# IQD-REP-02-x1D

## IQRF Repeater

## User's guide



Smarter Wireless. Simply.

## Description

IQD-REP-02-x1D is a series of two types of indoor repeaters for the IQRF platform. It is intended to increase RF range, throughput, and reliability in IQRF wireless Mesh networks. Moreover, it supports Beaming sensors.

## Key features

- Increasing RF range
- Beaming sensors supported
- NFC chip for easy including into the network
- Wall plug or soffit mount versions
- Supplied from mains
- SW upgradeable via RF

## Purpose

- RF range prolonging
- To increase network redundancy, robustness, and reliability
- Creating a routing structure for moving Nodes
- Covering of deaf places
- Aggregating data from Beaming sensors

## Applications

- IQRF wireless Mesh (IQMESH) networks
- IQRF interoperable as well as non-interoperable applications
- For STD as well as STD+LP networks
- Interfacing low-power Beaming sensors
- Internet of Things

*IQD-REP-02-W1D*
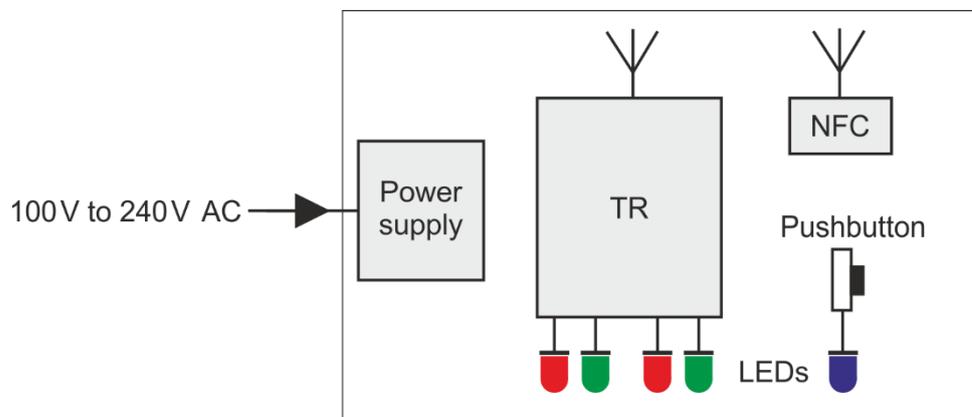
*IQD-REP-02-S1D*

## Simplified block diagram

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**Warning**

Installing and all other handling the IQD-REP-02-S1D with removed cover must only be done by a person authorized to work with dangerous voltage.

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## *Technical specifications* *Typical values (until otherwise specified)*

| | |
|---|---|
| Supply voltage | 100 V to 240 V AC, 50 Hz to 60 Hz (mains) [2] |
| Supply current | 15 mA max. |
| | |
| RF transceiver | TR-76DA (with antenna built-in the TR board) |
| RF band | 868 MHz or 916 MHz, configurable |
| Effective radiated power | Up to 6.5 dBm, programmable in 8 levels |
| RF range | Up to 500 m [1] |
| Other RF parameters | See TR-76D datasheet. |
| | |
| IQMESH network Node type | STD |
| Custom DPA Handler | |
|   IQD-REP-02-W1D | HWPID = 2804 |
|   IQD-REP-02-S1D | HWPID = 2C04 |
| Alternative DSM channel | 67 |
| Default Access Password | All 16 B filled with zeros |
| | |
| Temperature | |
|   Operating | -20 °C to +60 °C |
|   Storage | -40 °C to +80 °C |
| Ingress protection | IP54 (IQD-REP-02-W1D as well as IQD-REP-02-S1D) |
| Size | |
|   IQD-REP-02-W1D | 77.6 mm x 54.8 mm x 82.0 mm |
|   IQD-REP-02-S1D | 122 mm x 93 mm x 56 mm |
| Weight | |
|   IQD-REP-02-W1D | 100 g |
|   IQD-REP-02-S1D | 160 g |

**Note 1:** Test arrangement: bidirectional communication with counterpart TR-72DA transceiver plugged in DK-EVAL-04A kit, both devices in free space, 1.6 m above the ground, antennas in the repeater and the counterpart oriented parallelly. For **non-parallel** arrangement, the range is **seriously lower**. See chapter *Antenna*.

