Installation and operating manual GB/en

# X-AIRCONTROL

## FAM-RD

Field Application Module

with RadioDuct expansion module


TROX® TECHNIK

The art of handling air

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## 1 Product overview

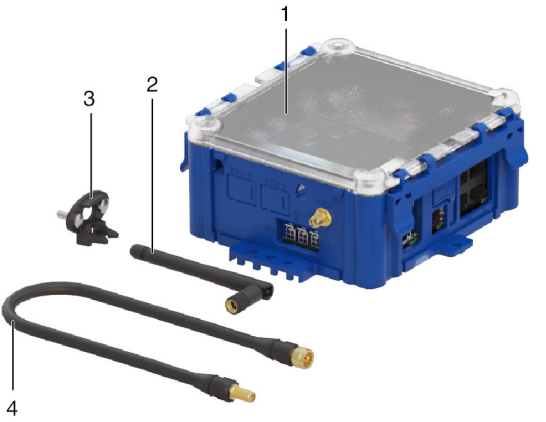


*Fig. 1: FAM-RD*

| | | | |
|---|---|---|---|
| 1 | FAM-RD (Field Application Module with Radio-Duct expansion module) | 3 | Antenna mounting bracket |
| 2 | Antenna | 4 | Antenna cable, 50 cm long |

## Connections and interfaces

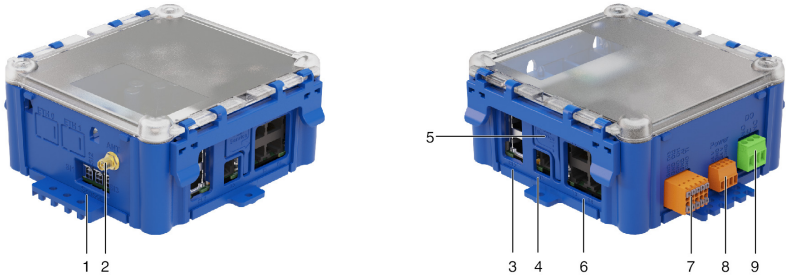


*Fig. 2: Connections*

| Item | Description | Note |
|---|---|---|
| 1 | Sensor connections S1, S2, S3 | Not used |
| 2 | Antenna connection | |
| 3 | CL1<br>CL2 | Not used |
| 4 | T5 = X-AIRCONTROL connection | |
| 5 | Push button for enabling service port T1 | |
| 6 | T1 = service and multi port<br>T2 -T4 = multi ports | T2-T4 not used |
| 7 | Digital input 1 (DI1 + GND)<br>Digital input 2 (DI2 + GND)<br>Digital input 3 (DI3 + GND)<br>Analogue input 1 (AI1 + GND)<br>Temperature input (TI1 + GND) | Not used |
| 8 | Power = power supply | |
| 9 | Digital output DO (NO, C, NC) | Not used |

## 2 General information

### About this manual

This operating and installation manual enables operating or service personnel to correctly install the TROX product described below and to use it safely and efficiently.

This operating and installation manual is intended for use by fitting and installation companies, in-house technicians, technical staff, instructed persons, and qualified electricians or air conditioning technicians.

It is essential that these individuals read and fully understand this manual before starting any work. The basic prerequisite for safe working is to comply with the safety notes and all instructions in this manual.

The local regulations for health and safety at work and general safety regulations also apply.

This manual must be given to the system owner when handing over the system. The system owner must include the manual with the system documentation. The manual must be kept in a place that is accessible at all times.

Illustrations in this manual are mainly for information and may differ from the actual design.

### Other applicable documentation

In addition to these instructions, the following documents apply:

- FAM-RD product information
- X-AIRCONTROL commissioning and service manual
- Project-specific wiring documents

### TROX Technical Service

To ensure that your request is processed as quickly as possible, please keep the following information ready:

- Product name
- TROX order number
- Delivery date
- Brief description of the fault

| | |
|---|---|
| Online | *www.troxtechnik.com* |
| Phone | +49 2845 202-400 |

### Limitation of liability

The information in this manual has been compiled with reference to the applicable standards and guidelines, the state of the art, and our expertise and experience of many years.

The actual scope of delivery may differ from the information in this manual for bespoke constructions, additional order options or as a result of recent technical changes.

The obligations agreed in the order, the general terms and conditions, the manufacturer's terms of delivery, and the legal regulations in effect at the time the contract is signed shall apply.

