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MANUAL

REGIO RCX SERIES

REGIN

THANK YOU FOR CHOOSING REGIN!

Regin provides comprehensive solutions for building automation, including intuitive BMS-solutions, freely programmable and pre-programmed controllers, field devices and more.

Regin's offer, in combination with DEOS and Industrietechnik, empower system integrators, installers, and property owners with a powerful toolbox, setting them in a position to create building automation solutions that save both energy and engineering time. Today, versatile building management, optimized room control, and effective workflows have become the pillars for leading property owners in realizing significant energy savings in properties. Regin shares the clear goal of the group; to make this challenge easier on the way towards a sustainable future.

DISCLAIMER

The information in this manual has been carefully checked and is believed to be correct. Regin makes no warranties about the contents of this manual and users are requested to report errors and discrepancies to Regin, so that corrections may be made in future editions. The information in this document is subject to change without prior notification.

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PART OF
REGIN GROUP

Table of Contents

1 Introduction

1.1 About this manual

Special text formats used in the manual:

Note! This box, text, and symbol are used to highlight useful tips and tricks.

Caution! This box, text, and symbol are used to highlight cautions.

Warning! This box, text, and symbol are used to highlight warnings.

```
This box is used to show formulas and mathematical calculations
```

```
This box is used to
represent the display
window on the
controller
```

1.2 More information

- ✓ Regio RCX - Product sheet
- ✓ Regio RCX - Instruction
- ✓ Regio RCX - Variable list
- ✓ Regio RCX - Menu structure
- ✓ RCX-BL/RCX-BM - Instruction, (backplates)
- ✓ Regio RCX - Manual (this document)

All the above documents are available for download from Regin's website, www.regincontrols.com.

Note! All settings and configurations of the Regio RCX room controllers should be done with the Regin:GO app or Application tool 2.

2 Information for the end user

2.1 Regio zone controllers

The Regio RCX series comprises a wide range of room controllers that handle everything from heating, cooling, and ventilation to humidity and CO_2 monitoring. Regio RCX can be used to create anything from stand-alone systems for managing functions in a single room to being part of large, integrated systems with a comprehensive SCADA system.

2.1.1 Applications

The Regio RCX controllers have a discrete design and are easy to use, with an intuitive graphical LED matrix front and stylized touch buttons (depending on the model). They are suitable for buildings where you want optimal comfort and low energy consumption, such as offices, schools, shopping centres, airports, hotels, and hospitals.

In a room, the Regio RCX controller can measure and detect, for example:

- ✓ Temperature
- ✓ CO_2 level
- ✓ Relative humidity level
- ✓ Presence of condensation (with external condensation sensor)
- ✓ Motion of a user
- ✓ Air quality (VOC)
- ✓ If a window is open

2.1.2 Mounting

The modular design with a separate backplate for wiring, available in several models, makes the whole Regio RCX series easy to install and commission. The controllers are mounted directly on a wall or in a wall box (backplate).

For more information, see *Table B-2 Backplate assembly models* in *Appendix B Model overview*.

For more information about mounting, see the RCX-... Instruction, to be found at www.regincontrols.com. Or, see detailed information in *chapter 4.1 Installation*.

2.2 Regio RCX

2.2.1 Communication

RS485

The controllers can be connected to a central SCADA-system via RS485 (EXOline, Modbus, or BACnet), and configured for a particular application using the Application tool 2, which can be downloaded free of charge at www.regincontrols.com. For more information, see section *3.2 Application tool 2*.

The Arrigo template is adapted to support the Regio RCX series models (RCX-...).

Bluetooth® Low Energy

Communication is also supported by Bluetooth® (Regin protocol compatible with the Regin:GO app).

The controllers can be connected to the Regin:GO app (iOS/Android) and a cloud back end via Bluetooth® Low Energy. For more information, see section *3.1.5 Bluetooth® activation*.

For Regin:GO default access level passwords, see section *3.1.4 Accessing, operation, and settings in the Regin: GO app*.

For more information, see section *3.1 Regin:GO app*.

Caution! When you configure the device exclusively via RS485 using Application tool 2, it is recommended to disable Bluetooth® Low Energy (BLE) during setup. If BLE remains enabled, the device may still be accessed and reconfigured via Regin:GO using the default password. Please note that this password can only be changed within the Regin:GO interface.

2.3 Display, LEDs and buttons

2.3.1 User interface description, for models with display

The user interface consists of three (3) touch sensitive buttons, and a display made up of a matrix of LEDs (25x11 pixels), in a plastic casing. The display can be seen through the plastic material, and the buttons can be pressed by touching the icons printed on the front cover.

Note! LED display and buttons are not available on all models. For more information, see *Table B-1 Controller models* in section *Appendix B Model overview*.

If no interaction has taken place with the room controller for a while, the display can emit light with full intensity as usual, be dimmed to emit a lower light intensity, or completely be shut off depending on the settings made by the administrator. If you set the display to be dimmed, or to be shut off when inactive, the room controller blends in with the room and is then not likely to disturb the end user. The dimmed mode is preferable for situations where you not want to be distracted by the light emitted by the room controller. Such as, at a hotel, where guests sleep in the room where the room controller is mounted, or in an office, where employees do not want to be distracted by a bright display. It is up to the administrator and the installer of the room controller to configure when the product should be dimmed, or lit.

The Regio RCX controller user interface is shown in *Figure 2-1 Regio RCX controller model with display*.

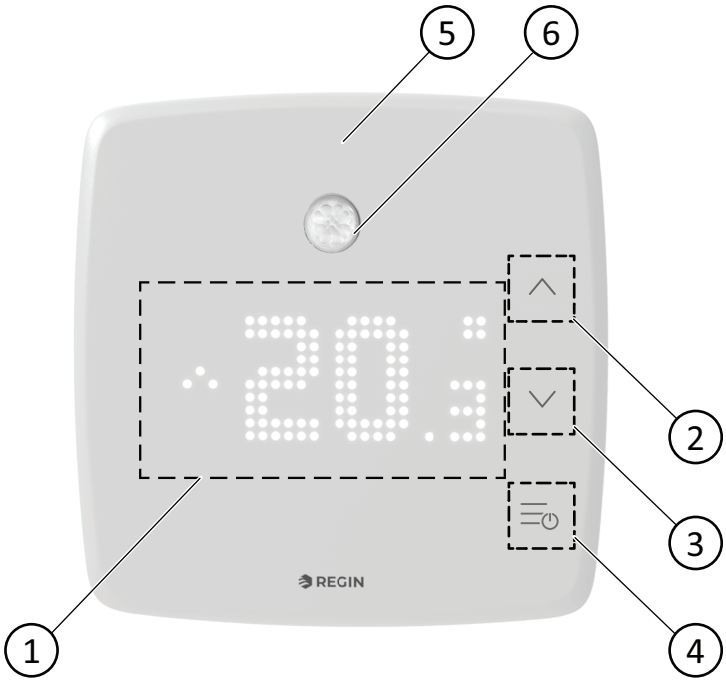


Figure 2-1 Regio RCX controller model with display

① *LED matrix*
② ***[Down]** arrow button*
③ ***[Up]** arrow button*
④ ***[Menu]** button*
⑤ *RGB LED light (for controllers with/without display)*
⑥ *PIR sensor (on selected models)*

Table 2-1 describes the buttons and LED matrix available on Regio RCX controllers with and without display.

Table 2-1 Button and LED descriptions for Regio RCX controllers with display

Controllers with display	
№	**Description**
1	LED matrix with the current mode or value displayed
2	**[Down]** arrow button ▼. Used for toggling values downwards.
3	**[Up]** arrow button ▲. Used for toggling values upwards.
4	**[Menu]** button ≡. Used for navigation in menu.
5	RGB LED light. Used for Bluetooth® and CO_2 level indications. For more information, see section *2.3.3 RGB LED functions*.

Idle LED display

When no button is pressed, the LED display will return to idle mode after a time-out. After a configurable time delay, the LED display will first dim and then be turned off (by default).