**Note 2:** The electrical installation must be equipped with a circuit breaker (6 A, characteristic B), which also serves as the main disconnecting means.

## *Absolute maximum ratings*

Stresses beyond those values may cause permanent damage to the device. Exposure to maximum rating conditions for extended periods may affect the device reliability.

| | |
|---|---|
| Supply voltage | 240 V AC max. |
| Temperature | -20 °C to +60 °C operating, -40 °C to +80 °C storage |

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# *Hardware*

## IQRF antenna

The antenna is built in the TR-76DA PCB board. The repeater must be **installed with respect to the orientation of the antenna** inside the product case. See chapter *Layout*.

All antennas in the IQRF application should be oriented with respect to their polarization and radiation patterns. Therefore, all IQRF devices should be placed to have the longitudinal axis of the antennas oriented parallelly:



| Correct | Incorrect | Correct | Incorrect |
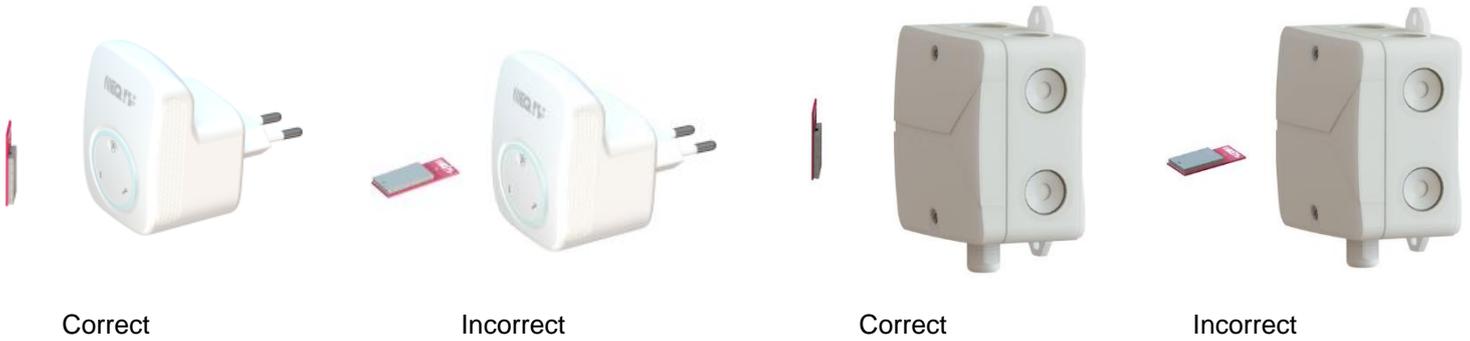
## Pushbutton

The pushbutton PB1 is accessible from outside the case in IQD-REP-02-W1D (via the circular cap) and inside the case in IQD-REP-02-S1D. It is intended for advanced features only. See chapters *Local bonding* and *Factory settings*.

## LEDs

The LEDs are visible from outside the case in IQD-REP-02-W1D (through the edge of the circular cap) and only inside the case in IQD-REP-02-S1D. See chapter *Layout* for LED locations.

| LED | Functionality |
|---|---|
| **LEDG1** | Indication during installation |
| **LEDR1** | |
| **LEDG2** | *Not used in this firmware version* |
| **LEDR2** | |
| **LEDB** | Button press indication |