### Warranty claims

The provisions of the respective general delivery terms apply to warranty claims. For purchase orders placed with TROX GmbH, these are the regulations in section "VI. Warranty claims" of the Delivery Terms of TROX GmbH, see *www.trox.de/en/*.

### Copyright



### Safety notes

Symbols are used in this manual to alert readers to areas of potential hazard. Signal words express the degree of the hazard.

Comply with all safety instructions and proceed carefully to avoid accidents, injuries and damage to property.

**DANGER!**

Imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING!**

Potentially hazardous situation which, if not avoided, may result in death or serious injury.

**CAUTION!**

Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**NOTICE!**

Potentially hazardous situation which, if not avoided, may result in property damage.

**ENVIRONMENT!**

Environmental pollution hazard.

## 3 Safety

### Correct use

FAM-RD is used as part of X-AIRCONTROL for radio-based data transmission through ducting.

The data is transmitted in two directions between zone module and zone master.

Correct use requires that both the transmitter module and the receiver module are placed in the same duct system, i.e. either in the supply air duct or in the extract air duct. FAM-RD must not be used outdoors.

### Residual risks

A power failure will interrupt data transmission. If a system has to be highly reliable and available, you should take backup measures to prevent problems in case of a power failure.

Also, the radio communication between the various nodes of an X-AIRCONTROL system can be interrupted by interference. This, too, may lead to transmission losses.
If a system has to be highly reliable and available, a wired connection is the better option for data transmission.

### Incorrect use

Do not use the product for areas of application that are not described in this manual.

Do not use the product:

- outdoors
- in wet areas
- in areas with potentially explosive atmospheres

### Dangers and risks

**NOTICE!**

**Risk of damage to property due to large temperature differences**

If any electronic components have been kept in an unheated area, condensation may form and damage the electronic components beyond repair.

– Before you start commissioning, make sure that all devices have warmed up to the ambient temperature. Only after about 2 hours will the system have reached ambient temperature.

**NOTICE!**

**Risk of damage to property due to foreign matter and liquids!**

Foreign matter and liquids that get into the unit may damage the electronic parts.

– Remove foreign matter, if any.
– If the device emits a smell or smoke, have it checked by the manufacturer.
– If liquid gets into the module, let the module completely dry before commissioning.

**NOTICE!**

**Risk of damage to property!**

Over tightening the fixing screws may damage the device.

– Tighten the screws only finger-tight.

### Qualified staff

The work described in this manual has to be carried out by individuals with the qualification, training, knowledge and experience described below:

**Skilled qualified electrician**
Skilled qualified electricians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on electrical systems, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

## 4 Delivery and storage

### Supply package

Check delivered items immediately after arrival for transport damage and completeness.

Supply package

- FAM-RD
- Antenna
- Antenna cable, 50 cm long
- Antenna mounting bracket
- Installation and operating manual

### Transport

- If possible, take the product in its transport packaging up to the installation location.
- Do not remove the protective wrapping until just before installation.

### Storage

For temporary storage please note:

- Leave the product in its packaging and do not expose it to the effects of weather.
- Store the product in a dry place and away from direct sunlight.
- Temperature –10 °C to +70 °C, humidity 90% max. (no condensation)

### Packaging

Properly dispose of packaging material.

## 5 Parts and function

### Functional description

FAM-RD is used for two-way radio-based data transmission through ducting, specifically between:

- zone master (ZMA) and zone module (ZMO)
- zone module (ZMO) and zone module (ZMO)

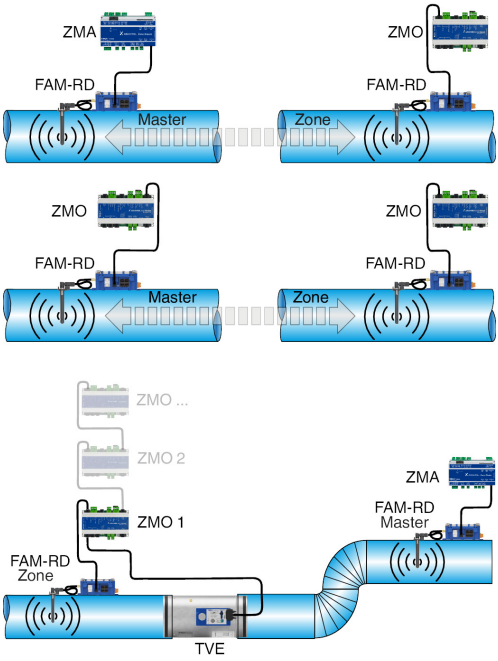


*Fig. 3: Two-way data transmission via radio link through ducting*

The system uses all the nodes of a network to route data to its destination.