The value shown in idle mode is configurable:

- ✓ Actual temperature
- ✓ Actual setpoint + adjustment
- ✓ Heat setpoint
- ✓ Cool setpoint
- ✓ Average value of heating and cooling setpoint
- ✓ Setpoint adjustment
- ✓ CO_2 level
- ✓ Heat setpoint + adjustment
- ✓ Cool setpoint + adjustment
- ✓ Average setpoint + adjustment
- ✓ Calculated air flow

2.3.2 User interface description, for models without display

For controllers without display (and then also without buttons) all configurations are made via the Regin:GO app or Application tool 2.

2.3.3 RGB LED functions

An RGB LED is present above the LED display (in upper front area for models without display). With the LEDs you will be notified if and when the Bluetooth® is activated or not, and when the CO_2 sensor indicates CO_2 levels, if these functions are activated. The RGB LED can be configured to show the CO_2 level in green, yellow and red for low, medium and high CO_2 level respectively. The indication can be off, always active, or active only when the CO_2 value is shown in the display. See *Table 2-2 RGB LED functionality table*.

The RGB LED setting can be configured individually.

Table 2-2 RGB LED functionality table

Colour	Pattern	Description
Blue	Steady	Bluetooth® activated - device connected, or **Identify** pressed.
Blue	Blinking off 5 s, on 500ms	Bluetooth® temporarily activated - no device connected. If Bluetooth® is set to **Always on**, the LED does not blink.
Red	Steady	Indicating CO_2 high level
Yellow	Steady	Indicating CO_2 medium level
Green	Steady	Indicating CO_2 low level

2.4 Navigation - controller menu

2.4.1 Controllers with display

Organized menu structures enable users to navigate through different configuration options and access various features efficiently, ensuring a logical and user-friendly interface.

Figure 2-2 Controller model with display

Menu button

The **[Menu]** button cycles through all available set *Menu* options. Which options are available depends on the model, the set configuration, and the connected sensors.

Up/Down buttons

In idle mode, the up/down buttons will initiate setting of the setpoint adjustment. Such as, when the fan control page is selected with the **[Menu]** button, the **[Up]** & **[Down]** buttons will increase/decrease the fan speed.

Display indications

When no button is pressed, the LED display will return to idle mode after a time out. After a configurable time delay the display will first be dimmed, then turned off. The display settings can be customized. See the document *RCX - Menu structure*, to be downloaded at www.regincontrols.com.

The display indications are shown in *Figure 2-3 Indications in the controller display 1* and *Figure 2-4 Indications in the controller display 2*.

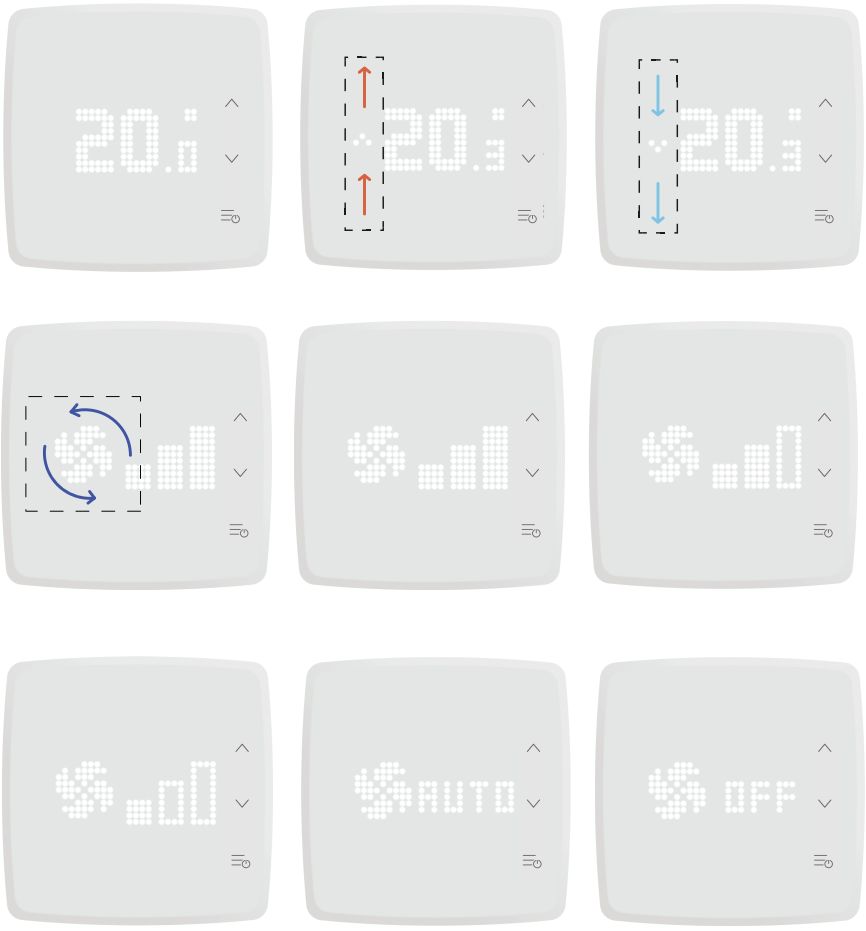


Figure 2-3 Indications in the controller display 1

Figure 2-4 Indications in the controller display 2

Figure 2-5 Indications in the controller display 3

When setting the setpoint adjustment, the value shown on the display is configurable as follows:

- ✓ Setpoint adjustment
- ✓ Actual setpoint
- ✓ Heating setpoint
- ✓ Cooling setpoint
- ✓ Heating setpoint, Occupied + adjustment
- ✓ Cooling setpoint, Occupied + adjustment
- ✓ Average cooling/heating setpoint

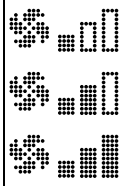
The display and function indications are described in *Table 2-3* and *Table 2-4*.

Table 2-3 Display indication descriptions

Indication	Description
Actual temperature 	When you press the **[Up]** arrow button, the temperature setpoint is increased, and when you press the **[Down]** arrow button, the temperature setpoint is decreased. The increment of each button press is of 0.5 °C. The range of the temperature is normally between 18 to 24 °C and can be adjusted only by the administrator of the room controller. For the temperature setting to take effect, the user must wait 10 seconds (s) without pressing any buttons. The display then returns to the current default view. When the user presses one of the arrow buttons, the temperature setpoint is shown and the LED display flashes between the dimmed mode and full intensity mode.
Actual fan speed 	When you press the **[Up]** arrow button, the fan speed setpoint is increased and when you press the **[Down]** arrow button, the fan speed setpoint is decreased. The fan can be set in three (3) levels - 1, 2, and 3. For the fan speed setting to take effect, the user must wait 10 seconds (s) without pressing any buttons. The display then returns to the current default view.

In *Table 2-4* you find descriptions of the functions in the menu and their indications, available when you press the **[Menu]** button.

Table 2-4 Function indication descriptions

Indication	Description
Fan speed 	The fan symbol rotates at different speeds when the user cycles the speeds with the arrow buttons. The fan can rotate with three different speeds, visualized with three bars on the display. The fastest fan speed is reached by pressing the up arrow repeatedly. Pressing the down arrow button repeatedly slows the fan down in increments until it turns the fan to OFF, and the animated fan stops spinning.
Fan Auto 	The fan speed Auto mode simply adjust the fan speed automatically, depending on the need.
Fan Off 	The fan speed is set to Off. The fan is disengaged.
Forced ventilation On 	The setting **Forced ventilation On** lets in fresh air, as it enables a damper to open so that new, fresh air from the duct flows into the room. The benefit of forced ventilation is that even though the fresh air is brought into a room, the current temperature is not changed.
Forced ventilation Off 	The forced ventilation setting is disabled by default (visualized with a breeze of air that is crossed over).
Relative humidity level 	The relative humidity level of the room is presented as a percentage along with a drop symbol. This is only indoor climate information, and no action can be taken to adjust the levels.
CO_2 level 	The system measures the amount of CO_2 in the room. The value is displayed in the unit parts per million (ppm).
VOC level 	The system measures the VOC level in the room according to a VOC index. See section *VOC Control*. The VOC level screen switches after a brief delay. This is only indoor climate information, and no action can be taken to adjust the levels.

