



Installation and service manual



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1 IQRC system description

The IQRC control system is focused on zone heating control, which ensures temperature comfort for the customer, the ability to regulate the temperature of rooms separately in the office, corridor, kitchen..., the ability to set parameters from anywhere in the world via the Internet, with the right settings, the customer can achieve savings of up to 25% and a quick return on the system. Another great advantage is that the system automatically moves the heating to rooms with a lower temperature (*usually the north side of the buildings*) from rooms where the temperature is already reached (*south side of the buildings*). Heating is therefore active only where it is needed. The software can differentiate between user levels and thus restrict some functions to users, even limiting access to individual rooms. The IQRC system can be connected to 667 IQRC elements (control unit, temperature sensor, thermostatic head, FanCoil...) and is therefore designed for office buildings, schools, multifunctional buildings, shopping centres, hospitals...

The IQRC system uses Zigbee wireless standards for communication, which allows to combine several different functional control elements (*switching, dimming of lights, window blinds, sensing of window contacts, alarm systems, sensors...*). Amicus SK plans to incorporate other systems into its system, but its primary focus is on heating control.

This manual is intended for IQRC installers who have at least a basic knowledge of computer networking, heating control, and have been introduced to the IQRC system. As the system is not exclusively designed for households, not all settings may be intuitive for the average user.

2 IQRC heating control system installation manual

2.1 Checking the functionality of the existing heating system (hot water heating system)

Before the installation of the IQRC system, always carry out a site survey, where the exact technical and electrical solution of the building itself is examined, and a specific solution is proposed, a specific number of elements for each room, and based on the difficulty of the implementation itself, the final quotation is also provided. Some quotations can also be made on the basis of answering questions about the technical equipment and design of the building and the heating of the building and on the basis of technical drawings and documentation.

Before installing the IQRC system it is necessary to check all radiators and their functionality (*whether they work*). This can prevent the problems of radiator not heating before IQRC installation, or disagreement between the customer and the contractor about the (*non*) functionality of the system before and after installation. If the radiator does not work before installation, it will not work after the IQRC heads are installed! The radiator needs to be repaired (vented, cleaned, valve replaced...).

2.2 Installation procedure for IQRC heating control system elements

1. **FFD equipment** ("*Full Functional Device*" - **controller, boiler switch, router, radiator**) are installed and switched on first. These devices form the backbone communication network between all devices.
2. **Central Unit** - (hereafter referred to as CU) In the second step, install the IQ24GW CU to start connecting FFD devices to it, because if no device connects to the CU, the CU reboots every hour (due to re-initialization of the peripherals - the so-called self-correcting function).
3. **RFD devices** ("*Reduced Functional Device*" - **battery-powered devices - heads, temperature sensors**) are installed last. Heads are mounted on the valves and insert the batteries. We also install the temperature sensors and batteries are inserted. It is advisable to install all FFD devices first to ensure RFD devices are connected to the network. **The RFD device has no possibility to connect to the network without the FFD device (it has no connection point available)!**
4. The last step is to create and set up zones (rooms), equipment, reservations, temperature programs, system control...

Note: No RFD device should be installed first; they should be installed last, because if a wireless network is not established by the Central Unit, RFD devices will still try to connect at shorter intervals to ensure the longest battery life (maximum connection attempt interval is 4 hours). This protection against increased battery discharge is activated only when the head is unconnected for 1 day or more after each battery insertion.

3 Installation of IQRC operating software

Operating system: Windows XP/Vista/7/8/8.1/10 x86 or x64.
NET.Framework 3.5 and later.

3.1 Installing the IQRC

Installer: The IQRC program is installed by running the iqrc_setup.exe file, which is available on request.

Portable version: The IQRC.zip archive is extracted to any folder and the IQRC program is run using the iqrc.exe file.

Use only AMICUS SK, s.r.o. products and abide by all licensing agreements. Any manipulation, re-distribution or reverse engineering of any part of the system is prohibited and may be subject to penalties.

4 IQRC Operating Software

With the IQRC software it is possible to fully control, set up and test the IQRC system. All functions are only available to System Administrators, which means that the system differentiates the login name and password of the logged-in user.