This is why it is an advantage to have as many nodes (devices) as possible in a network. Each node in the RadioDuct network forwards the data packets it receives from other nodes so that the packets eventually reach their destination. The network always tries to find the most efficient route. Such networks are called mesh networks. The con-

nection between the RadioDuct slaves (which are connected to the zone modules) and the RadioDuct master (which is connected to the zone master) is made with a simple procedure using the service tool.

**Security**

Radio communication across the entire system is encrypted and authenticated according to the AES-128 method. This technology provides high data security and meets the requirements of the relevant data protection standards.
The transmission output power is adapted to the transmission distance, 100 mW max. So the system meets the radio standards applicable to the 2.4 GHz band.
The RadioDuct module allows for frequency hopping to reduce interference caused by other radio transmitters in the same frequency band. The systems keeps changing, or hopping, to the radio channel with the least interference.

**Installation example 1**

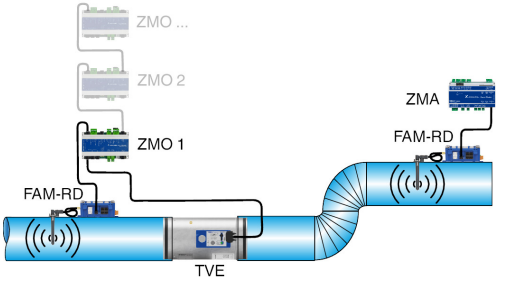


*Fig. 4: Radio transmission between zone master and zone module 1*

The connection between the first zone module and the zone master is made with one FAM-RD at each end of the transmission route. The zone modules are interconnected by cables.

**Installation example 2**

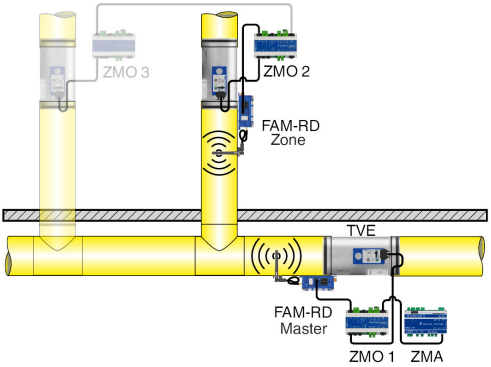


*Fig. 5: Radio transmission between zone module 1 and zone module 2*

The connection between the first zone module and the second zone module is made with one FAM-RD at each end of the transmission route. Zone module 1 and the zone master as well as zone modules 2 and 3 are interconnected by cables.

## 6 Installation

### General installation information

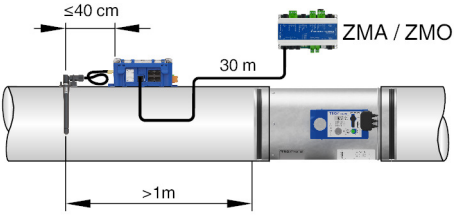


*Fig. 6: Positioning*

Please note:

- All modules that should communicate via radio have to be installed in the same duct system, i.e. either in the supply air duct or in the extract air duct.
- Place the antenna at least 1 m away from control dampers, shut-off dampers and measuring devices.
- The distance between the RadioDuct module and the antenna must not exceed 40 cm.
- The distance between the RadioDuct module and ZMA / ZMO must not exceed 30 m.
- Fix the antenna in the middle of the duct wall (applies to rectangular ducts).