## NFC

The NFC non-volatile memory (EEPROM) with a contactless interface enables wireless Near-Field Communication between the repeater and a portable device like a mobile phone when it is located very close (up to a few centimeters) to the NFC antenna. See the picture below. This is primarily intended for bonding (including the repeater into the IQMESH network).
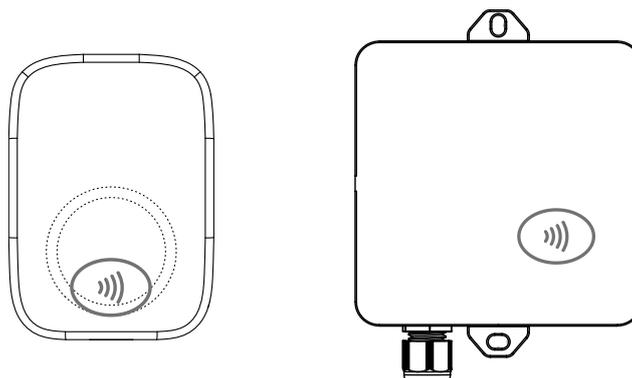
## Power supply connecting
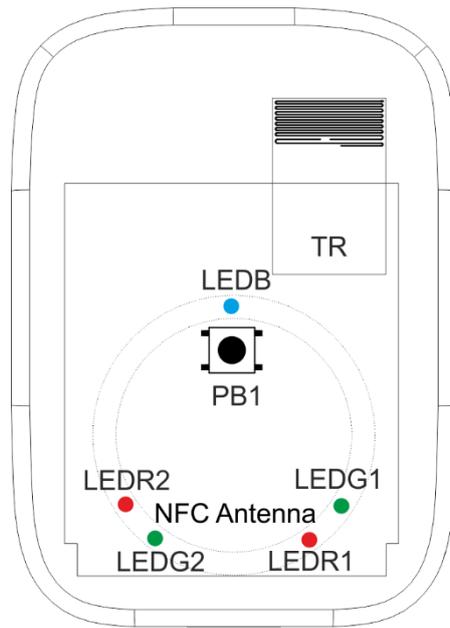
For IQD-REP-02-S1D only:

> **Warning**
>
> The IQD-REP-02-S1D is intended for mounting in the building soffits. After connecting the power supply cable, the bushing must properly be tightened to avoid plucking the cable out and the cover must be fixed by both screws.
>
> Installing and all other handling the IQD-REP-02-S1D with removed cover must only be done by a person authorized to work with dangerous voltage.
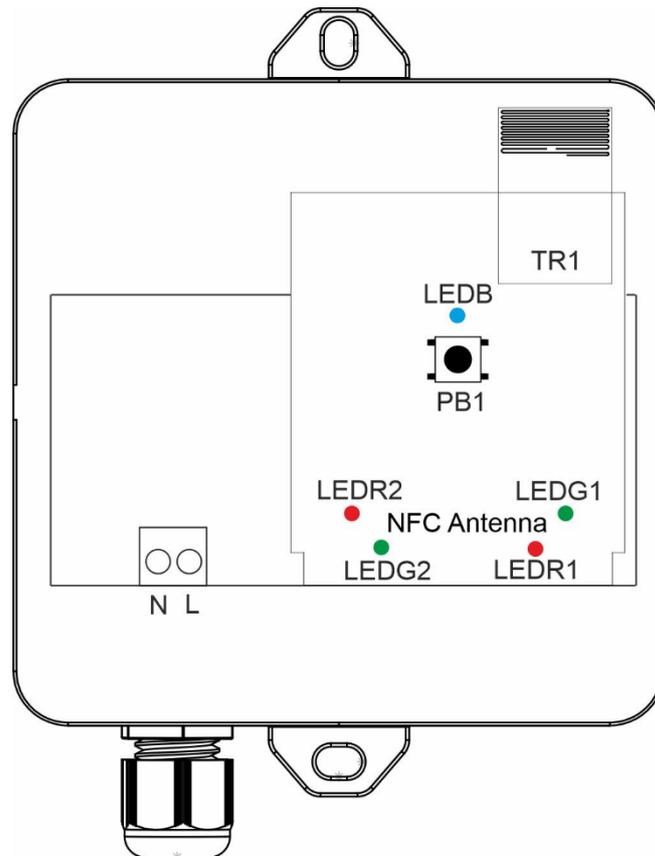
The IQD-REP-02-S1D must be supplied via a 2-wire cable certified for powering from mains, with outer diameter 3.5 to 6 mm, connected through the bushing to the screw clamp connector. The cable is not delivered with the repeater.