4.1 Description of the IQRC login window:

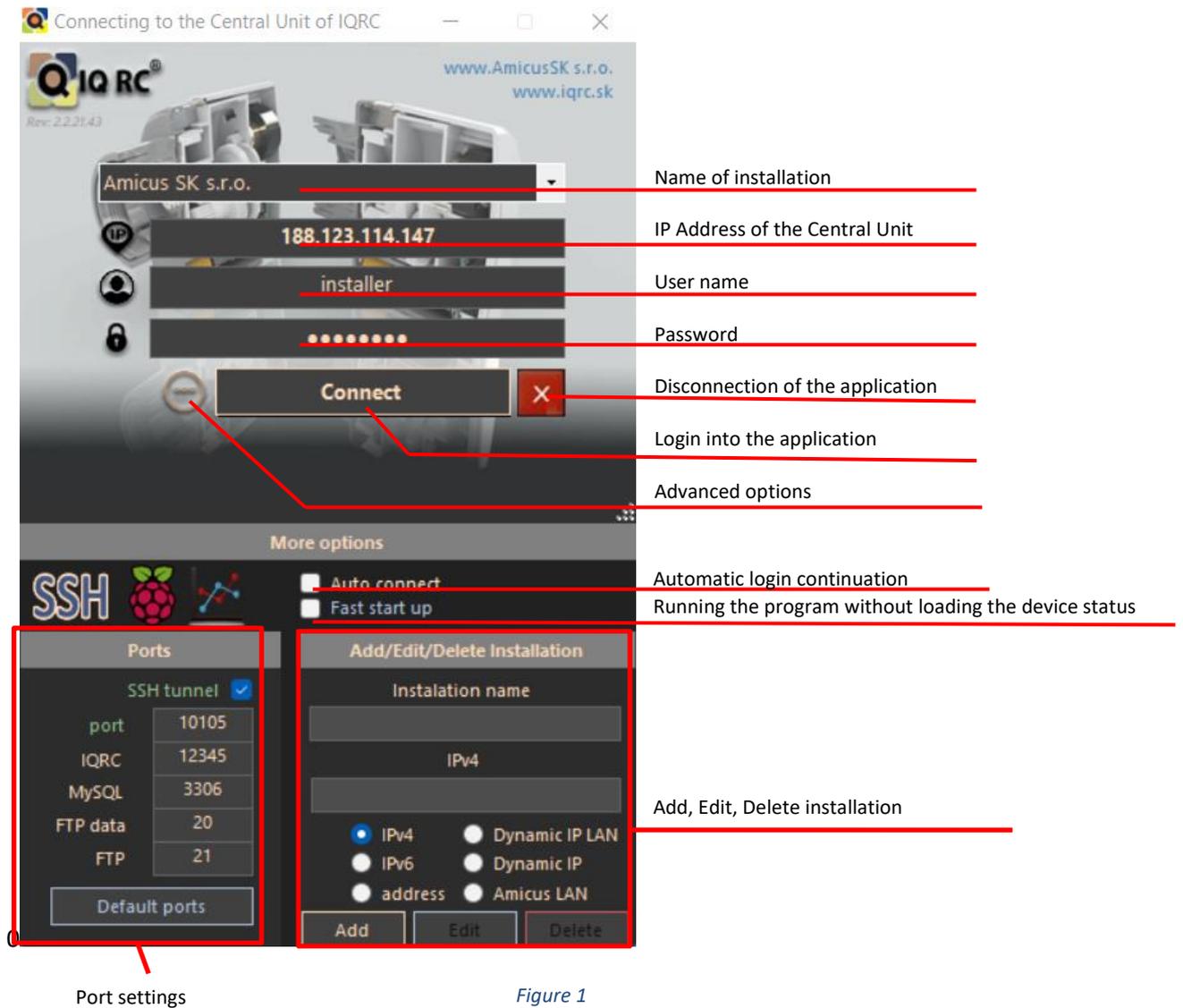


Figure 1

4.2 IQRC Software Main Window

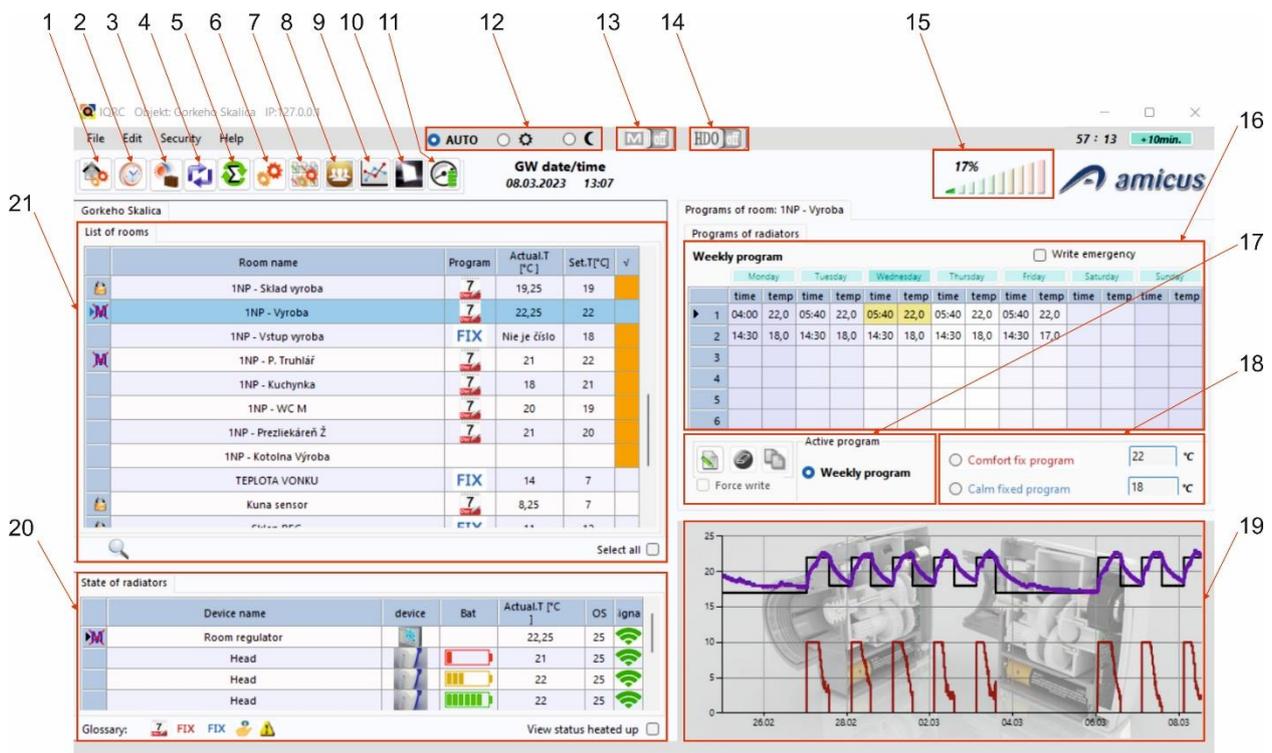


Figure 2

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. Room and Facilities Management 2. Time and Date Settings 3. Arrival/Departure/Holiday Mode Settings 4. Slow Update of Device Status 5. Quick Update of Device Status 6. Device settings 7. Bulk Device Setup 8. Account Setup 9. Graph 10. Timetable Import 11. Estimated battery consumption and reset | <ol style="list-style-type: none"> 12. Central heating mode 13. Summer mode status 14. HDO Status (high/low tariff) 15. Percentual Heating Status (% of head opening) 16. Overview of the Weekly Program 17. Adjusting the Weekly Program 18. Quick Change of Heating Program 19. Heating Graph 20. List of Equipment in the Rooms 21. List of Rooms |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

4.3 GW Central Unit Activation

The activation of the Central Unit was designed to protect Amicus SK against copying of IQRC devices. If the Central Unit is not activated, no changes can be made to the IQRC system! Inactive status of the Central Unit is determined by flashing the orange LED with the key icon on the Central Unit (GW), or by the IQRC software.

Note: The license key has a prescribed shape and content that is controlled by both the IQRC system and the IQRC software.

Prescription of the license key:

LicenceCode_ **A0E25A0020B00001** _2019.txt

- LicenceCode - Prescribed text and the “_” linking character
- **A0E25A0020B00001** - serial number of the Central Unit
- 2019 - license key validity year
- .txt - file extension

4.3.1 Activation procedure in the IQRC software:



1. Connection to the Central Unit is made using the IQRC program.
2. In the main window, click on the  icon (device information and configuration).
3. In the right part of the window, select the “**Central Unit Parameters**” tab.
4. In this window, click on the “**Load and send license key**” button.
5. Select the license key file.
6. The program will notify us if the activation was successful.

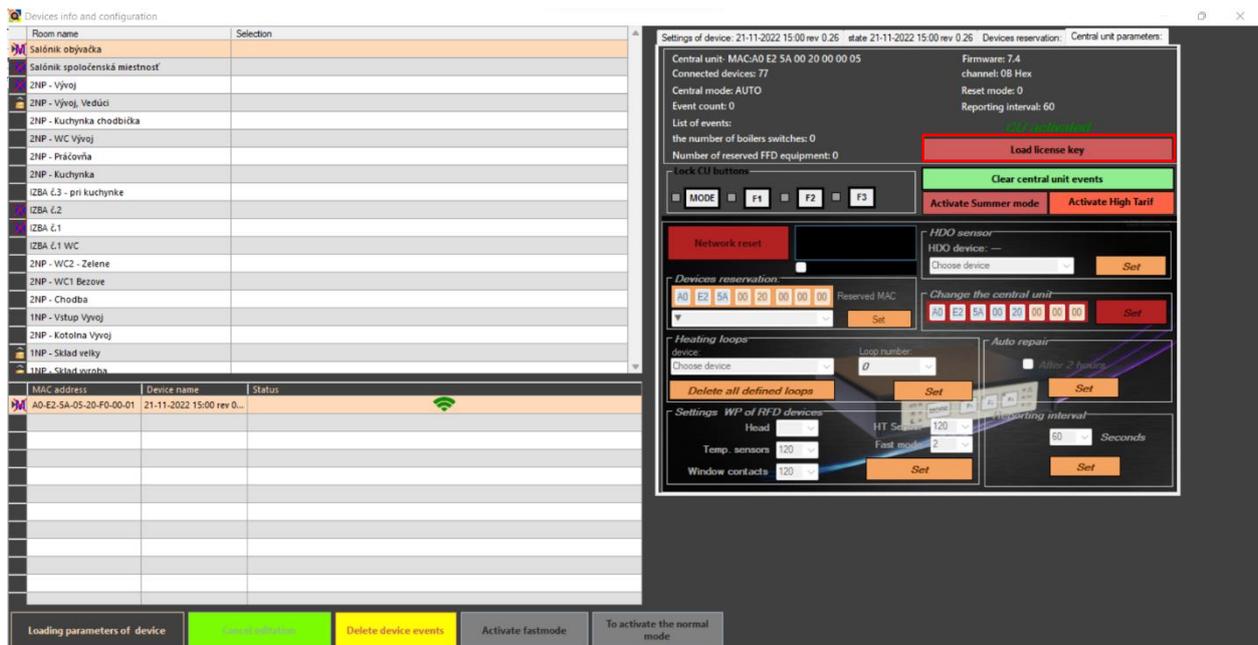


Figure 3

The Central Unit must be activated in the following cases:

1. Annually (activation allowed until the end of January of the new year!!!)
2. With every reset of the IQRC network (activation only allowed in January!!!!)

4.4 Setting up user accounts and rights

The IQRC program allows you to create multiple users to manage your heating. Users may have limited rights in setting heating parameters, rooms they can access and change various other settings...