2.4.2 Controllers without display

Controllers without a display have the same functionality, with either the built-in sensors (varies for different models) or with external sensors. No button or display interaction can be made, apart from RGB LED indications. For more information, see section *2.3.3 RGB LED functions*.

2.5 Detection sensor - PIR

2.5.1 Range

The detection range of the detection sensor (PIR sensor) is dependent on the difference between the object and the room temperature, and cannot be adjusted.

2.5.2 Detection pattern

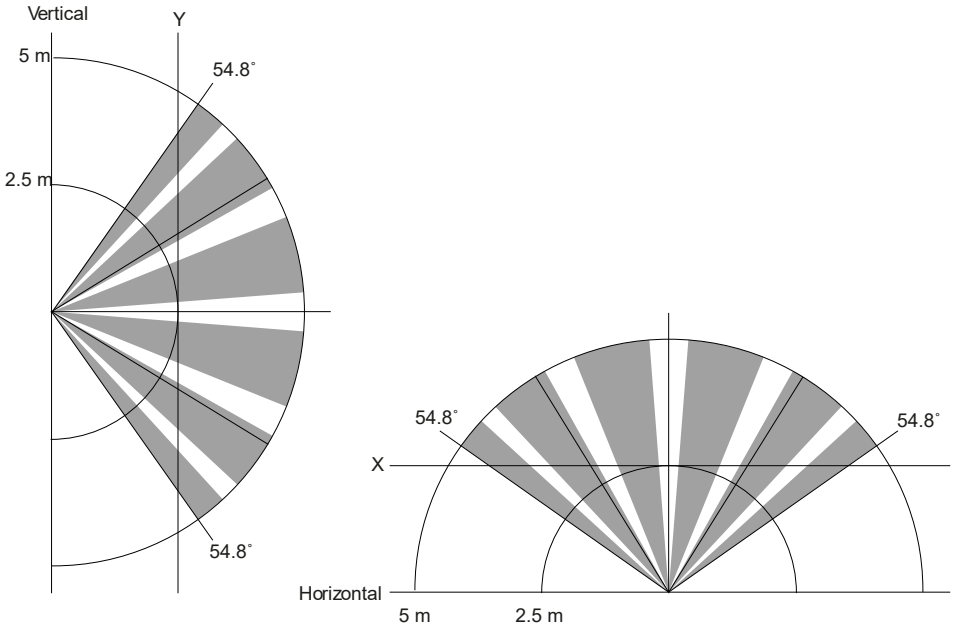


Figure 2-6 Detection pattern range PIR sensor - Vertical and Horizontal

2.6 CO_2 sensor

2.6.1 CO_2 sensor integration and measurement range

CO_2 regulation functionality is available when either an integrated or an external CO_2 sensor is connected. The integrated sensor supports a measurement range of 0 to 2000 ppm.

2.6.2 Automatic self-calibration

The integrated CO_2 sensor includes an automatic self-calibration feature designed to ensure long-term measurement stability. This function records the lowest CO_2 concentration detected each day and performs a weekly evaluation to adjust the baseline, either upward or downward, based on observed trends. See also *3.7 CO_2 sensor calibration* .

For optimal performance, the monitored space must be adequately ventilated and remain unoccupied for a minimum of four (4) hours daily. This calibration method is not recommended for continuously occupied environments such as greenhouses or hospital rooms.

Note! If inaccurate readings are suspected, allow a period of 7 to 14 days for the automatic self-calibration process to stabilize and adapt.

2.7 Changing values

Below you find examples of how to change setpoints directly on the controller.

Note! Valid only for controllers with display. For more information, see section *Display indications* and *Table 2-3 Display indication descriptions*

2.7.1 Controllers with display

Performing a setpoint adjustment

For controllers with display, a setpoint adjustment of temperature and fan speed settings can be performed.

To perform a setpoint adjustment:

1. Press the **[Menu]** button until the desired function is shown
2. Press the **[Up]** or **[Down]** button to increase or decrease the setpoint

Note! The new set setpoint is valid instantly and need no confirmation. When you have changed a setpoint, the controller automatically returns to the previous menu state after 10 seconds.

2.8 Configuration

You use the Regin:GO app and the Application tool 2 as two ways to configure the Regio RCX series controllers. It is a matter of choice which application you use, with the important difference that with Application tool 2 you can configure several devices. With the Regin:GO app you can only configure one device at a time.

For more information, see sections *3.1 Regin:*GO *app* and *3.2 Application tool 2*.

3 Information for the specialist

3.1 Regin:GO app

The Regio RCX series controllers are Bluetooth® compatible, and can be connected via the Regin:GO app. The Regin:GO app is available on Android and iOS. It is used for upgrading, configuring, and commissioning one or several Regio RCX series controllers. The Regin:GO app can also be used to upgrade the firmware. You can get the Regin:GO app from *App store* (iPhone and iPad) or *Google play* (Android).

3.1.1 Language

The language setting is inherited from the handheld device settings.

3.1.2 Application data

Updated application data will be asked for automatically the first time the app starts, but it must be updated periodically to get the latest firmware and settings.

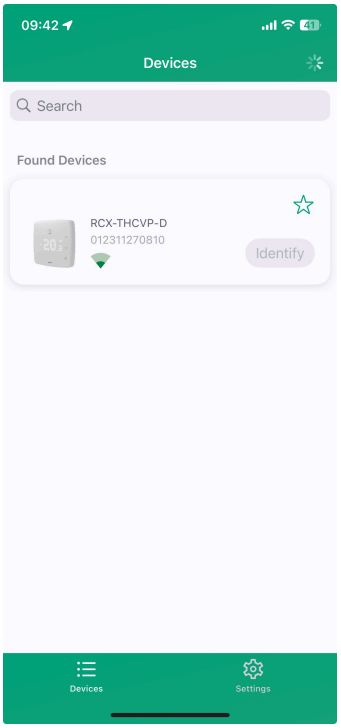
3.1.3 Introduction Regin:GO app

Below you find screenshots and short descriptions of some of the basic functions of the menu pages in the Regin:GO app. To access and enable operations and settings in the Regin:GO app, see section *3.1.4 Accessing, operation, and settings in the Regin:GO app*.

For a complete and more detailed menu structure and available settings, see the document *RCX - Menu structure*, to be downloaded at www.regincontrols.com.

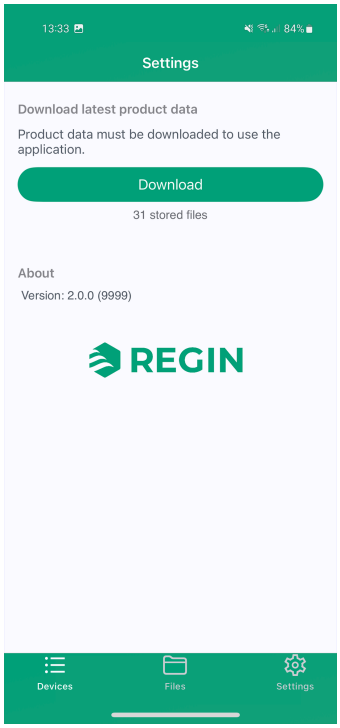
Note! Depending on your configuration, you will have different setting options.

Note! The language setting is inherited from the handheld device.



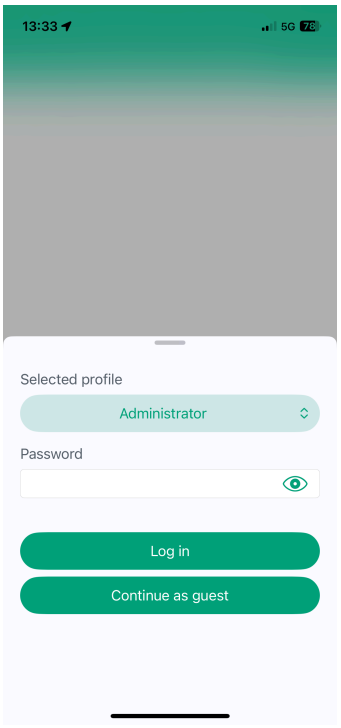
Devices page

This is the first page after the logo page. The *Devices* page lists all units found, with the possibility to identify new units and create favourites in a long list of units. The list presents a unit's name and serial number. When the **Identify** button is tapped in the Regin:GO app, the unit connection symbol is lit in blue for a few seconds and then turns blinking yellow to indicate which unit is selected.