## Layout



*IQD-REP-02-W1D*



*IQD-REP-02-S1D*

## *Installation*

> **Warning**
>
> Installing and all other handling the IQD-REP-02-S1D with removed cover must be done only by a person authorized to work with dangerous voltage.

The repeater should be put into operation by a person a bit familiar with IQRF technology.

## Including into the network

The repeater can be used in both IQMESH network types: STD as well as STD+LP.

The repeater must be included (bonded) into the desired IQMESH network. From the bonding point of view, the two states of the repeater are recognized: **bonded** or **not bonded**.

## LED indication

The behavior is depicted in the time diagrams below where individual lines relate to **LEDR1**, **LEDG1**, and the **pushbutton** (in black). Possible actions of the network **Coordinator** (typically inside a gateway) are depicted in purple.

The legal bonding states are indicated **after power on** by LEDR1 and LEDG1.

### Bonded repeater

The bonded repeater is indicated by a single flash of the red LEDR1.

### Not bonded repeater

Not bonded repeater is indicated by rapid LEDR1 flashes, **waiting for** (a new) **bonding** (in power-saving LP RX mode).

### Error

Other ways of LEDR1 and LEDG1 behavior indicate **errors** (e.g. an incomplete bonding). To recover from an error state, unbond the repeater or restore the factory settings of the repeater and try to bond it once more. If not helped, it is probably a question of a more serious fault. Contact IQRF support in such a case.
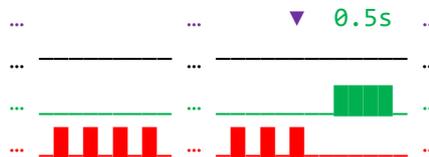
## Bonding

A repeater to be bonded **must** always be in the **not bonded** state. Thus, before a new bonding, the possibly bonded repeater (e.g. still remaining bonded to another network from a previous application) must be unbonded first.

It is recommended to bond the repeater via **Smart Connect**. Other methods (Local bonding or Autonetwork) are also possible but should be performed by an IQRF-skilled person only. See chapter *Advanced bonding methods.*

### Smart Connect

To bond the repeater using the Smart Connect, perform the following steps:

- The repeater is identified by the so-called **IQRF Smart Connect Code**. For Smart Connect bonding, this code must be transferred into the Coordinator (gateway) in advance. It can be accomplished in various ways, e.g. via the QR code or via NFC. See chapter *IQRF Smart Connect in practice* for details.
- Place the repeater to be **in range with** at least one **Node already bonded** in the network (with routing enabled and not sleeping). It may but need **not** be the **final location** of the repeater.
- Switch the power supply on. The LEDR1 starts rapidly flashing and the repeater is waiting for bonding.
- Launch the Smart Connect procedure (▼) at the Coordinator.
- Wait until the Smart Connect process is finished. Successful bonding is indicated by a single LEDG1 flash for 0.5 s.



- Relocate the repeater to the **final location** (if needed).
- Perform **Discovery** at the Coordinator (to update routing paths with respect to the new topology).

## Unbonding

To exclude (unbond) the repeater from the network, perform the following steps:

- Switch the **power supply off**.
- **Press** and **hold** the **pushbutton**.
- Switch the **power supply on**. The LEDG1 goes on for 2 s.
- **Release** the **pushbutton** immediately (**within 0.5 s**) once the LEDG1 gets off.
- Unbonding is indicated by 1 s LEDR1 flash.
- Then the repeater is automatically restarted and rapid LEDR1 flashes indicate the unbonded repeater.
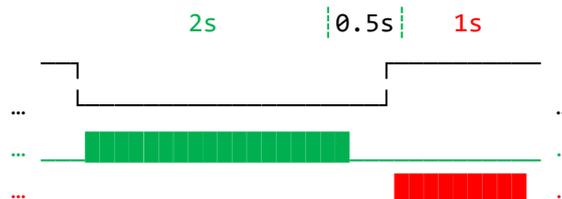
## Factory settings

Regardless of the actual configuration and bonding information stored in the bridge, it is anytime possible to restore the factory setting to the default values.