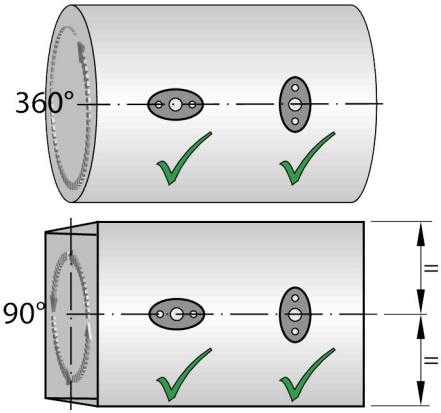


*Fig. 7: Position on ducts*

### Fixing the antenna mounting bracket

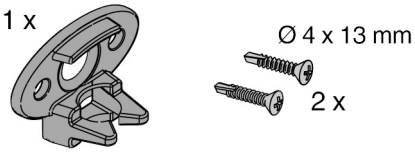


*Fig. 8: Fixing material (not included in the supply package)*

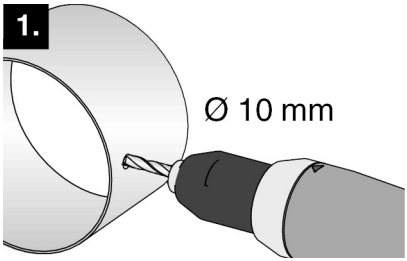


*Fig. 9: Drill a hole ∅10 mm*

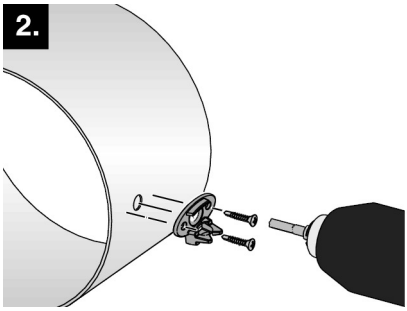


*Fig. 10: Use the screws to fix the bracket*

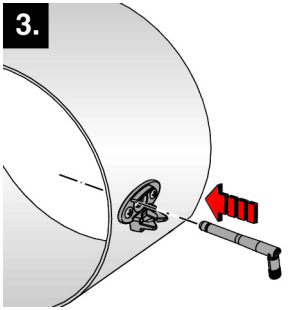


*Fig. 11: Insert the antenna so that it locks into place*

## 7 Electrical connection

### General information

### Connecting the power supply

**Personnel:**

- Skilled qualified electrician
- Supply voltage *'Technical data' on page 20*
- Do not connect more than 5 RadioDuct modules in series using the double terminals.
- Note that a series connection with a zone master or zone module requires 24 V AC supply.

### Modbus connection

Connect FAM-RD and zone master or zone module with an RJ12 cable:

- Type AWG26/6C
- RJ12 plug (6P6C)
- Max. length 30 m

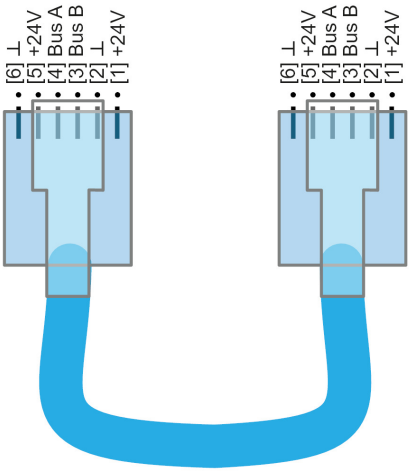


*Fig. 12: 1:1 Modbus connection*

### Wiring examples

### Zone master

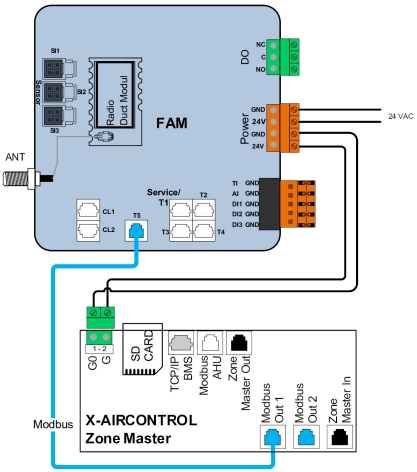


*Fig. 13: Connection to zone master – data connection (Modbus) and external power supply*

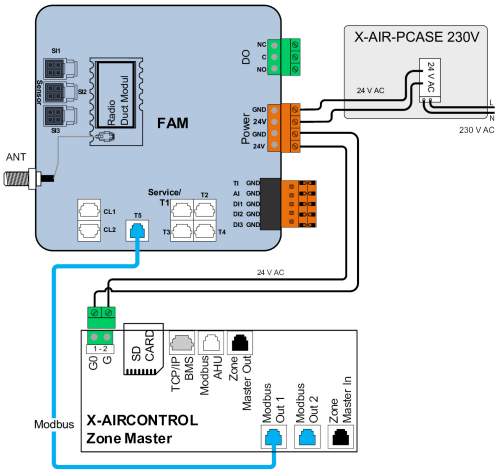


*Fig. 14: Connection to zone master – data connection (Modbus) and power supply with X-AIR-PCASE230 V*

