3 freezes and a blank screen with the text "ANDROID" is displayed	Probably root cause is a known hot plug & play issue of the Display Port monitor towards the EDGE FCR 3. To resolve the issue, make sure that a computer monitor is turned on (not in standby), connected to the EDGE FCR 3 by means of a display port cable (no adapters / converters used), and reboot the EDGE FCR 3. To avoid this symptom in general: - Always connect the Display Port monitor before switching on the EDGE FCR 3. - Do not unplug, switch off or allow the monitor to go on stand-by at any time.
Getting Alarm from Cloud that EDGE FCR 3 communication is interrupted	In case that you do not get data from the EDGE FCR 3 displayed in your application, do the following steps: 1. Ensure that communication to cloud is established 2. Ensure that communication chain from cloud to EDGE FCR 3 is established (router, repeater, etc.) 3. Repower / reboot EDGE FCR 3
The LTE SIM card is inserted by the EDGE FCR 3 does not connect to the network.	1. Check that EDGE FCR 3 reports to the cloud 2. Check that the inserted SIM card is from a supported provider (recommended is Telenor).
The EDGE FCR 3 cannot recognize an external USB device (like a mouse, keyboard or USB hub)	The expected cause is a known USB hot-plug & play issue. To resolve, connect all USB devices and then reboot the EDGE FCR 3. To avoid this symptom in general: - Connect the USB device before switching on the EDGE FCR 3. - Do not plug or unplug USB devices while the EDGE FCR 3 is on.
Wi-Fi is not accessible when LTE is enabled	Disable the LTE data and delete the APN configuration.
EDGE FCR 3 cannot recognize an external USB memory stick	This is a known limitation. The USB memory stick needs to be mounted manually.

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8 Annex: Supported & Unsupported Features

Feature	Supported ⁵	Hot Plug & Play ⁶
Use an external powered USB hub with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes ⁷
Use an external <u>non</u> -powered USB hub with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes ⁸
Use a wired USB keyboard with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes
When attaching it to an external powered USB Hub	Yes	Yes
When attaching it to an external non-powered USB Hub	Yes	Yes
Use a wired USB mouse with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes
When attaching it to an external powered USB Hub	Yes	Yes
When attaching it to an external non-powered USB Hub	Yes	Yes
Use a wireless USB keyboard with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes
When connecting it to an external powered USB hub	Yes	Yes
When connecting it to an external non-powered USB Hub	Yes	Yes
Use a wireless USB mouse with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes
When connecting it to an external powered USB hub	Yes	Yes
When connecting it to an external non-powered USB Hub	Yes	Yes
Access the Internet via LAN when WI-FI and LTE are disabled ⁹ :		
When connecting the PoE Ethernet cable to LAN Port 0 (HOST)	Yes	Yes
When connecting the PoE Ethernet cable to LAN Port 1 (PROFINET)	Yes ¹⁰	Yes ¹⁰

⁵ 'Yes' = equipment is recognized and usable when connected to the EDGE FCR 3 prior to system boot-up.

⁶ 'Yes' = equipment can be plugged / unplugged while EDGE FCR 3 is up and running without affecting system stability.

⁷ Only if no devices are connected to the USB hub.

⁸ Only if no devices are connected to the USB hub.

⁹ Note that the sequence of interfaces used for Internet connectivity can be configured in the MYNXG Baseport.

¹⁰ Disabled by default. Must be activated and configured by the respective MYNXG APP using the MYNXG Middleware.

Feature	Supported ¹¹	Hot Plug & Play
Use a wireless keyboard and a wireless mouse at the same time with the EDGE FCR 3:		
When connecting it to an external powered USB hub	Yes	Yes
When connecting it to an external non-powered USB Hub	Yes	Yes
Use a wireless USB mouse / keyboard combo plug with the EDGE FCR 3:		
When connecting it directly to the external USB slot	Yes	Yes
When connecting it to an external powered USB hub	Yes	Yes
When connecting it to an external non-powered USB Hub	Yes	Yes
SIM-based LTE data connectivity on the EDGE FCR 3:		
SIM card with 3G / LTE subscription inserted into external SIM card slot	Yes ¹²	No
SIM card with 3G / LTE subscription inserted into a connected external USB SIM card reader (connected to the EDGE FCR 3 via the external USB slot, external powered USB hub, or internal extension card USB slot)	No	No
Use external displays via Display Port (DPORT):		
External display is connected to EDGE FCR 3 via standard DPORT cable with a length of up to 1 meter	Yes	No
External display is connected to EDGE FCR 3 via standard DPORT cable with a length greater than 1 meter	No ¹³	No
EDGE FCR 3 is connected via DPORT-to-VGA adapter to an external display with VGA port (using a VGA cable length of up to 5 meters)	Yes ¹⁴	No
EDGE FCR 3 is connected via DPORT-to-DVI adapter to an external display with DVI port	No ¹⁴	No
EDGE FCR 3 is connected via DPORT-to-HDMI adapter to an external display with HDMI port	No ¹⁴	No
No DPORT display is connected to the EDGE FCR 3	Yes ¹⁵	No

¹¹ 'Yes' = equipment is recognized and usable when connected to the EDGE FCR 3 prior to system boot-up.

¹² Tested with SIM from Telenor Connexion.

¹³ MYNXG tested several commercial DPORT cable products which did not work. However, high-quality, low-attenuation DPORT cables may work even if longer than 1 meter, but no guarantees are given by MYNXG.

¹⁴ MYNXG tested several commercial adapter products. No tested DPORT to DVI / HDMI adapter product worked. DPORT to VGA adapters with cable length of up to 5m were tested successfully. It is the responsibility of the customer to test the functioning of DPORT adapters before use and no guarantees are given by MYNXG.

¹⁵ In order to attach a display, the controller must be shut down first and the display connected before reboot.

Feature	Supported ¹⁶	Hot Plug & Play
External display is connected to EDGE FCR 3 via standard DPORT cable and the display is disconnected while EDGE FCR 3 is turned on	No ¹⁷	No
External display is connected to EDGE FCR 3 via standard DPORT cable and the display is turned off while EDGE FCR 3 is turned on	No ¹⁷	No
External display is connected to EDGE FCR 3 via standard DPORT cable and the display goes into Stand-by while EDGE FCR 3 is turned on	No ¹⁷	No

¹⁶ 'Yes' = equipment is recognized and usable when connected to the EDGE FCR 3 prior to system boot-up.

¹⁷ Currently not working due to issue related to native DPORT Plug & Play driver. Feature support under investigation and development by MYNXG in collaboration with Intel.

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