Settings page

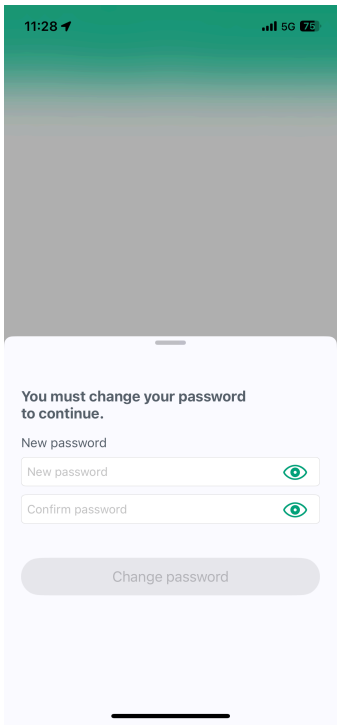
In this page it is possible to download the needed product data files. Tap **[Download]**.



Login pop up window

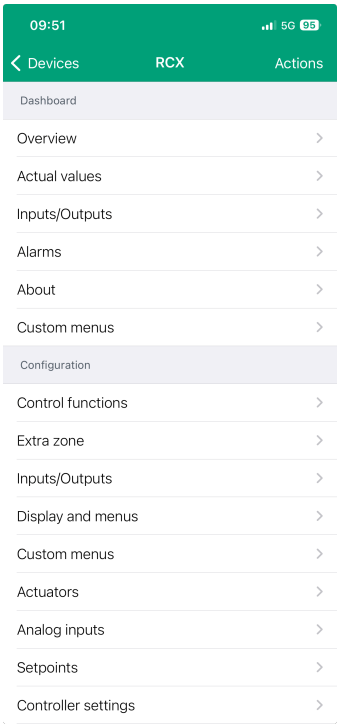
In the *Login* window you can choose the user login type, or to *Continue as guest*.

You need to be logged in as an *Administrator* to change the unit name and address, backup and restore settings, as well as doing firmware updates.



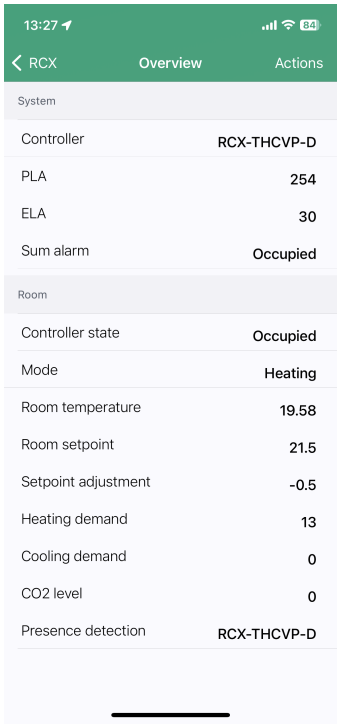
New password pop up window

Upon initial login to a device using an *Administrator* account, the *New password* dialogue prompts the user to create and confirm a new password.



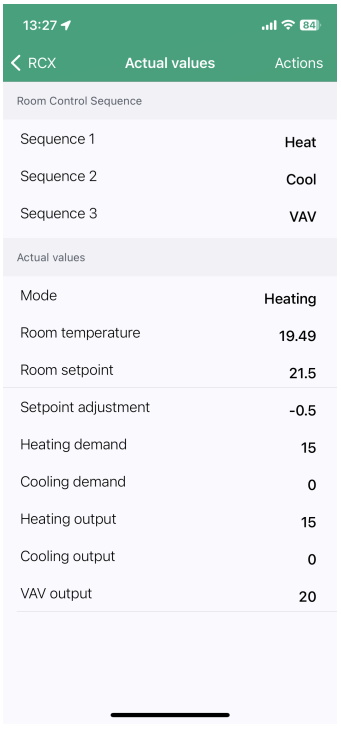
Menu page

This page is a menu page to navigate to other sub-menus, such as Overview, Configuration, and Manual/Auto etc.



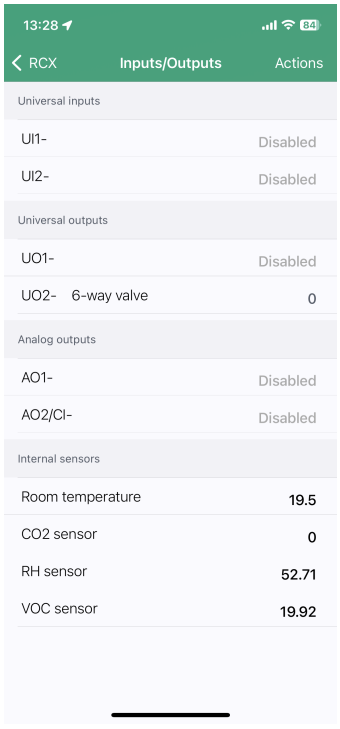
Overview page

This page is an overview page where you can see the actual values of *System* and *Room* settings.



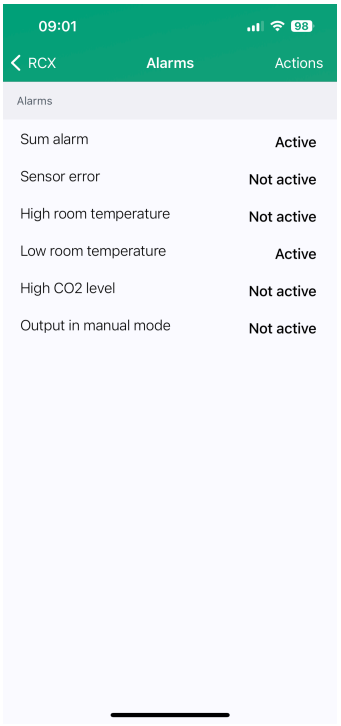
Actual values page

This page is an *Actual values* page where you can see actual values.



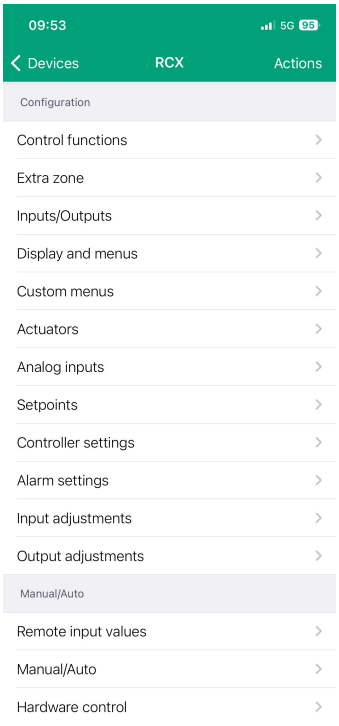
Input/Outputs page

This page is an *Inputs* and *Outputs* overview page, where you can view the actual values of all the I/O:s and the built-in sensors.



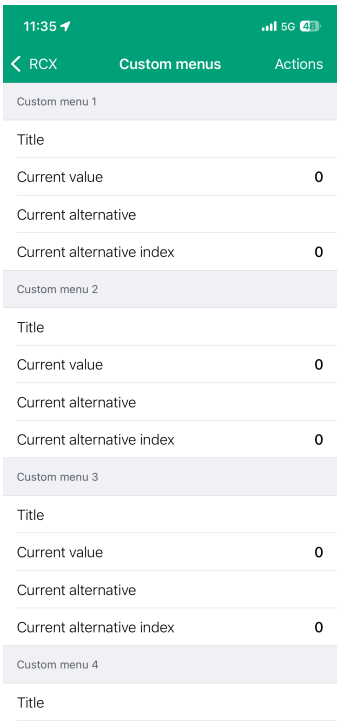
Alarms page

This page is an overview page of all alarms.