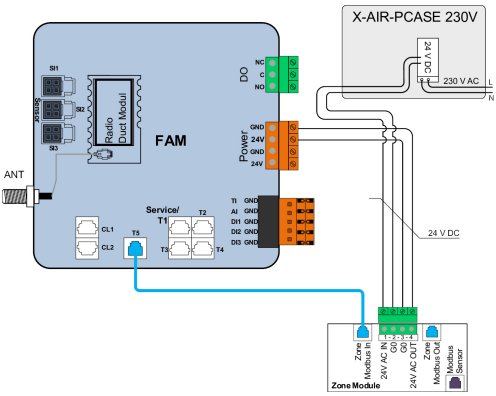


*Fig. 16: Connection to zone module – data connection (Modbus) and power supply with X-AIR-PCASE230 V*

## Zone module

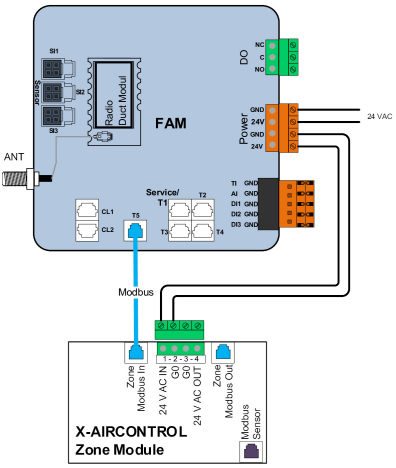


*Fig. 15: Connection to zone module – data connection (Modbus) and external power supply*

## 8 Commissioning

### General

> ***Commissioning***
>
> *RadioDuct module commissioning and radio link setup are part of commissioning of the X-AIR-CONTROL single room control system and are carried out by the HVAC contractor, the system owner or the TROX Technical Service.*

Commissioning requires that the *'RadioDuct Config Tool'* configuration software is installed on a PC. Once the software has been enabled, the PC can communicate with FAM-RDs. The configuration software is not only used for commissioning, it also includes functions for diagnosis and for saving the settings. To make a connection to the PC, you need one of the following components:

**Configuration cable: EasyConnect-CAB**


*Fig. 17: EasyConnect-CAB*

1 PC (by others)
2 USB–RS485 and connecting cable (for a wired connection)
EasyConnect-CAB

**Configuration cable: EasyConnect-BC**


*Fig. 18: EasyConnect-BC*

1 PC (by others)
2 Bluetooth adapter module BlueCON (for wireless connection)
Order code: EasyConnect-BC

### Activation

Activate the system as described below.
**Important:** Always commission **the mesh master first**.

### Mesh master – network setup


*Fig. 19: Service port T1*

1. Connect your PC with the module. To do so, plug the configuration cable (yellow) into port *'Service/T1'*, then start the configuration software.

> ***For connections with a Bluetooth adapter module:***
> *Make the connection according to the instructions supplied.*

2. Press the *[Push Service]* (Fig. 19/1) button on the FAM-RD for 2 seconds to activate port Service/T1.

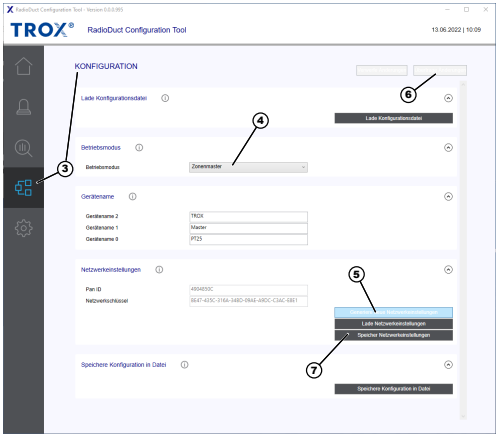


*Fig. 20: Zone master configuration for RadioDuct*

3. Go to the *'Configuration'* page.
4. Set the operation mode to *'Zone master'*.
5. Click on *[Generate new network settings]* to have a Pan ID and a network code (128 Bit AES Key) created.
6. Click on *[Transmit changes]* to transmit your entries to the RadioDuct master.
7. Click on *[Save network settings]* to save the network parameters on your PC so that you can use them later for other other network devices.