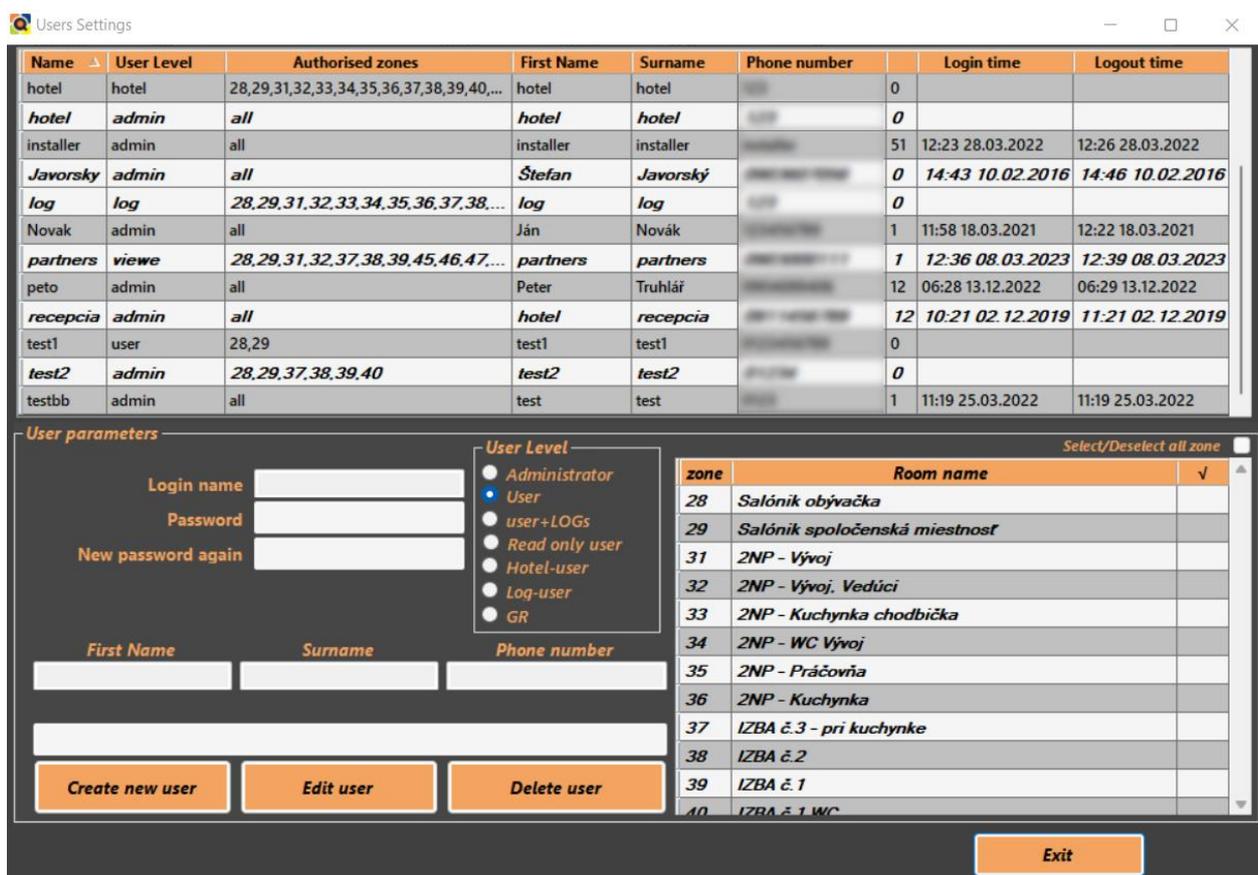
Only the IQRC system administrator can change the user administration.

Each IQRC system administrator should ensure that no one other than the administrator can change sensitive IQRC system parameters, but that only the administrator can manage them.

Example: We have a building that houses multiple companies and each company representative wants to manage their own heating. It is therefore advantageous to restrict the rights to set temperature programs only to zones that the company owns.

Click on the icon in the main program window  to display the User Management dialog box.

4.5 Description of the user management window



The screenshot shows the 'Users Settings' window. It contains a table of users and a form for creating or editing users.

Name	User Level	Authorised zones	First Name	Surname	Phone number	Login time	Logout time
hotel	hotel	28,29,31,32,33,34,35,36,37,38,39,40,...	hotel	hotel		0	
hotel	admin	all	hotel	hotel		0	
installer	admin	all	installer	installer		12:23 28.03.2022	12:26 28.03.2022
Javorsky	admin	all	Štefan	Javorský		14:43 10.02.2016	14:46 10.02.2016
log	log	28,29,31,32,33,34,35,36,37,38,...	log	log		0	
Novak	admin	all	Ján	Novák		11:58 18.03.2021	12:22 18.03.2021
partners	viewe	28,29,31,32,37,38,39,45,46,47,...	partners	partners		12:36 08.03.2023	12:39 08.03.2023
peto	admin	all	Peter	Truhlář		06:28 13.12.2022	06:29 13.12.2022
recepacia	admin	all	hotel	recepacia		10:21 02.12.2019	11:21 02.12.2019
test1	user	28,29	test1	test1		0	
test2	admin	28,29,37,38,39,40	test2	test2		0	
testbb	admin	all	test	test		11:19 25.03.2022	11:19 25.03.2022

User parameters

Login name:

Password:

New password again:

First Name: Surname: Phone number:

User Level

- Administrator
- User
- user+LOGs
- Read only user
- Hotel-user
- Log-user
- GR

zone | **Room name** |

28	Salónik obývačka	<input type="checkbox"/>
29	Salónik spoločenská miestnosť	<input type="checkbox"/>
31	2NP - Vývoj	<input type="checkbox"/>
32	2NP - Vývoj, Vedúci	<input type="checkbox"/>
33	2NP - Kuchynka chodbička	<input type="checkbox"/>
34	2NP - WC Vývoj	<input type="checkbox"/>
35	2NP - Práčovňa	<input type="checkbox"/>
36	2NP - Kuchynka	<input type="checkbox"/>
37	IZBA č.3 - pri kuchynke	<input type="checkbox"/>
38	IZBA č.2	<input type="checkbox"/>
39	IZBA č.1	<input type="checkbox"/>
40	IZBA č.1 WC	<input type="checkbox"/>

Create new user **Edit user** **Delete user** **Exit**

Figure 4

4.5.1 Creating a user

Click on the “Create New User” button, enter all parameters (*all fields are mandatory - first name, last name, phone contact, password, password confirmation, forgotten password reminder, indication of user rights, indication of rooms that the user can manage*), and confirm with the save button, which is now in place of the “Create New User” button.

4.5.2 Types of user rights

A user can have 4 types of rights to operate the IQRC program:

1. **Administrator** - Has all rights to set up the entire system in the zones assigned to him.
2. **User** - Has rights only to set temperature programs in the zones assigned to him
3. **Hotel** - Has the right to change only the Auto parameters, Arrival mode (red fix) and Departure mode (blue fix), in the assigned rooms. Primarily used in hotel and reservation systems
4. **Log** - Has the right to read charts (logs) in assigned rooms

4.5.3 Edit user parameters

When editing a user, select the user from the list and then press the Edit User button. It follows a similar procedure to creating a user.

4.5.4 Deleting a user

Select the user from the list and confirm by pressing the delete user button.

5 Installation of FFD devices and their connection to the power grid

Before installing FFD devices (“**Full Functional Device**” - controller, boiler switch, router, radiator), it is necessary to survey the building and optimize the routes between controllers, routers, radiators to avoid “dead” network spots and to make the Zigbee network itself simple and reliable.

5.1 Setting the controller in the room

You can modify the controller parameters in the “Device Information and Configuration” window in the “Device Parameters” section.

Procedure:

1. Select the room where do you want to change the controller setting
2. Select the controller
3. Use the “Load Device Parameters” button to load the current settings. Edit the parameters.
4. The “Cancel Editation” button saves and updates the parameters for the room.

Temperature calibration: calibration of real temperature in the room

Temperature limits in manual mode: if Temperature limit (MAN - manual) is checked, it is possible to set “Max Temp”- maximum heating temperature and MIN temperature.

Moving Average: temperature average (number of last measured temperatures in 2 min intervals)

Optimal start: setting the pre-heating (Limit up), temperature to be reached already at the set hour to the desired temperature. (the controller calculates the approximate start of heating on the basis of the heating history, so that the room is X degrees already at the hour when the temperature is set)

Temperature control: the temperature can be controlled according to the room temperature, floor sensor (for underfloor heating). For underfloor heating, the type of floor sensor and the floor temperature at which the heating is switched off are set

Temperature control type: hysteresis or PID algorithm

Figure 5

5.2 Wireless signal ranges

Another condition for proper room temperature control is the correct choice of the place for installing the controller and therefore the power supply for the controller. So all power supplies need to be properly installed and 230V AC power needs to be brought to them (*power from sockets, lights, standalone*). It is advisable to connect all controllers to a separate circuit breaker - circuit if possible (*especially in new buildings*). **Controller, router, boiler switch** - Power supply must be permanent and not switched e.g.: light circuit and light switches, contactors, HDO electrical circuit.

Electric Radiator – IQ Line Bee - HDO or permanent power supply and not switched e.g.: light circuit and light switches.