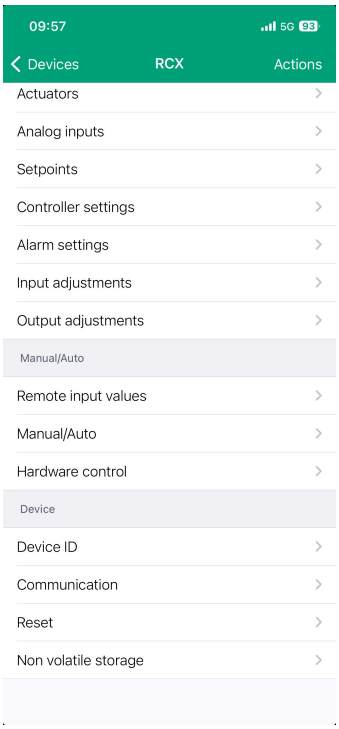
Configuration menu

This menu enables you to configure *Control functions*, *Extra zone*, *Inputs/Outputs*, *Display and menus*, *Analog inputs*, *Setpoints*, *Controller settings*, *Alarm settings*, and *Input/Output adjustments*.



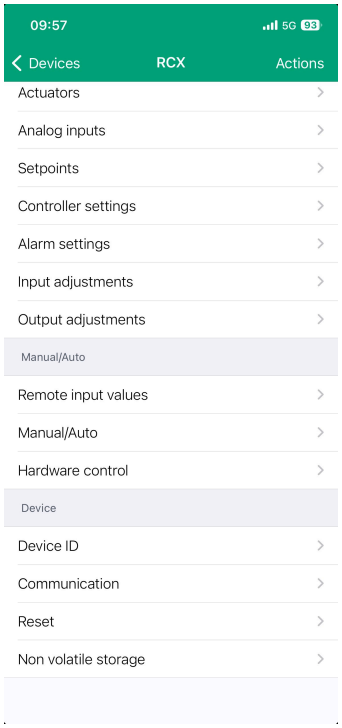
Custom menus page

This page is a settings page to configure custom menus for the display.



Manual/Auto menu

This menu enables you to configure *Remote input values*, *Manual/Auto* settings, and *Hardware control*.



Device menu

This menu enables you to configure the *Controller ID*, *Communication* settings, and *Reset* the device.

3.1.4 Accessing, operation, and settings in the Regin:GO app

To access and enable operations and settings in the Regin:GO app, a valid password is required. See the list of access rights below.

Access rights

Administrator - password: Admin

- ✓ Update firmware
- ✓ Reset to default values
- ✓ Save and import local configuration
- ✓ Change password
- ✓ Read and write all values that are possible to change, including all settings and configurations

Note! You will be prompted to change the default password after the first *Admin* login. See section *Password handling*.

Guest - password: N/A

- ✓ Read values decided by Regin:GO app.

Activate an identification notification in the Regin:GO app

If the device has Bluetooth® Low Energy support and Bluetooth® Low Energy is turned on, it is possible to activate an identification notification in the Regin:GO app.

To activate the identification notification:

1. Perform a short press (<1.5 seconds (s)) to activate the identification notification
2. Search for a device in the app
3. The device, with an active notification, will show on the top of the list with a blinking frame around it

Password handling

Upon initial login to a device with administrative privileges, the system will prompt the user to update their password. It is recommended to select a strong and unique password. The updated credentials will be temporarily cached within the application for a duration of 8 hours, and will be auto-filled during this period. See section *3.1.3 Introduction Regin:GO app*.

Connecting to a Regio RCX controller, with the Regin:GO app

To connect to a Regio RCX controller with the Regin:GO app:

1. Make sure Bluetooth® Low Energy is On in the device. Press the **[Menu]** button of the controller for five (5) seconds (press the lower right corner, if no **[Menu]** button). A blue LED indication is presented at On.
2. Open the Regin:GO app on your mobile device
3. In the **Search** field, in the **Devices** page (opens per default), type a controller serial number or wait until the Regin:GO app populates the controller by automatic detection
4. Tap the **Device** area on the desired identified controller to connect to the device
5. In the **Log In** dialogue, tap the **Selected profile** list and select the desired profile type. Then tap and type the corresponding password in the **Password** field.
6. Tap the **[Login as...]** button
7. The Regin:GO app is now connecting to the device

You can now navigate the menu in the Regin:GO app to view values or make configuration changes. For more information, see section *3.1 Regin:*GO *app* and the document *RCX - Menu structure*, to be downloaded at www.regincontrols.com..

3.1.5 Bluetooth® activation

There are two settings that control the activation of Bluetooth®. The configuration of the Bluetooth® functions and the turn off after an activation, as described in section *Bluetooth® function*.

Bluetooth® function

In *Table 3-1 Bluetooth® functions* the four (4) different activation functions are described, with the corresponding activation procedure.

Table 3-1 Bluetooth® functions

Function	Description
Off	Bluetooth® is disabled. Only serial line communication is possible.
Always On	Bluetooth® is always activated. LED indication is off.
On after start up	Bluetooth® is activated after power on for a configurable time. LED indication is On.
Activated by button (default)	Bluetooth® is activated by pressing the **[Menu]** button of the controller for five (5) seconds (the lower right corner, if no **[Menu]** button). LED indication is On.

When Bluetooth® is temporarily activated (valid for the functions O*n after startup* or *Activated by button*), it is indicated with a blue LED flash every five (5) seconds.

Turn off after activation

Turn off after activation is only applicable for the Bluetooth® function options O*n after start up* and *Activated by button*, meaning the time in seconds that Bluetooth® should be activated. The permissible range for the setting value lies between 10 and 3600 seconds (default 120 s).

3.1.6 Device software update

Use the Regin:GO app to connect to the device via Bluetooth® and start a software update. During loading, the RGB LED flashes red/green, then yellow/blue. When the update is complete, the device reboots. See section *Connecting to a Regio RCX controller, with the Regin:GO app* for connection details.

3.2 Application tool 2

The Application tool 2 is a PC-based configuration software tool. It is used for upgrading, configuring, and commissioning one or several Regio RCX series controllers.

Warning! Always disconnect the control unit from the power supply before connecting or disconnecting any connectors on the control unit.

3.2.1 Open Application tool 2

The Application tool 2 opens a dialogue at startup where you can create an offline project, open an existing project, or connect to a Regio RCX controller via an RS485 serial connection.

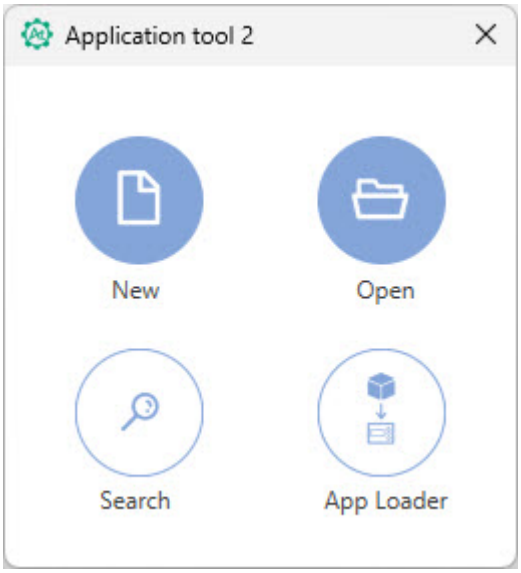


Figure 3-1 Application tool 2 start dialogue

To create and open a new offline project, click the **[New]** button.

To open an already existing project, click the **[Open]** button.

To search and connect to a controller, click the **[Search]** button.

The *App Loader* function can be used when you just want to upload the application to the controller. It is then not possible to configure the settings in the controller. Just send the application to the controller. Click the **[App Loader]** button, and upload the application to the controller.

Serial search

The **Search** window can also be opened by pressing **[F7]** on your keyboard, or from the **Tools** menu, via **Search**. Select **Search** serial and choose the serial port to be used.

Figure 3-2 The Application tool 2 Search window

3.3 Set up, Import, and Export configurations

You can create configurations in both the Application tool 2 and the Regin:GO app, and then export and import them in both tools when needed.

3.4 Function overview

3.4.1 Control functions

Room Control Sequence function

The *Room Control Sequence* function enables the controller to support control of various room HVAC systems, that is, different combinations of heating, cooling, and variable air volume (VAV) devices that are part of a room. This function is used for setting up a regulation case.