   ⇨ Once the integration is complete and the connections to the zone modules have been established, you can configure the zone master, ↳ *'X-AIRCONTROL commissioning and service manual'*.

### Mesh nodes (devices) – network setup

1. Connect your PC with the module. To do so, plug the configuration cable (yellow) into port Service/T1, then start the configuration software.

> ***For connections with a Bluetooth adapter module:***
>
> *Make the connection according to the instructions supplied.*

2. Press the *[Push Service]* (Fig. 19/1) button on the module for 2 seconds to activate port Service/T1.

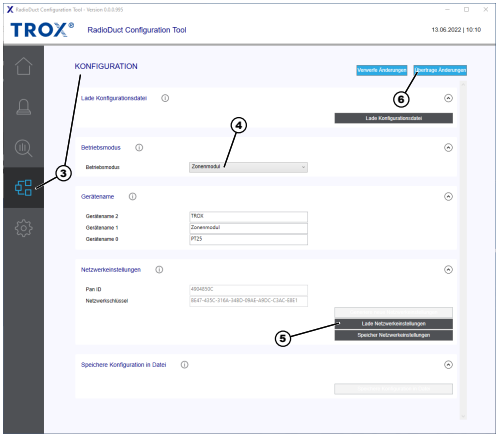


*Fig. 21: Zone module configuration for RadioDuct*

3. Go to the *'Configuration'* page.
4. Set the *'Operation mode'* to *'Zone module'*.
5. To use the Pan ID and network key saved earlier as part of the RadioDuct master configuration, click on *[Load network settings]*.
6. Click on *[Transmit changes]* to transmit your entries to the zone module.

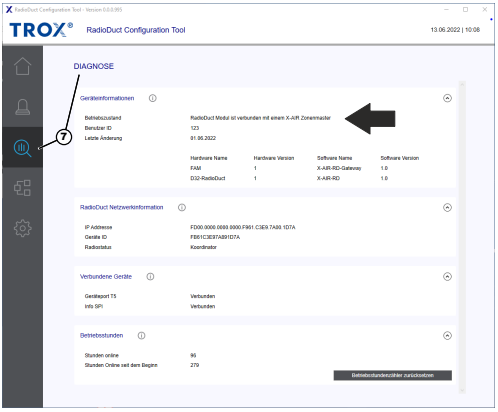


*Fig. 22: RadioDuct diagnosis*

7. Go to the *'Diagnosis'* page to check whether the connection to the master has been correctly made.
8. To find out whether the zone master has assigned the zone modul a correct address, see the segmented display of the X-AIR-CONTROL zone module ↬ *'X-AIRCONTROL commissioning and service manual'*.

   ⇨ 99 = no address has been assigned by the zone master
   1 – 25 = valid address assigned by the zone master

**Mesh repeater – network setup**

If a connection tends to fail of if a connection from a network node (device) to the master has a poor signal quality, a repeater is required in the transmission path. A repeater is just another node in the mesh network; it receives a signal and amplifies it before forwarding it.

1. ▶ Connect your PC with the module. To do so, plug the configuration cable (yellow) into port Service/T1, then start the configuration software.

> ***For connections with a Bluetooth adapter module:***
> *Make the connection according to the instructions supplied.*

2. ▶ Press the *[Push Service]* (Fig. 19/1) button on the module for 2 seconds to activate port Service/T1.

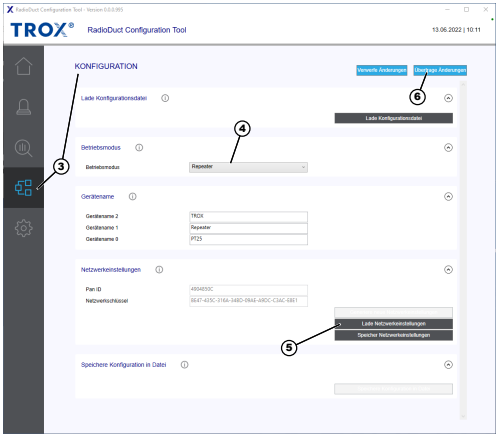


*Fig. 23: Repeater configuration for RadioDuct*

3. ▶ Go to the *'Configuration'* page.