HDO: The radiator can work with HDO mode in two ways:

- **Power supply is switched by HDO** - the radiator is switched off with the electronics during HDO failure.
This is a functional but not recommended wiring of the IQRC system.
- **HDO sensor - a hardware device located in the electrical junction box** - sends information to the radiators about the status of the HDO and they heat or not based on the HDO status.

5.3 Factors affecting the displayed sensor temperature:

- The effect of the sun on the temperature sensing device (Regulator, Head, IQ Line Bee Radiator...)
- Correct placement - height of the temperature sensing device (*e.g.: to prevent vandalism of the control units, place them in higher positions but in this case it is necessary to adjust the calibration temperature of the control unit so that the resulting displayed temperature on the device corresponds to the room temperature measured at the optimum height. (1.5m above the floor). (The fact that the room temperature varies from floor to ceiling should be taken into account.)*)
- Do not place the temperature measuring device above a heat generating device (*e.g.: screen, TV, in hot water distribution, above a radiator, above or behind a fridge, freezer...*), or in places where temperature changes frequently (*draught, door, window, chimney...*)

Note: If a suitable location for the controller cannot be selected due to unreachable electrical wiring, a temperature sensor (IQ24 TS - RFD device) can be placed in the room, which can be placed anywhere in the room as it is portable and battery powered.

6 Central unit - IQ24 GW-B

The Central Unit "GW-B" (**GateWay** - gateway to the IQRC system, Zigbee network) is the basic building block of the IQRC system. It is the device coordinating the entire ZigBee network, the unit representing the communication between the user and the IQRC system (*applications running on the Central Unit communicating with the computer application or other devices as well*).



Figure 6

The IQRC system is designed using a Central Unit only. Use without the Central Unit is considered as an emergency condition (*in case of damage to the Central Unit, power failure...*). Thus, if the Central Unit is removed (*disconnected from the mains, switched off, etc.*) from the IQRC system, the system becomes non-functional (the devices behave according to their last set parameters, which cannot be changed except for manual - manual intervention of temperature adjustment, if the user is allowed to do so!).

It is configurable using a computer and a network connection (*internet is not required*). It communicates exclusively via LAN.

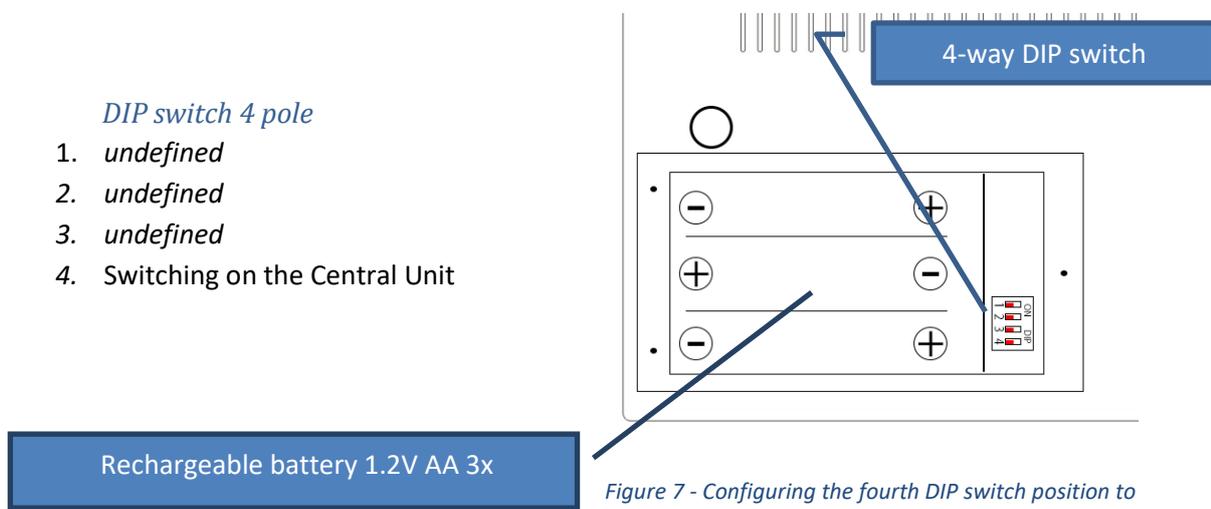
6.1.1 Switching off/on the Central Unit

Due to the fact that the IQRC system has been designed for continuous operation, it is not possible to simply switch off the Central Unit but only to put it into long-term sleep (*the LED flashes with a period of one second*). In order to minimize the battery drain in the Central Unit, the time when the Central Unit operates without the power adapter should be reduced to a minimum. Otherwise, the batteries will run down and the Central Unit will switch off and lose its current time. After reconnecting the Central Unit to the mains, it is necessary to wait a few minutes for the backup batteries to charge, which is accompanied by a 2-second double-flash of the green LED.

Note: if the Central Unit is reconnected (e.g. after a power failure) the symbols will be displayed as they were set before the Central Unit was switched off. (heating mode, F1-F3)

6.1.2 Switching on the Central Unit

1. Remove the battery cover of the Central Unit using screws
2. Insert the backup batteries into the battery holder. Make sure the polarity is correct!
3. Switch the fourth position of the DIP switch to the "OFF" position (Fig. 7, towards the batteries)
4. Put the battery cover on
5. Connect the network cable from the local computer network to the Central Unit
6. connect the power adapter connector to the POWER terminal, plug the adapter fork into the mains, the status light (Green LED) will flash rapidly to indicate the Central Unit is starting the system



Note: If the Central Unit does not start up after plugging the adapter into the mains, but continues to hibernate, the backup batteries are probably dead. In this case, you need to wait a few minutes for the backup batteries to charge.

6.1.3 Switching off the Central Unit

Correct shutdown

Correct switching off of the Central Unit is done by switching DIP switch No. 4 to the "On" position (to the position away from the batteries). The green LED of the Central Unit starts flashing with a period of 0.8 to 0.2s (800 milliseconds LED on - 200 milliseconds off) to indicate the Central Unit is switching off (switching to hibernation mode). After 3 minutes, the Central Unit switches to hibernation mode, which is represented by the repeated double flashing of the green LED with the mode (0.5s on / 0.5s off / 0.5s on / 2s off). During hibernation, all elements of the Central Unit are switched off except the real time clock (The set time is not lost when the Central Unit is switched on again).

Only now is it possible to pull the plug out of the mains and remove the power connector from the POWER terminal! Replacement or removal of batteries is also possible.

Note: By removing or replacing the batteries, the set time of the Central Unit will be lost. The set time is also lost if the Central Unit remains in hibernation mode (battery discharge) for a long time.

Incorrect shutdown

Incorrect shutdown means disconnection of the Central Unit from the mains (disconnection of the adapter) or power failure. The Central Unit activates an acoustic alarm (notification of power loss). The green LED of the Central Unit starts flashing with a period of 0.8 to 0.2s (800 milliseconds LED on - 200 milliseconds off) to indicate the Central Unit has switched to emergency mode. In emergency mode, the Central Unit cannot be communicated with, but the ZigBee network remains active for one hour. The indicated mode is indicated by a green LED flashing with a period of 3 seconds (0.5s on / 2.5s off). The other LEDs are still in the same state as before the power was disconnected. The acoustic alarm remains active. After 1 hour of power failure, the Central Unit switches to hibernation mode (see. the Chapter above).

Note: In the event of a power failure, the acoustic power interruption alarm can be temporarily switched off by pressing the F2 and F3 buttons simultaneously.

6.1.4 Other indicated conditions

If the Central Unit start-up indication (rapid flashing) lasts an unusually long time, there is probably a malfunction of the minicomputer operating system. After 30 minutes, the above state changes to a state where the green LED on the Central Unit flashes in the SOS rhythm. In this case, service intervention is required. This state has no effect on the heating control (the system operates according to the current settings), but it is not possible to change the heating modes, change the equipment settings or supervise the system. Also, information on the heating progress of individual zones and the functionality of the whole system is not collected. Therefore, in this case, service intervention is recommended as soon as possible after identification of the fault.

6.2 Connection to the Central Unit:

Each device (pc, phone, TV, server...) connected to the internet has its own network settings for connecting to the network/internet. That's why our Central Unit also has network settings for connecting to the internet.

For the first connection to the Central Unit you need a network cable and a computer. We can also use a switch or router.