Based on the selected controller sequences, the controller outputs one or multiple control signal sequences, denoted *Sequence 1*, *Sequence 2*, and *Sequence 3*. The signal sequences control the heating, cooling, and VAV devices in the room, and are assigned to the different controller outputs via configuration.

Figure 3-3 shows the drop down that is used to select a control sequence in Application tool 2.

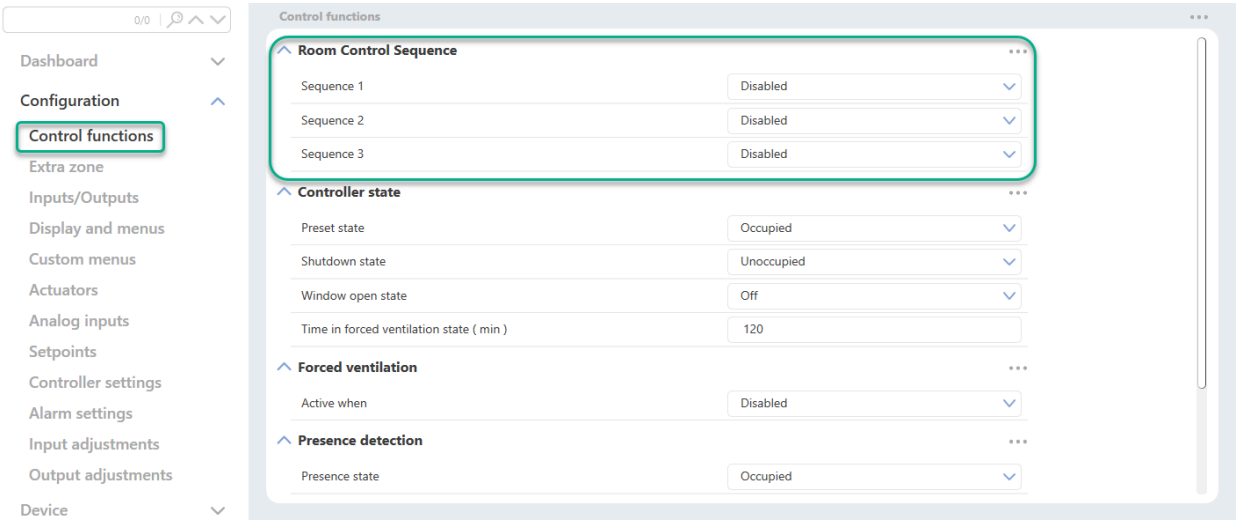


Figure 3-3 Room control sequence selection in Application tool 2

Control sequences

The control sequences are set in three (3) freely selectable sequence steps.

There are three (3) sequence steps to be chosen and configured in Application tool 2. Each step can be set to one (1) of the following functions:

- ✓ *Unused*
- ✓ *Heat*
- ✓ *Heat 2*
- ✓ *Cool*
- ✓ *Cool 2*
- ✓ *VAV*
- ✓ *VAV 2*
- ✓ *Change-Over*
- ✓ *Change-Over VAV*
- ✓ *6-way valve*

Excluded from the sequences are overall outputs like *Fan-control* and *Forced ventilation*. The sequence settings are also not dependent on the actuator (valve) type, which will be selected at a later stage.

Note! Depending on the function selected, there are additional parameters to be set for each sequence.

For each sequence either an analogue or digital output can be used to control a valve/damper actuator.

Order of sequence steps

The sequences will always be utilized in order, from one (1) to three (3). When the controller is in heating mode, cooling sequences will be skipped and vice versa. A *6-way valve* sequence is both a heating and cooling sequence. A *Change-over* sequence will be considered a heating or cooling sequence depending on its mode, see section *Change-over*.

Allowed sequence combinations

Not all control sequence combinations are possible. As a general rule, the faulty sequence step will be ignored and considered unused.

Some examples of illegal control sequence combinations:

- ✓ Every function can be used only once in the three (3) chosen sequences. If any duplicates are found, such as two *Heat 1* sequences, the first one found will be used and the second will be ignored.
- ✓ The *Heat 2*, *Cool 2*, and *VAV2* cannot be used without the *Heat 1*, *Cool1*, and *VAV1* sequences respectively. If they are used without each other, they will be ignored.

Sequence Functions

Disabled

If one sequence is unused, **Disabled**, this will always be ignored.

Heating (Heat, Heat 2)

Up to two (2) heating sequences can be configured, *Heat 1* and *Heat 2*.

The following settings can be made:

- ✓ **Max limit (%)**
- ✓ **Min limit (%)**
- ✓ **Fan off delay for electric heater** (possibility to delay fan off to prevent overheating of electric coil)

This sequence is suitable for applications where you want to control a heating source, such as a radiator.

The controller acts as a heating controller and regulates based on the heating setpoint and the current room temperature.

The controller is always in heating mode and outputs a heating signal, **Heating output (%)**, that is configured on the controller outputs by using the configuration values listed in *Table 3-2*.

Maximum and minimum limits for the output signal can be set. See section *Minimum limit for heating output*.

Table 3-2 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
Heating output (%)	Heating	Analog
Heating 2 output (%)	Heating valve, thermal (PWM, Pulse Width Modulation, or use of thermostat function)	Digital

Figure 3-4 illustrates the control behaviour for this controller mode when no maximum or minimum limits are set.

The heating demand increases as the room temperature falls. When the room temperature falls below the heating setpoint, **Heating output (%)** increases to respond to the heating demand. At 100% heating demand, **Heating output (%)** reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, **Heating output (%)** is at its minimum.

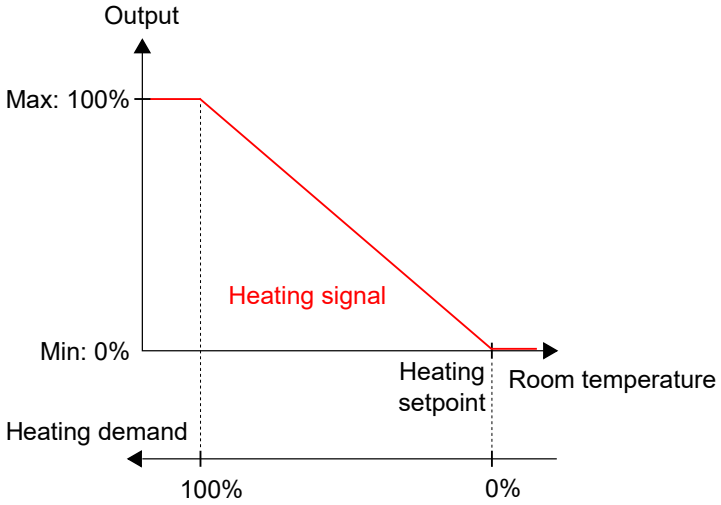


Figure 3-4 Control behaviour for the Heating sequence

Minimum limit for heating output

A minimum limit for the heating output sequence can be set. *Figure 3-5* illustrates the control behaviour for the controller mode when maximum or minimum limits are set for the heating output.

The heating output limits are active when the controller is in heating mode, and inactive when the controller is not in heating mode. Whether the controller is in heating mode or not is defined by the used controller mode. See section *Room Control Sequence function*.

Figure 3-5 illustrates how the control behaviour is affected when limits are set for the heating output. For example, when a 20% minimum limit is set, *Heating signal* is always 20% as long as the controller is in heating mode.

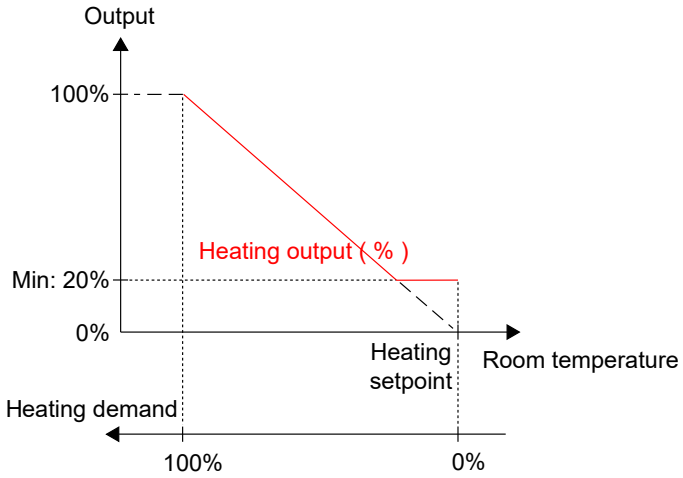


Figure 3-5 Control behaviour when maximum and minimum limits are set for the heating output

Cooling (Cool, Cool 2)

Up to two (2) cooling sequences can be configured, *Cool* and *Cool 2*.