4. ▶ Set the *'Operation mode'* to *'Repeater'*.

5. ▶ To use the Pan ID and network key saved earlier as part of the RadioDuct master configuration, click on *[Load network settings]*.

6. ▶ Click on *[Transmit changes]* to transmit your entries to the repeater.

7. ▶ Checking the connection to the master: The radio status is shown on the *'Diagnosis'* page and on the module, Fig. 22.

### Commissioning X-AIRCONTROL

After all FAM-RDs have been successfully commissioned, X-AIRCONTROL has to be commissioned ↳ *'X-AIRCONTROL commissioning and service manual'*.

Using RadioDuct requires that you set a timeout in the X-AIRCONTROL master.
You can enter it under *'Settings* ➔ *MODBUS Timeout'* (requires special user access rights).

You can adjust the timeout (Modbus timeout) to the actual conditions according to the following examples:

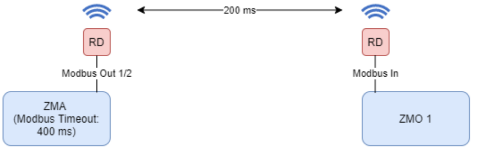


*Fig. 24: X-AIRCONTROL with one mesh connection*

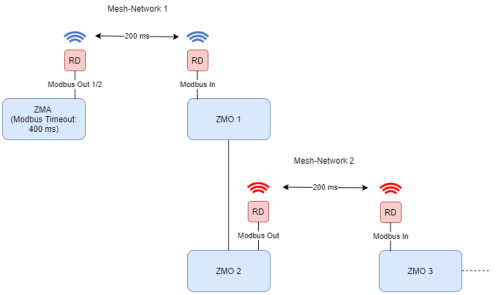


*Fig. 25: X-AIRCONTROL with two mesh connections*

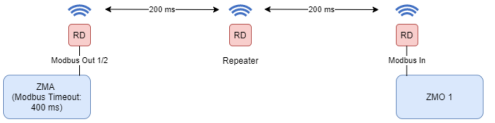


*Fig. 26: X-AIRCONTROL with one mesh connection that includes a repeater*

## 9 Diagnosis / troubleshooting

### Diagnosis information in the configuration software

The following status information displays:

- Radio status
- Signal quality:
  - green (1 – 2) = good
  - yellow (2 – 3) = sufficient
  - red (3 – 5) = poor
- Signal time [ms]
- Connection loss (counter)
- Network address
- Device ID

### Diagnosis information on the main PCB

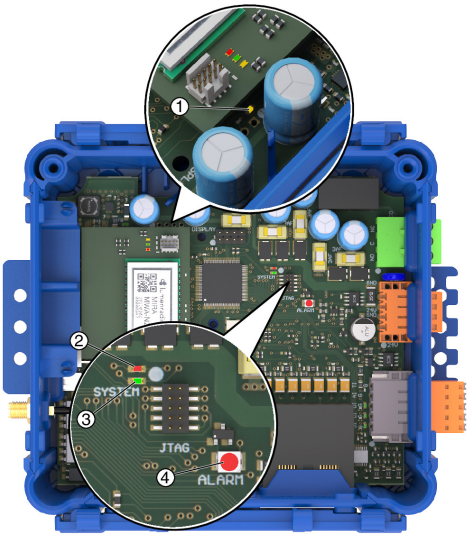


*Fig. 27: Diagnosis information on the main PCB*

**(1) Yellow LED (CONFIG)**

On - The connection between FAM and the RadioDuct expansion module has been established.

Off - No connection between FAM and the RadioDuct expansion module

Blinking - Data transmission from FAM to the RadioDuct expansion module is in progress. The blinking frequency depends on the data transmission rate.