It can be useful as a retrieval when the common methods are not applicable, e.g. in case of lost Access Password or for bonding a repeater with unknown history into a new network.

### Bonded repeater

To restore the factory settings of a bonded repeater, perform the following steps:

- Switch the **power supply off**.
- **Press** and **hold** the **pushbutton**.
- Switch the **power supply on** and **continue holding** the **pushbutton**. The LEDG1 goes on for 2 s.
- Still **continue holding** the **pushbutton**. After another 2.5 s the LEDG1 goes on once more for 2 s.
- **Release** the **pushbutton** immediately (**within 0.5 s**) once the LEDG1 goes off for the second time.
- Restored factory settings are indicated by 1 s LEDR1 flash.
- Then the repeater is automatically restarted and rapid LEDR1 flashes indicate the unbonded TR.
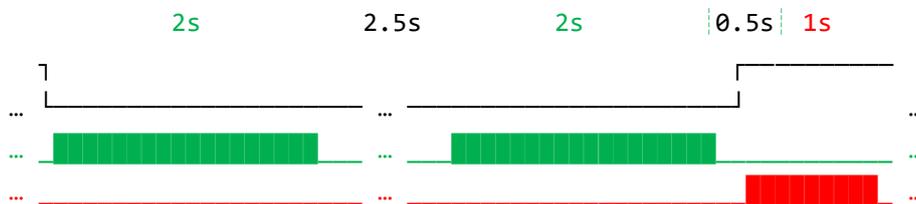


### Not bonded repeater

To restore the factory settings of a not bonded repeater, perform the following steps:

- Switch the **power supply off**.
- **Press** and **hold** the **pushbutton**.
- Switch the **power supply on** and **continue holding** the **pushbutton**. After 2.5 s the LEDG1 goes on for 2 s.
- **Release** the **pushbutton** immediately (**within 0.5 s**) once the LEDG1 goes off.
- Restored factory settings is indicated by 1 s LEDR1 flash.
- Then the repeater is automatically restarted and rapid LEDR1 flashes indicate the unbonded repeater.
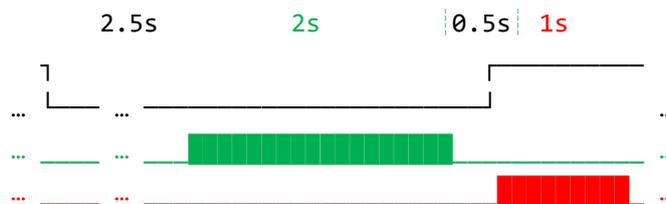
## *Operation*

## Routing

Once the repeater is successfully **bonded** and **discovered**, it immediately starts routing all received packets according to the IQMESH routing rules.

## Data aggregation from Beaming sensors

For IQRF OS v4.04D and DPA v4.15 or higher only.

Besides of the routing mentioned above, the IQD-REP-02-x1D concurrently works as an **Aggregating repeater**. This means that it serves as an interface and datalogger for low-power sensors working in **Offline mode** (so-called **Beaming sensors**).

A Beaming sensor, once bonded, works in Offline mode. It is sleeping all the time and periodically or on some event asynchronously sends data to all Aggregating repeaters which are in direct RF range. Aggregating repeaters always store the last received data from every Beaming sensor and automatically clear it after reading out. The data can be read out synchronously by the Coordinator using the Offline FRC. The Offline FRC is an analogy to the common FRC intended to read out common (non-Beaming) sensors. The data incoming to the Coordinator has the same format as from common (non-Beaming) sensors.

## *For advanced users*

## Software

The TR inside the repeater is equipped with the following software:

- **Operating system** IQRF OS
- **DPA plug-in** `DPA-Node-STD…`
- **Custom DPA Handler** according to the HWPID assigned to the given IQD-REP-02 version.