To connect using a switch or directly with a network cable to a PC, you need to change the IP configuration of our computer and set a static IP, mask, gateway:

For example: IP 192.168.2.2

Mask: 255.255.255.0

Gateway: 192.168.2.1

*Because the production settings of the Central Unit belong to this network: **192.168.2.XXX**.*

Production network settings of the Central Unit:

IP: 192.168.2.222

MASK: 255.255.255.0

GATEWAY: 192.168.2.1

DNS: 192.168.2.1

To communicate with the Central Unit, use these network settings for the first connection. Then change settings of the network (IP, MASK, GATE, DNS...) the Central Unit is installed in.

The choice of the appropriate location of the Central Unit in the building is a major influencing factor in the subsequent connection of other IQRC devices to the network. If there were a Central Unit located at the edge of a long building, the network might not be assembled in its entirety because the equipment on the other side of the building would have nowhere to connect to (exceeding the capacity of the IQRC system). Certain constraining mechanisms need to be learned and the actual implementation of the installation needs to be well planned.

6.2.1 Central Unit network settings (IP, Mask, Gateway, DNS)

1. To set up the IP of the Central Unit, connect the Central Unit via cable directly to the PC, using a switch, or using a preconfigured router...
2. Then, using the remote desktop (RDP) or SSH client (PUTTY), connect to the Central Unit, log in using the *installer* login name and its pre-set password.

Note: RDP at the command prompt, type mstsc to start the remote desktop.

```
login as: installer
installer@192.168.2.105's password:

The programs included with the Debian GNU/Linux system are free
software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Jul  9 10:08:03 2019 from 192.168.2.71
installer@bpi-iqrc:~ $
```

3. enter the command `nano /etc/dhcpd.conf` and confirm enter. This command opens the “`dhcpd.conf`” file in the “`etc`” folder in the “`nano`” text browser, which is a configuration file for setting the IP address of the Central Unit.

```
installer@bpi-iqrc:~ $ nano /etc/dhcpd.conf
```

- a. **To set up DHCP (dynamic IP address assignment for the Central Unit)**, it is sufficient to delete the entries `interface eth0`, `static ip_address`, `static routers`, `static domain_name_servers`, `static domain search` (all parameters), and activate DHCP (dynamic IP address assignment for the central unit) when the central unit is rebooted. The Central Unit must then be located on the network, because the

IP address assigned by the DHCP server to the Central Unit is not predetermined (unless it is specified by the DHCP server).

- b. **For STATIC setting of IP addresses** you have to enter these mandatory lines at the end of the “dhcpd.conf” file. *interface eth0, static ip_address=“address”, static routers=“address”, static domain_name_servers=“address”, static domain_search=“address”*. When the Central Unit reboots, the static IP setting for the IQRC Central Unit is activated. **These settings should be remembered.**

```
interface eth0
static ip_address=192.168.2.222
static routers=192.168.2.1
static domain_name_servers=192.168.2.1
static domain_search=
```

(factory setting)

```
interface eth0
static ip_address=10.20.30.100
static routers=10.20.30.1
static domain_name_servers=8.8.8.8
static domain_search=
```

(example of a new setting)

- c. To complete the setup, press CTRL + X, enter the name (unchanged) and confirm ENTER to save the dhcpd.conf file

6.3 Central Unit Uniqueness (Extended PAN ID)

Individual devices connect to the Central Unit they are programmed to by the manufacturer, so it is possible to have 2 IQRC systems installed in the same building and the devices connect to the default Central Unit (the programmed **Extended Pan ID** which simply means the Central Unit serial number (MAC)).

6.4 Central Unit states and symbols

The IQRC system is designed for continuous operation and communication between devices. Therefore, to ensure the operation of the most important equipment of the “Central Unit”, it is equipped with its own power backup.

Under the removable lid there are 3 rechargeable 1.2V AA NIMH batteries which, in the event of a power failure, keep the Central Unit in emergency mode (*disabling access to changes in IQRC system settings*) for one hour if at least one device is connected to the GW. During this time the Central Unit keeps the IQRC system/network live. After one hour, it enters sleep mode and the basic parameters (*time, date...*) are backed up **Green LED flashes once every 2 seconds**. If the **green LED flashes regularly when the power is reapplied - (2 flashes with a 2 second pause)** the batteries are discharged and charging.

Only after charging to the level specified by the manufacturer will the GW turn on. (*occurs when the whole building is shut down for a longer period of time...*).

If a power failure occurs and no device is connected to the GW, the GW will go to sleep after 8 minutes until the power is restored.

6.5 Description of the states of the diodes on the Central Unit:

The 'LED indicators' are used to indicate the status of the Central Unit, and the status of the IQRC system (*central heating mode, HDO, Summer mode...*).

The Central Unit contains the following LEDs:

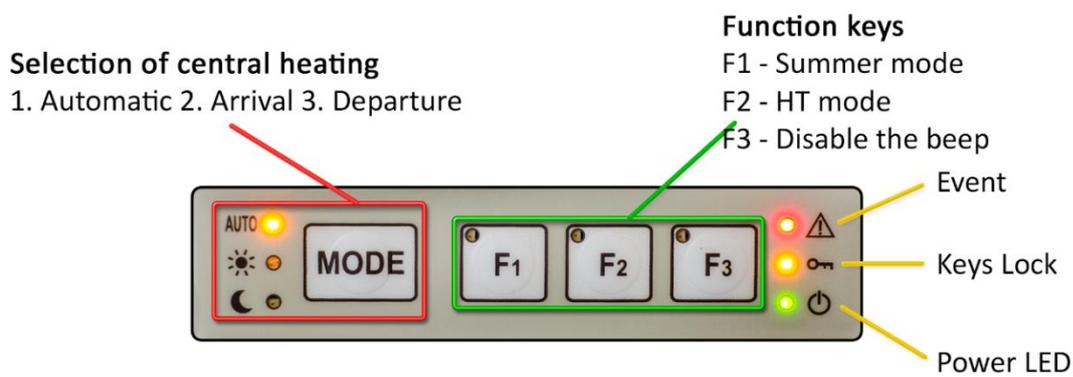


Figure 8

Automatic Central Mode indicates that the entire system is operating in 'Automatic Central Mode'.

Arrival Central Mode indicates that the entire system is operating in 'Arrival Central Mode'.

Departure Central Mode indicates that the entire system is operating in 'Departure Central Mode'.

F1/F2/F3 function indicates the status of the F1/F2/F3 function.

- **F1** - Activate summer mode
- **F2** – High Tarif mode status and activation
- **F3** - Disable the beep when the mains power fails

Exclamation mark indicates an IQRC "event". An event is defined as a situation where at least one of these possible error conditions has occurred:

- No device is connected to the Central Unit
- The Central Unit has at least one event marked (the event field is 10 records in size)
- At least one connected device has not reported for more than 35 minutes (disconnected)

Key indicates software locking of some or all buttons of the Central Unit.

Power and Basic Functionality Status - Possible indicator states are:

- **Permanently lit** - The Central Unit connects to the main power supply (power adapter) for the first time and a successful hardware and software initialization takes place, or when it wakes up from long-term sleep without error (see below).
- **Flashing once a second** - The Central Unit switches flawlessly to long-term sleep. This condition occurs when the Central Unit disconnects from the main power supply (power adapter) and automatically switches to battery backup power (battery must not be fully discharged). In this state, the Central Unit does not communicate with the computer via USB nor with other wireless devices via ZigBee messages. It only works on a circuit for real time hours.
- **Light off** - The Central Unit is disconnected from the main power supply (power adapter) and is not powered by the backup battery (battery is fully discharged) or when there is some undefined fault.

6.6 IQRC Zigbee network policies and limitations

- The Central Unit can create a network with 667 elements (*the sum of all devices in the network - headers routers controllers' heat sensors, boiler switches...*)
- **Central unit can be connected to 3 FFD devices and no RFD devices**
- If no **device** is connected to the Central Unit, it will **reboot cyclically every 8 minutes**. It is a protection mechanism that in case of a GW jam (*not communicating with devices*) it restarts and resets all peripherals (*self-correcting mechanism*).
- **FFD Devices** can be **connected to 3 FFD devices and 8 RFD devices**.
- The network is generated by a tree structure and its **maximum layer (tree depth) is 8**.
- **FFD** The device can connect to a **maximum of 7 layers**. At Layer 7, no more FFD devices can attach to each other. If possible, the network should be optimized to connect the controller to the lowest layer possible.
- **RFD** The device can connect to a **maximum of layer 8**. No device can connect to these types of devices. They are so-called end devices.