**(2) Red LED (SYSTEM)**

On - Device not configurated

Off - Device OK

**(3) Green LED (SYSTEM)**

On - Normal (error free) system operation

Off - Normal system operation or no voltage

Blinking, 2 Hz - Heartbeat controller is working

**(4) Red LED (ALARM)**

Off - Not used, LED remains off

**Diagnosis information on the RadioDuct expansion module**

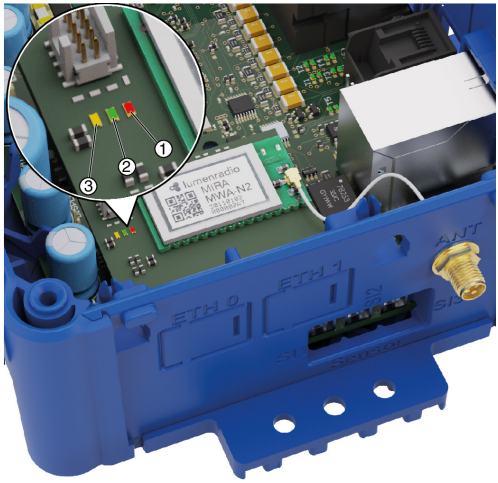


*Fig. 28: RadioDuct diagnosis information*

**Mesh network master**

**(1) Red LED (error)**

On - Module has not been configured with the network parameters

Off - Currently no alarm

**(2) Green LED (connect)**

On - Connection to at least one node (device) has been established and is working

Off - Module has not been configured with the network parameters

Blinking, 1 Hz - Master has been configured, but no network device has initiated a connection

**(3) Yellow LED (data)**

Blinking - Data transmission in progress, blinking frequency depends on data transmission rate

**Mesh network devices and mesh repeaters**

**(1) Red LED (error)**

On - Module has not been configured with the network parameters

Off - Currently no alarm

Blinking, 2 Hz - ETX value > 3 = network connection with poor signal quality

**(2) Green LED (connect)**

On - Connection to radio network has been correctly established

Off - Module has not been connected to a radio network

Blinking, 1 Hz - Connection to the network is being established (state: network calibration)

Blinking, 2 Hz - Connection to the network is being established (state: network assignments)

**(3) Yellow LED (data)**

Blinking - Data transmission in progress, blinking frequency depends on data transmission rate

## 10 Technical data

### Dimensions

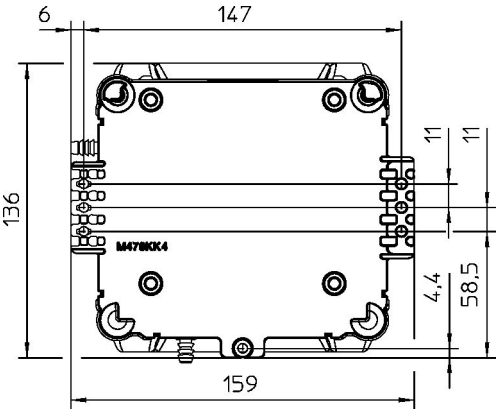


*Fig. 29: Dimensions and fixing points*

### Technical data

| | |
|---|---|
| Radio frequency | 2.4 GHz |
| Max. radio transmission output | 100 mW |
| Power rating | 5 VA |
| Encryption | 128 bit AES |
| Power supply | 24 V AC or DC |
| IEC protection class | III (protective extra-low voltage) |
| Ambient temperature | 10 to 50 °C |
| Protection level | IP20 |
| CE conformity | ■ EMC directive 2014/30/EU<br>■ RoHS 2011/65/EU<br>■ Radio equipment directive *'RED 2014/53/EU'* |
| Weight | 500 g |

## 11 Decommissioning

If the device is no longer used, it has to be removed and disposed of in an environmentally friendly manner.

### Safety

#### Personnel

- Disassembly must only be carried out by specially trained personnel.
- Only skilled qualified electricians must work on the electrical system.

#### Electrical system

**DANGER!**

**Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Live electrical components may suddenly move uncontrollably and seriously injure people.

Therefore:

– Switch off the power supply and disconnect the product permanently before you begin to disassemble it.
– Make sure that stored residual electrical energy is discharged.

### Disassembly

Before you start disassembly:

- Switch off the device and secure it against being switched on accidentally.
- Physically disconnect the unit from the power supply and make sure that any stored residual energy is discharged.
- Remove any other connected cables.

Then disassemble the device professionally in compliance with local occupational safety and environmental protection regulations.

### Disposal

If no take back (disposal) agreement is in place, the various parts should be recycled:

- Scrap the metals.
- Take plastic parts to be recycled.
- Dispose of other components in a suitable manner, i.e. depending on their material properties.

**ENVIRONMENT!**

**Risk of harm to the environment due to improper disposal**

Electronic waste, electronic components and chemically contaminated parts (e.g. from extract air systems) are hazardous waste and must be disposed of by a specialist company.

If you are not sure how to dispose of anything in an environmentally friendly manner, contact your local authorities or a specialist disposal company.

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