The following settings can be made:

- ✓ **Max limit (%)**
- ✓ **Min limit (%)**
- ✓ **Set to max at forced ventilation state**
- ✓ **Turn off output when fan is off** (possibility to delay fan off fan to prevent frosting and condense on chilled beam)
- ✓ **Follow change-over state**

It is suitable to use the cooling sequence(s) when a cooling source should be controlled, such as chilled beams.

Table 3-3 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
Cooling output (%) **Cooling 2 output (%)**	Cooling	Analog
	Cooling valve, thermal (PWM, Pulse Width Modulation, or use of thermostat function)	Digital

Figure 3-6 illustrates the control behaviour for this controller mode when no maximum or minimum limits are set.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, the **Cooling output (%)** signal increases to respond to the cooling demand. At a cooling demand of 100%, the **Cooling output (%)** signal reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists **Cooling output (%)** signal is at its minimum.

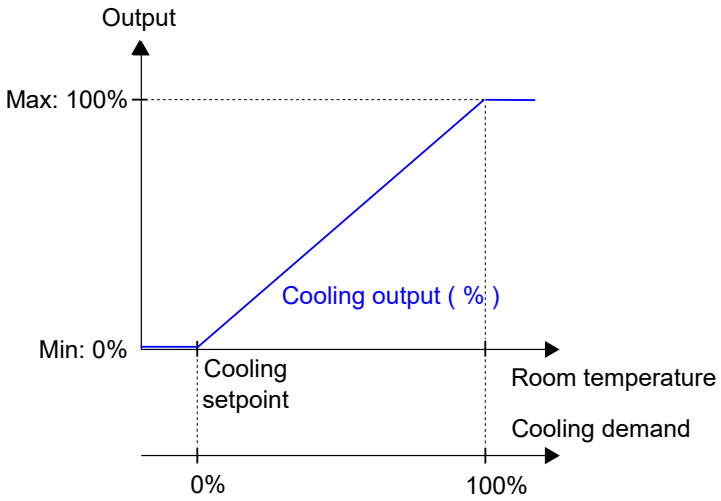


Figure 3-6 Control behaviour for the Cooling sequence

VAV (VAV, VAV 2)

Up to two (2) VAV sequences can be configured, *VAV 1* and *VAV 2*.

The following settings can be made:

- ✓ **Max limit (%)**
- ✓ **Min limit, off (%)**
- ✓ **Min limit, unoccupied (%)**
- ✓ **Min limit standby (%)**
- ✓ **Min limit, occupied (%)**
- ✓ **Min limit, forced ventilation (%)**
- ✓ **Set to max at forced ventilation state (on, off)**
- ✓ **Max limit when heating (%)**
- ✓ **Minimum Limit for VAV Output**
  This function is intended to put a minimum flow in VAV systems. As such the function puts a minimum output on the VAV output regardless if the controller is in heating or cooling mode.
- ✓ **Maximum Output Limit when Heating**
  This setting is used to open the VAV-damper at *Heating* mode. The purpose is to increase the airflow into the room at *Heating* mode if the heater is placed in the duct.
  When the function is active, the VAV output follows the heat output between the configured minimum limit and the configured maximum limit. No scaling of the output is used, the VAV has the same value as the heat output.
  The minimum and maximum VAV limits have precedence. When used together with the minimum and maximum VAV limits, the VAV signal is never lower than the minimum VAV limit and never higher than the maximum VAV limit, regardless of the configuration of this function.

This controller mode is suitable for room HVAC systems that use low supply air temperature that is distributed into the room via a diffuser damper to provide cooling and fresh air. The air must be pretreated and cooled since the diffuser damper itself does not have any cooling capacity.

The controller acts as a cooling controller and regulates based on the cooling setpoint and the current room temperature. In addition, the controller can be set to regulate based on fresh air demand instead of cooling demand, or based on cooling demand and fresh air demand simultaneously, see section *VAV control source*. The controller regulates based on fresh air demand by using CO_2 control. See section CO_2 *control*.

The controller is always in cooling mode and outputs a VAV signal, **VAV output (%)**, that is configured on the controller outputs by using the configuration value listed in *Table 3-4*.

Maximum and minimum limits for the VAV output signal are set via the *VAV control* function. For more information, see section *VAV control source*.

Table 3-4 Controller output configuration value and controller output type

Output signal	Controller output configuration value	Controller output type
VAV output (%)	VAV	Analog

Figure 3-7 illustrates the control behaviour when the controller regulates based on cooling demand, and when a minimum limit is set for the VAV output signal.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, **VAV output (%)** increases to respond to the cooling demand. At a cooling demand of 100%, **VAV output (%)** reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, **VAV output (%)** is at its minimum.

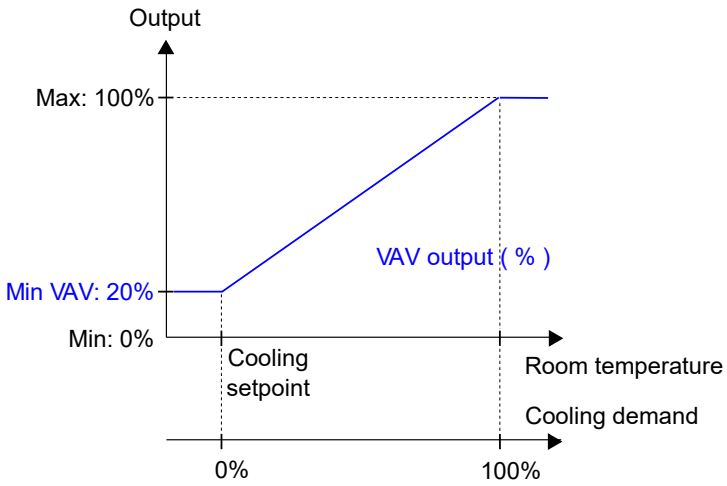


Figure 3-7 Control behaviour for the VAV controller mode when the controller regulates based on cooling demand

VAV control source

The VAV output can be controlled by cooling demand (or heating demand, see below), CO_2 level, and/or humidity. If more than one function is selected, the highest output value will be used. If no function is selected, the output will be set to the minimum value for the current controller state.

The following settings can be made:

- ✓ **Cooling demand** (On/Off)
- ✓ **CO_2 level** (On/Off)
- ✓ **VOC Index** (On/Off)
- ✓ **Humidity** (Off/humidify/dehumidify)

The *Variable Air Volume* (VAV) control function is used to manage the behaviour for a damper that is controlled by the analogueue VAV output signal.

The *VAV control* function enables the controller to regulate based on:

- ✓ **Both cooling and fresh air demand simultaneously**
  The highest demand determines if the VAV output signal currently is controlled based on the cooling setpoint and the room temperature, or the CO_2 setpoint and the CO_2 level in the room.

For information about CO_2 control, see section CO_2 *control*.

The maximum damper airflow can be controlled by setting a maximum limit on the VAV output signal. The minimum airflow that applies for each controller state can also be controlled by setting minimum limits on the VAV output signal.

The damper can also be controlled based on heating demand. This is useful when the heating device that provides the room with heat is located in the supply air duct and behind the damper that regulates the airflow into the room. When this function is active and the heating demand increases, the damper opens correspondingly and the distribution of heat into the room is boosted. This function is active when the **Max limit when heating** configuration setting is greater than zero.