An example of an IQRC network set-up:

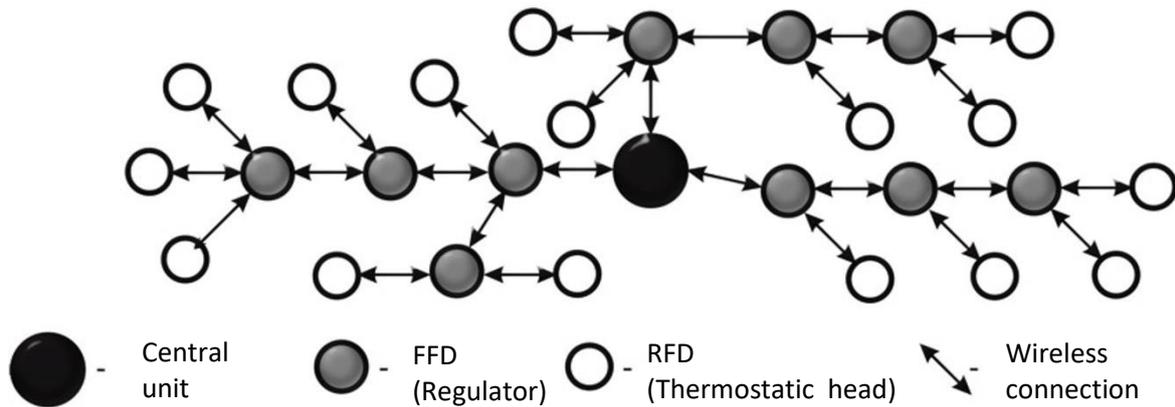


Figure 9

If a device (*child* - max 3xFFD, max8xRFD) is connected to the parent device (*parent*), i.e. the Central Unit or the control unit, the parent stores this child in its memory until the next time the table of these connected devices is cleared. We call this table the **neighbour table**. If one FFD device is connected, then only two new FFD devices can be connected. However, if 3 devices are connected and one of them drops out, the FFD device will also remember this disconnected “child” device and will not allow a new device to be connected. **It is possible to remove these devices from the parent table by rebooting the system or by a special deletion using the IQRC program.**

Note: The MAC Address of the GW Central Unit is not the same as the MAC Address of the BPI miniature computer.

If you want to optimize the network manually, you can use “devices reservation”, i.e. assign device (s) that should connect to a given parent and thus “reserve” a place for it at that point in the network. However, this doesn’t mean that the device can’t connect anywhere else. If it connects to another device then the device that has it reserved in the table will only accept 2 new devices. This reservation can only be cancelled using the IQRC program. (neither deleting the table nor restarting the network will help). Reservations can complicate the whole installation. You should always be very careful and have well thought out how do you want to build the network.

Deleting this table occurs when the entire network is restarted, or manually:

- through the IQRC programme
- Turn the FFD off, restart the unit and simultaneously press the MAN AUTO - controller, ON OFF - boiler switch buttons while the entire display is illuminated for three seconds.

7 Dedication

This means assigning a “child” device to a “parent” and constraining the network communication parameters of the devices (signal strengths, depth of connection in the tree)

In order to provide a connection point to the child, it is necessary to assign its address to the parent, i.e. the device to which another device (child) is to connect (reserved a place in the table). This ensures that

there will be a parent at Layer X for the child, but not that the child will connect here because other devices in the network are aware about this dedication.

7.1 Dedication of the “child” to the “parent”

Before dedication, create a zone in the Zone Management window, for example: “PARENT” and “CHILD”, to which the PARENT devices are assigned: parent device, CHILD: child device.

In the main window, click on the “Devices info and configuration” icon and select the Reservation tab

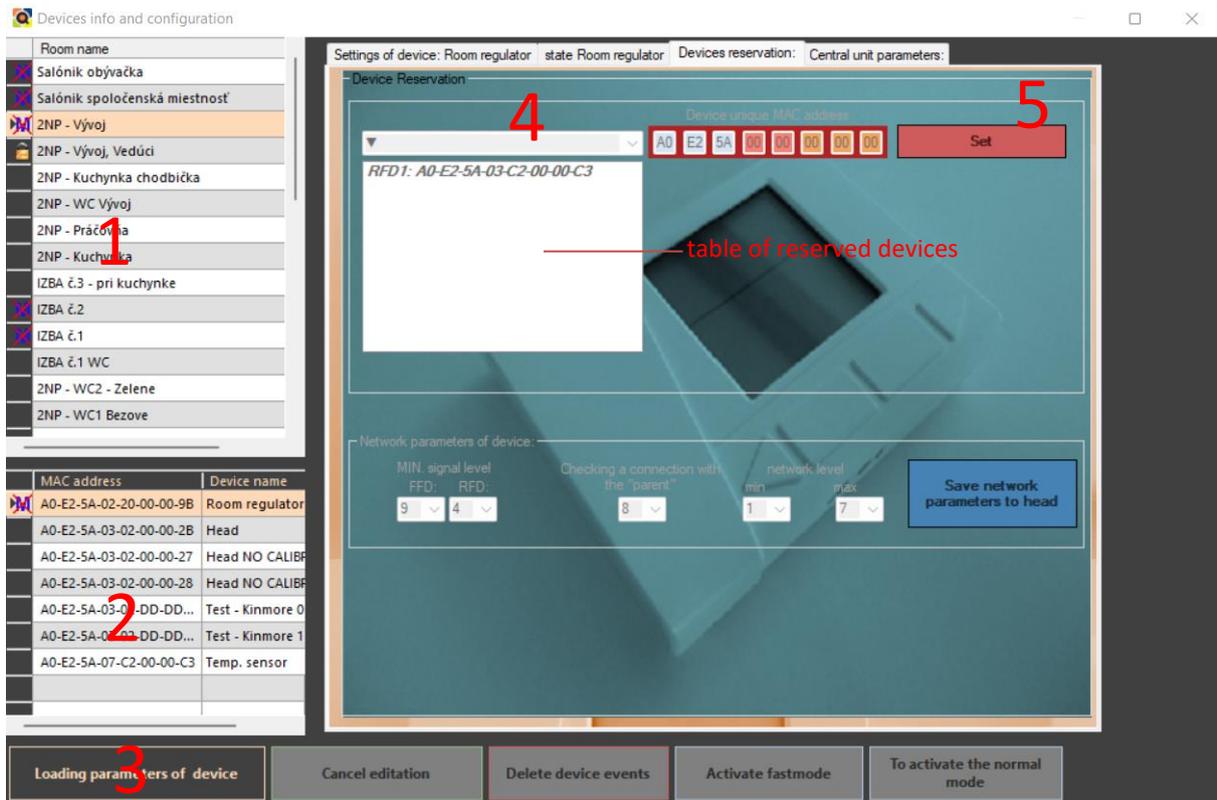


Figure 10

1. Select the “Parent” room
2. Select the “Parent” device
3. Click on “Load Device Parameters” to load the data from the device.
4. Select “save FFD child (1-3) - when dedicating permanently powered devices or “save RFD child (1-8) - when dedicating battery powered devices. In the MAC address field of the device, type the address of the reserved device (child)



Figure 11

5. confirm with the execute button

If there are already some dedicated devices in the database, you need to be careful not to mess up an important dedication.

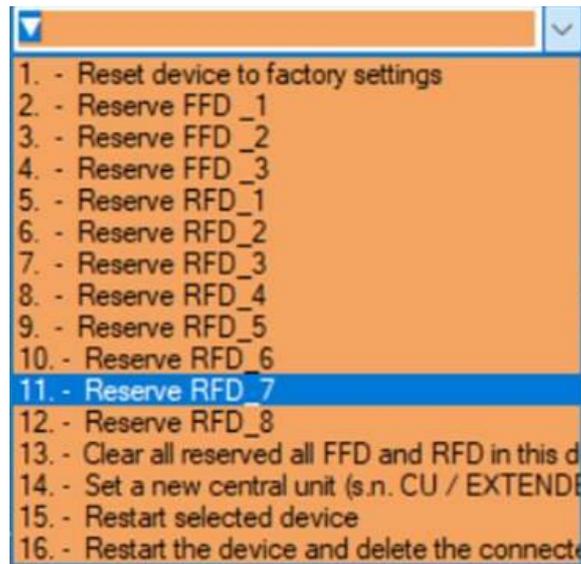


Figure 12

Do not reserve all or most of the devices! If a device should stop working, you need to ensure that controllers have free connection points and that the network can recover itself. For example, if all three spots on controller 1 were reserved and some controller 2 stopped working, it could happen that controller 1 is the only controller in radio range, but since it has 3 dedications, none of the controllers 3, 4, 5 could connect to it. Even devices that were connected to the 3, 4, 5 controllers would not be connected to the network. An entire branch could be left unconnected.