All software inside the repeater (see above) is upgradeable. However, the possible upgrade must be done by a person familiar with the IQRF technology. Refer to the *IQRF DPA Framework Technical guide*, chapter *Over The Air (OTA) upgrade of IQRF OS and DPA*.

> The **TR** inside the repeater must be equipped with **the same IQRF OS version** and with **the same DPA version** as all other TRs in the given network.

## Configuration

For security, advanced bonding methods (Local bonding and Autonetwork) require setting the proper **Access Password**. The Access Password of the repeater must be set the same as for the Coordinator in the given network. It must wirelessly be written into the **TR configuration** of the transceiver inside the repeater, using IQRF IDE and CATS. See the *IQMESH Network Deployment Technical guide*, chapter *CATS Service Tools.* Another possibility is via the network. See the *IQMESH Network Deployment Technical guide*, chapter *Change of TR Configuration.*

The **Access Password** is the only parameter from TR configuration which must be set before advanced bonding the repeater. All other configuration parameters are **preconfigured** from the factory or will be **inherited** wirelessly from the network Coordinator (automatically during bonding). See Default Access Password for the value preconfigured from the factory.

Additionally, the Access Password is also intended for possible subsequent **maintenance**, such as authorization in *DPA Service Mode* (DSM) and encryption and decryption of backup data during the *Backup / Restore* process intended for an easy future **replacement** of the repeater in the network (e.g. after the damage of the repeater).

## Product identification

The repeater product type can be identified in the IQRF Repository as an IQRF interoperable device through the HWPID.

# Advanced bonding methods

## Local bonding

To bond the repeater using the Local bonding, perform the following steps:

● Ensure setting the Access Password according to the network Coordinator. See chapter *Configuration* above.
● Temporarily place the unbonded repeater to be **in direct RF range** with the Coordinator.
● Switch the **power supply on**. The LEDR1 starts rapidly flashing and the repeater is waiting for bonding.
● **Invoke** the **Local bonding** procedure (▼) at the Coordinator (in the gateway), e.g. via DPA command *Bond Node* or from the IQRF Gateway Daemon, either via the web page inside the IQRF Gateway webapp in the menu *IQRF network/Network manager* or via IQRF gateway API.
● Then **press** and **hold the pushbutton** within the **10 s** period. The LEDR1 starts flashing slowly. Continue holding the pushbutton until a single 0.5 s long **LEDG1 flash** appears. This indicates **successful** bonding. (If the bonding is **not completed** in about **5 s**, evidently a **failure** occurred.)
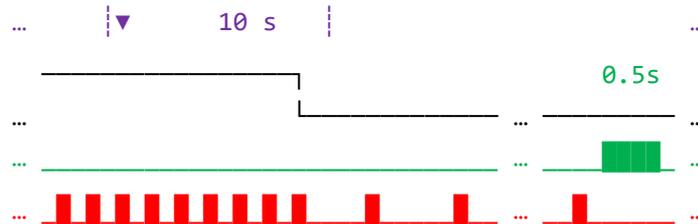


● Relocate the bonded repeater to the **final location**.
● Perform **Discovery** at the Coordinator (to update routing paths with respect to the new topology).

## Autonetwork

To bond the unbonded repeater using the Autonetwork, perform the following steps:

● Ensure setting the Access Password according to the network Coordinator. See chapter *Configuration* above.
● Place the repeater to its **final location**.
● Switch the power supply on. The LEDR1 starts rapidly flashing and the repeater is waiting for bonding.
● Launch the *Autonetwork* process (▼) at the Coordinator. See the *IQMESH Network Deployment Technical guide*, chapter *Autonetwork*.

The Autonetwork automatically bonds the repeater and performs the **Discovery** (to update routing paths with respect to the new topology). The resulting state of the repeater is either bonded (LEDR1 off) or unbonded (LEDR1 still flashing). The result can be detected at the Coordinator side, e.g. in IQRF IDE or IQRF Gateway Daemon (if applicable).

# Backup/Restore

To enable seamless replacing a possibly damaged repeater, the respective data must be read from the repeater before the damage. This data can be copied into a new repeater any time later. Refer to the *IQMESH Network Deployment Technical guide*, chapter *Transceiver replacement*.

# IQRF Smart Connect in practice

The Smart Connect should be performed by a person a bit familiar with IQRF technology.

## IQRF Smart Connect Code

**Read** the IQRF Smart Connect Code from the repeater by a **mobile application** (such as IQRF Network Manager for Android). It can be accomplished in various ways, e.g. via the **QR code** via **NFC**.

## QR code

The **IQRF Smart Connect Code** can anytime be read from the **QR code** on the **label** on the case of the repeater.

## NFC

The **IQRF Smart Connect Code** can anytime be read via **NFC**.

## IQRF Repository

The mobile application is linked to the IQRF Repository. It is is a public on-line **storage** and **database** containing information regarding all **IQRF interoperable products**. It provides information about and relations between the IQRF objects such as **companies**, **products**, **DPA handlers**, **standards**, **OS**, **DPA**, etc. Individual product types are identified by their **HWPID**s there.
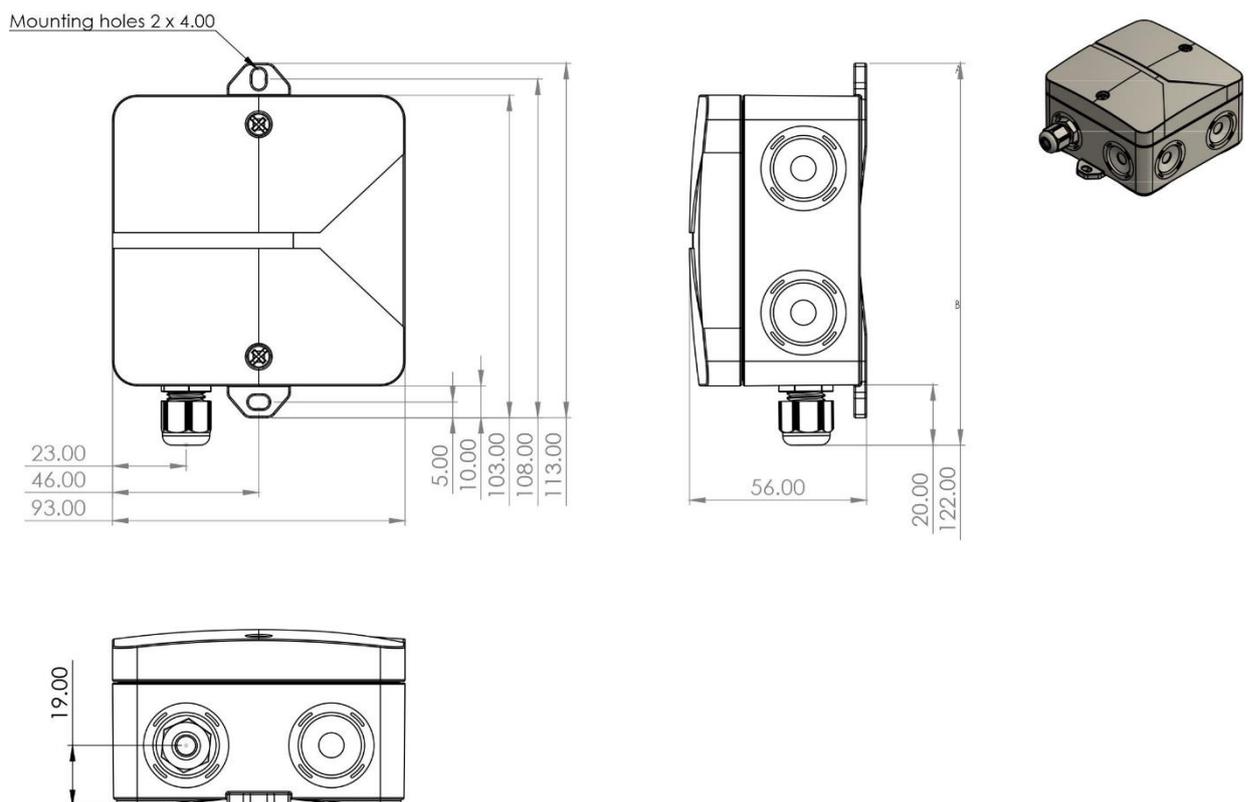
## Smart Connect launch

The Smart Connect can be launched via the web page inside the IQRF Gateway webapp the control application in the gateway.