7.2 Limiting the connection depth of the “child” device in the network - FFD devices ONLY

Limiting the depth of the network connection (the layer to which the device connects) is common when reserving to a given “parent” to prevent the “child” from connecting to a device in a different layer. If you restrict the “child” to connect only to 1 layer (Central Unit), and there are 3 controllers connected (fully occupied GW state), the “child” might not be able to connect to any device.

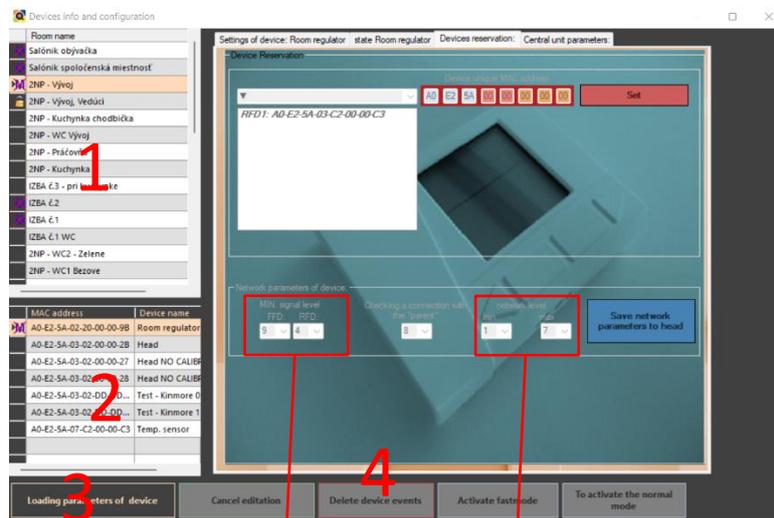
7.2.1 Procedure Restrictions on the device connection depth in the IQRC program:

Before dedication, create a zone in the Zone Management window, for example: “PARENT” and “CHILD”, to which the PARENT devices are assigned: parent device, CHILD: child device.

In the main window, click on the “Will open dialog with detailed devices information” icon  and select the **Settings of device: Regulator**

1. Select the “Child” room
2. Select the “Child” device

3. Press the Load Device Parameters button to set the Network depth parameters. **Min:** the closest layer where the child can connect (to the Central Unit). **Max:** the deepest layer where a child can attach. *If you want the device to connect to the Central Unit or to the second layer farthest away, set Min: 1 and Max: 2. Unlimited devices have pre-set values Min: 1 and Max: 7.*
4. The “Delete device events” button saves the set parameters



Rejoin Threshold: signal strength accepted by the device for its connection to the parent. (not recommended to change)

Network depth: depth of the device in the network, used in provisioning to limit which layers the device can connect to.

Figure 13

7.3 Signal strength and its adjustment

When making dedications, whether by limiting the signal or assigning a child to a parent, you need to be sure that the dedicated devices have sufficient signal to connect. The signal strength accepted by the connection device can be adjusted, but it is not recommended to change the value for FFD to a value other than 7 and for RFD to a value other than 3.

The lower the number, the greater the range of the device but the poorer the quality of communication. If the values are set too high, again you may not get devices to connect because the signal quality criteria are set very high.

8 Installation of RFD devices (battery-powered devices - heads, temperature sensors)

A series of heads placed in one zone (*room*) should be taken to that zone and then the batteries should be inserted into that zone, so that the head does not unnecessarily log on to another controller and after transferring to the zone it tries to log on to the correct controller again. This avoids unnecessary network congestion with login messages and longer setup times for the entire network.

Since names of the individual zones and device assignment to a zone is usually not known, it is advisable to arrange the devices in a logical order - *ascending from GW, by floor, by door number..*

Each head is calibrated after inserting the batteries and it is therefore advisable to mount it immediately on the radiator before switching it on, or if not, the heads must be calibrated manually later (by sending a command or by disconnecting the batteries and reinserting the batteries - about 5 seconds pause)

Note: if you are testing the heads at a location other than the installation site, it is advisable to open the heads to 100% before installation (or before fitting at the installation site) to make it easier to fit them to the radiator valve.

Depassivation of the batteries: the batteries are sometimes **passivated** before the first use. The passivation needs to be removed to reach their maximum voltage. The removal happens spontaneously when the batteries are inserted into the heads. There is no need to be alarmed that the head is still not working even though the batteries are new and fully charged. It is necessary to check after a while whether the head has switched on correctly.

After the overall physical layout of the equipment, move on to setting up the system, creating zones, assigning equipment to zones, setting up the program of each zone...

8.1 Calibration of barrels, Offset setting, Piston range, Operational speed, Open status.

If one of the aforementioned problems occurs when checking the installed system (see Chapter 7), you need to manually adjust the parameters of the head:

- **Offset** - head position after calibration (*at 0% open*)
- **Piston range** - working range
- **Operational speed** - speed of the head motor (*the faster the noisier but with greater battery life*)
- **Open status** - Head opening exists manually or automatically. For system functionality use exclusively automatic opening. Manual head opening is used for calibrations, or when threading heads onto valves (the head is easier to assemble when 100% open). When manually opening/closing the heads, the head does not follow the set temperature programs but is permanently in the set position.

Note: For any head work, the head must be switched to accelerated mode:

Calibration of the heads can be done **multi-selectively** or **individually**. Multi-selectively, you can only set the heads using the procedure in the following clause 2:

1. **If you have the head assigned to a zone:** click on the  icon in the main window of the program and select the "Settings of device:" and proceed as follows:

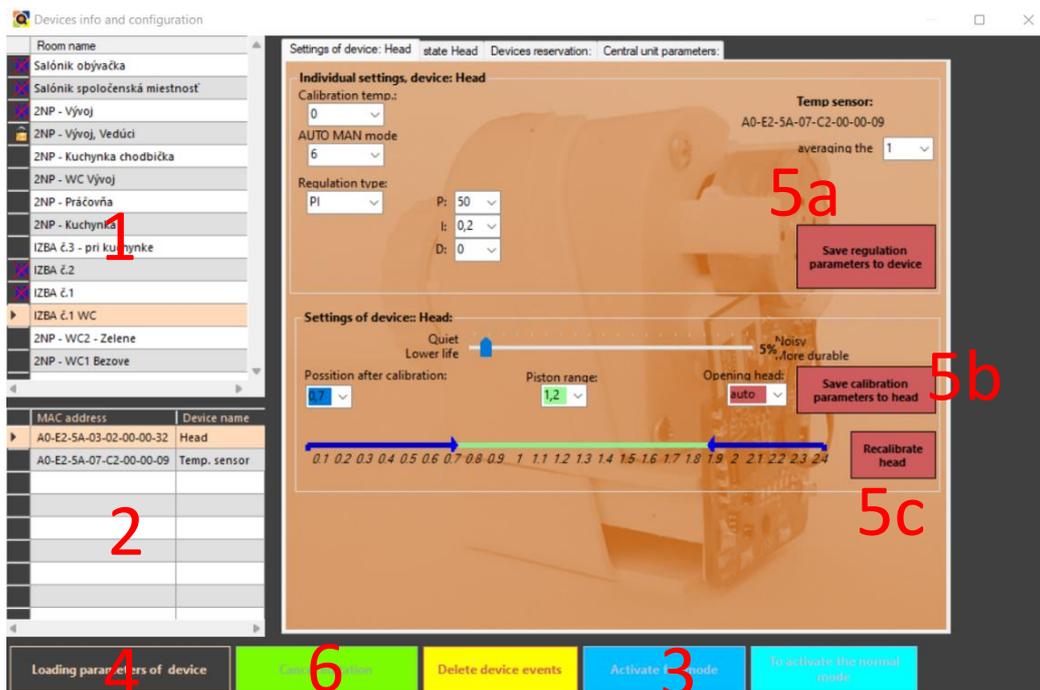


Figure 14

1. select the zone in which the head is located
 2. select a specific head for settings
 3. click on the Activate fast mode button if the head is not yet in fast mode
 4. click on the Load device parameters button. The device parameters are unlocked and you can adjust them
 - 5a. With button 5a you save setting which you change in head parameter section
 - 5b. With button 5b you save setting which you change in section with motor settings/motor calibration
 - 5c. After you change motor/piston range, you must recalibrate head with 5c button
 6. Click on the Cancel editation you close this specific head settings
- 2. If you do not (yet) have heads assigned to zones:**
- You can create a dummy zone, assign the head to it and make the settings 1. By
 - Clicking on the  icon in the main program window and a multi-command window will appear. Select the desired heads, set the parameters and confirm with the “Send to selected heads” button.