# Mechanical drawings

### IQD-REP-02-W1D
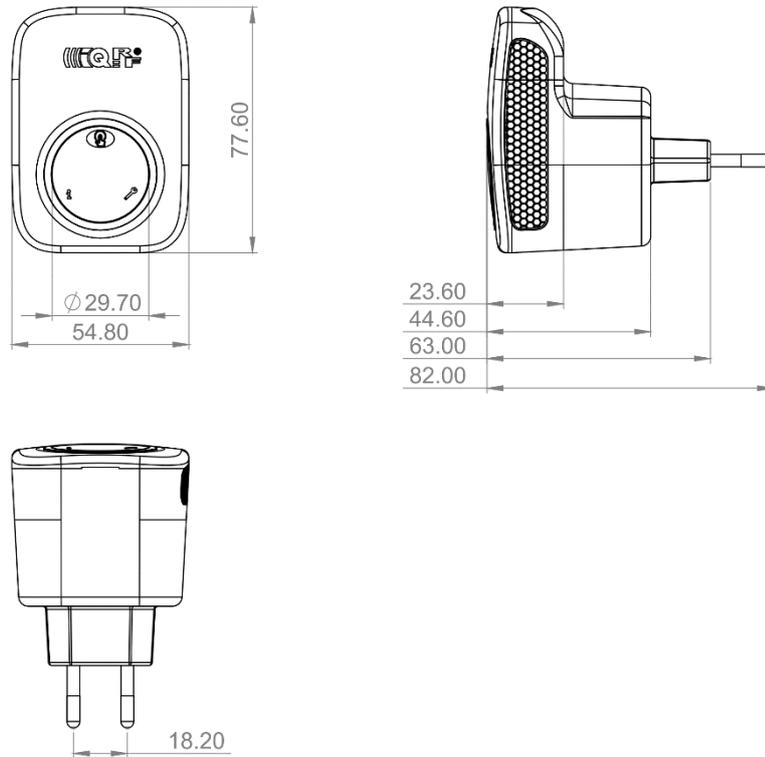


### IQD-REP-02-S1D

## *Product information*

## Ordering code

IQD-REP-02-W1D          IQRF Repeater, wall plug, with the socket for France, Czechia, Slovakia, and Poland.
IQD-REP-02-S1D          IQRF Repeater, soffit mount

## Supplied contents

For IQD-REP-02-W1D:          Wall plug IQRF repeater
For IQD-REP-02-S1D:          Soffit mount IQRF repeater, without a power cord

The repeater is delivered with current versions of all software included. Lower versions are available on request.

## Recommended option

For IQD-REP-02-S1D only:
2-wire power cord for powering from mains, 3.5 to 6 mm thick. The wall plug depends on the country.

## Document history

201217          Directives in chapter Quality management updated.
201116          First public release.

# Sales and Service

## Corporate office

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## Technology and development

www.iqrf.org
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## Partners and distribution

www.iqrf.org/partners

## Quality management

*ISO 9001 : 2009 certified*

*Complies with EN 62368-1:14+A11:17, EN 55032:15, EN 55024:10+A1:15,
ETSI EN 301489-1V2.2.3:19, ETSI EN 301489-3V2.1.1:19.*

*Complies with ETSI directives EN 301 489-1 V1.9.2:2011, EN 301 489-3 V1.6.1:2013,
EN 300 220-1 V3.1.1:2017, EN 300 220-2 V3.2.1:2018 and ERC Recommendation
70-03 (2017) and VO-R/10/05.2014-3.*

*Complies with directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).*

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## **Online support:** support@iqrf.org

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