The screenshot displays the MultiCommands software interface. On the left, a table lists various heads with columns for MAC, Speed of Head, Offset, Range, Open Status, AUTO (101) / MAN open-status, LQI, FM, and a selection column. The table contains 20 rows of data. On the right, the configuration panel is shown with tabs for 'The calibration', 'Heads parameters', and 'Network parameters'. The 'Heads parameters' tab is active, showing settings for 'Head open status %' (set to 'auto'), a calibration range slider (set to 0.7), and a 'Piston range' dropdown (set to 1.2). Below this, the 'Individual settings, device:' section shows various status indicators like Temperature, Battery, and Firmware. Red annotations include: 'List of heads' pointing to the table, 'Head information' pointing to the device settings, and 'Setting the head parameters' pointing to the calibration and parameter sliders.

MAC	Speed of Head	Offset	Range	Open Status	AUTO (101) / MAN open-status	LQI	FM	✓
A0-E2-5A-03-02-00-00-2C	100	0,6	1,2	0	101	📶		👉
A0-E2-5A-03-02-00-00-2D	100	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-00-00-2E	100	1,1	1,2	0	101	📶		👉
A0-E2-5A-03-02-00-00-2F	50	0,6	1,35	0	101	📶		👉
A0-E2-5A-03-02-00-00-30	5	1	1,35	0	101	📶		👉
A0-E2-5A-03-02-00-00-31	5	1	1,35	0	101	📶		👉
A0-E2-5A-03-02-00-00-32	5	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-00-00-33	100	1,1	0,9	30	101	📶		👉
A0-E2-5A-03-02-00-00-34	50	0,3	1,2	0	101	📶		👉
A0-E2-5A-03-02-00-00-35	100	1,1	1,05	30	101	📶		👉
A0-E2-5A-03-02-00-00-36	100	0,8	1,05	25	101	📶		👉
A0-E2-5A-03-02-00-00-37	100	0,9	1,2	20	101	📶		👉
A0-E2-5A-03-02-00-24-5D	100	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-10-00-01	50	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-10-00-02	100	0,5	1,05	0	101	📶		👉
A0-E2-5A-03-02-10-00-03	50	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-10-00-04	50	0,7	1,2	0	101	📶		👉
A0-E2-5A-03-02-10-00-05	100	0,5	1,2	0	101	📶		👉
A0-E2-5A-03-02-10-00-06	100	0,5	1,05	0	101	📶		👉
A0-E2-5A-03-02-10-00-07	100	0,5	1,05	0	101	📶		👉
A0-E2-5A-03-02-10-00-08	100	0,8	1,05	0	101	📶		👉
A0-E2-5A-03-02-10-00-09	50	0,9	1,35	15	101	📶		👉
A0-E2-5A-03-02-10-00-0A	50	0,9	1,35	20	101	📶		👉

Figure 15

9 Device pairing

Device pairing means assigning devices to a zone - a room. In order for the heads to be controlled by a controller or temperature sensor, you need to pair them

When matching, two principles should be followed:

- **Device pairing order**
 1. Regulator
 2. Head
 3. Temperature sensor
- **Switching the RFD devices to Fast mode.**

The pairing is done in the management window and in the following way.

1. First, in the “List of created rooms” section, create the desired rooms by clicking on the Create button. After typing the zone name, the window will reappear and you can proceed with adding another room. When you have all the rooms typed, press “Cancel” and the window for entering the name of the new room will close
2. Then in the “Connected Devices” window, all the devices not yet paired are listed. (They have a separate device icon without the house icon.) Clicking on the desired device and then dragging the device to the room will start the pairing of the device to the room.
3. If the pairing is successful, it will be displayed in the “Marked Room Device List”.
4. If pairing is unsuccessful, check that all RFD devices are in fast mode and connected to the IQRC system.
5. Repeat this process until all required devices are paired.

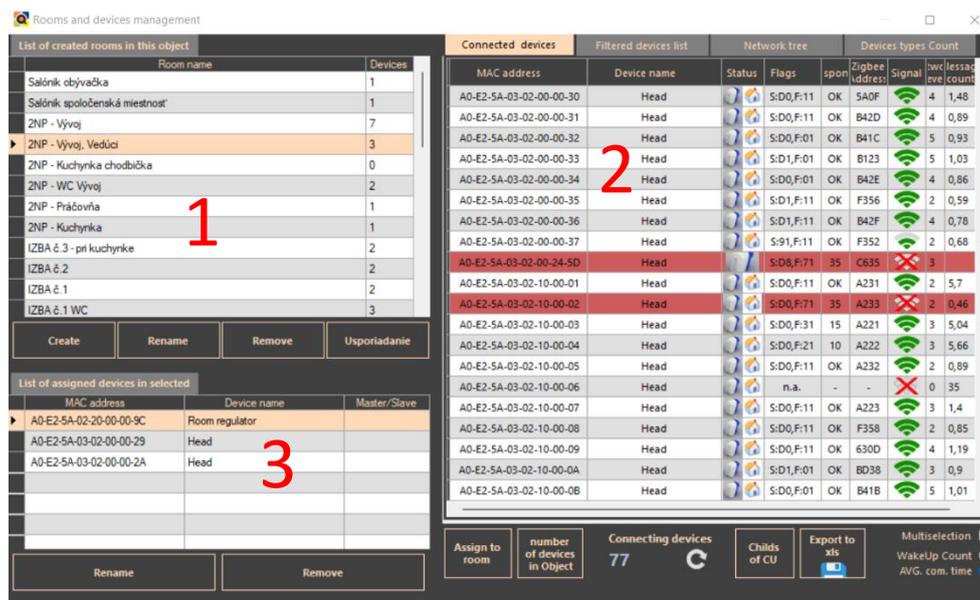


Figure 16

10 Checking the installed IQRC system

The procedure for the correct physical setup of this network when installing the entire IQRC network has been described, so that all devices communicate and behave according to predefined rules (temperature programs in zones, according to their temperature master - temperature sensor, controller or head sensor), the reliability of the communication of devices in the installation...

If you suspect that some of the heads do not follow the customer's idea, check if they are paired correctly (*with the right controller, temperature sensor*), because a head from another zone could be swapped to another one, or they are paired wrongly, thus the room is not heated according to the temperature master in the given zone, but from another zone... Customer can also swap a head from a room where they don't need it to a room where the head is broken, busted or stolen and rely on everything to work as it did before the swap.

At the end of the installation, you need to test the system and possibly fine-tune it to make it work as accurately as possible.

10.1 Parts to be tested:

1. **Valve throughput** - ***Valve in closed state overflows (warm radiator)***
 1. - smaller head offset needs to be set
 2. - check the valve (old valve, clogged, damaged)
 3. - *check the Open Status of the head to see if it is really closed*
2. **Valve leakage** - the ***valve opens at higher Open Status values (20% or more)***
 1. - larger head offset needs to be set
 2. - check the valve (old valve, clogged, damaged)
 3. - radiator venting
 4. - *check the Open Status of the head to see if it is really open*
3. **When installing the boiler switch, check its correct functioning - check the boiler switching**
 1. - if the boiler does not switch off - check that the heating demand is 0% everywhere
 2. - assignment of the Boiler Switch to a given heating circuit
 3. - manually turned off Boiler switch (*for max 10 minutes*)

11 Backup

IQRC works with a MySQL database and there was store all of devices and rooms parameters. Therefore, we recommend a manual backup of the database, in case the Central Unit has to be changed or the SD card, which includes the operating system, the database... This avoids recreating all the zones, temperature programs... So it is much easier and faster to restore the database from backup.

It is advisable to download logs (graphs) in order to have an overview of the heating history, set programs... A backup of the logs is on each computer that downloaded charts from the GW Central Unit, stored in the IQRC Program folder and its LOGS subfolder. Of course, the last log file will be the file from the day the log was last downloaded.