Normally for cooling

The *VAV control* function is enabled, and the VAV control configuration settings in the Regin:GO app or the Application tool 2 are shown when the *VAV* sequence is selected:

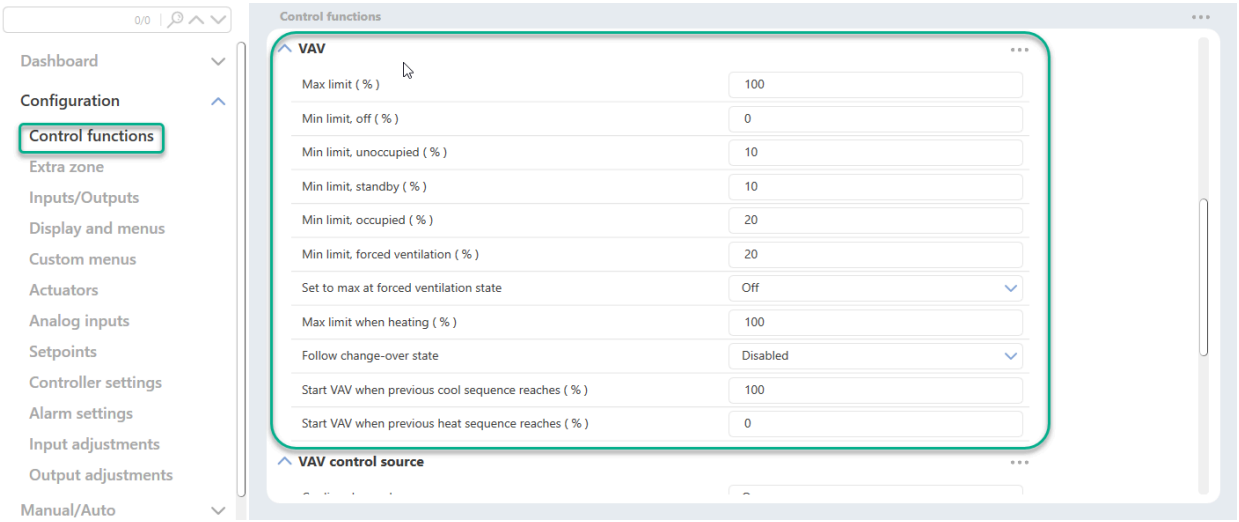


Figure 3-8 VAV control configuration settings in Application tool 2

The VAV control configuration settings are described in *Table 3-5*.

Table 3-5 VAV control configuration settings.

Configuration setting	Description
Max. limit (%)	Specifies the maximum limit for the VAV output signal for all controller states.
Min. limit, off (%)	Specifies the minimum limit for the VAV output signal when the controller is in the *Controller off* state.
Min. limit, unoccupied (%)	Specifies the minimum limit for the VAV output signal when the controller is in the *Unoccupied controller* state.
Min. limit, standby (%)	Specifies the minimum limit for the VAV output signal when the controller is in the *Standby controller* state.
Min. limit occupied (%)	Specifies the minimum limit for the VAV output signal when the controller is in the *Occupied controller* state.
Min. limit, forced ventilation (%)	Specifies the minimum limit for the VAV output signal when the controller is in the *Forced ventilation* state.
Set to max. at forced ventilation state	When the controller is in *Forced ventilation* state the output will be set to the maximum limit value.
Max. limit when heating (%)	Specifies the maximum limit for *Heating*.
Follow change-over state	Enable/disable to follow the *Change-over* state
Start VAV when previous cool sequence reaches (%)	Specifies the start limit for the VAV output signal when the previous Cool sequence reach NN %.
Start VAV when previous heating sequence reaches (%)	Specifies the start limit for the VAV output signal when the previous Heat sequence reach NN %.

Figure 3-9 illustrates the control behaviour for the Heating + VAV controller mode when VAV control is performed based on cooling demand, a maximum limit is set, and minimum limits for the *Occupied* and *Unoccupied* controller states are set.

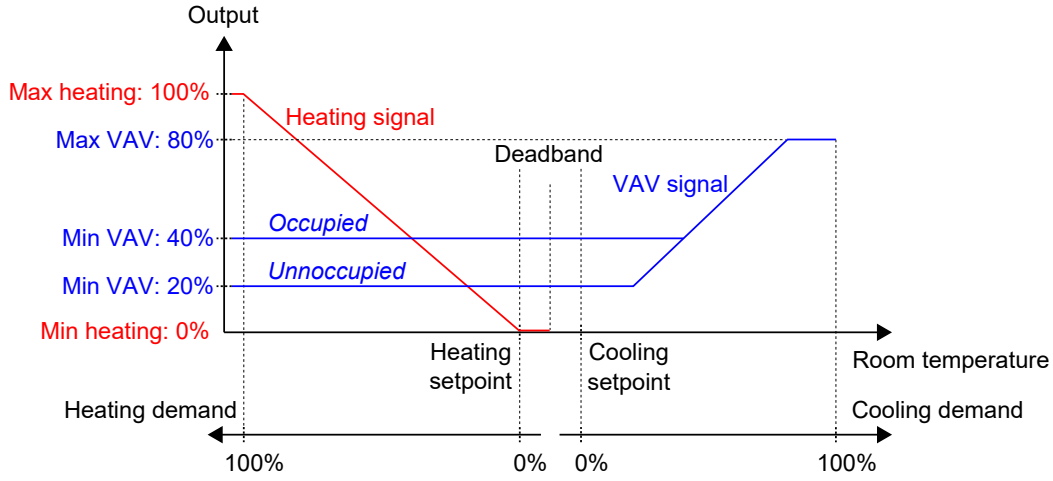


Figure 3-9 VAV control behaviour based on cooling demand when a maximum limit is set, and minimum limits for the occupied and unoccupied controller states are set

Figure 3-10 illustrates the control behaviour for the Heating + VAV controller mode when the **limit for VAV output at heating demand** setting is applied. For example, when a 50% maximum is set, the VAV signal follows the heating signal as the heating demand increases but never exceeds 50% of its practical maximum (100%).

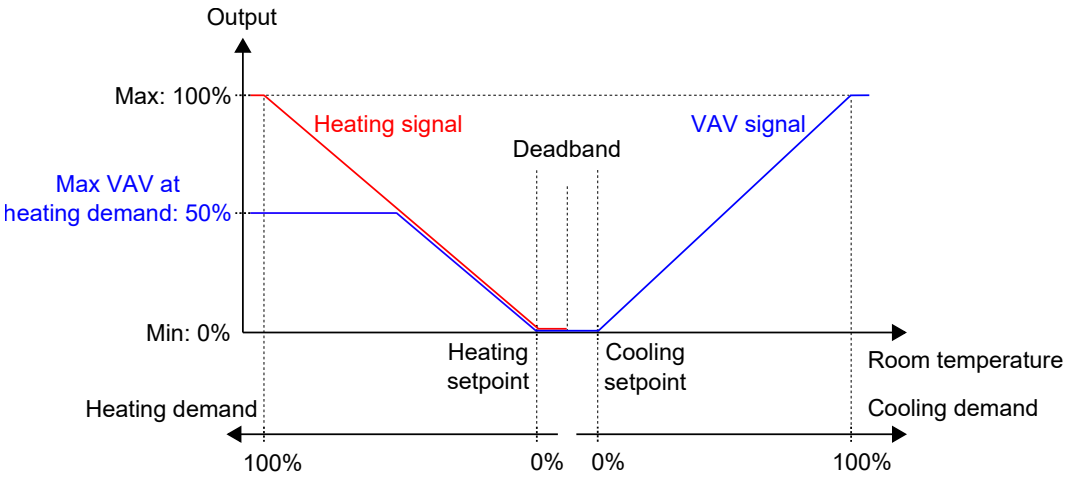


Figure 3-10 Control behaviour for the Heating + VAV controller mode when the maximum VAV output on heating demand setting is applied

Heating, cooling (change-over) and VAV - with cascade between the VAV and valve output (Valid for RCX 2.1 or later)

When you have a Heating, Cooling and VAV demand, it is possible to change the order with the Heating and/or Cooling parameters. However, it is also possible to define when the second VAV sequence start and stop. *Figure 3-11 Control behaviour for Heating, Cooling + VAV controller mode when cascading VAV max. and min. values is applied* illustrates the control behaviour for the Heating, Cooling (change-over) + VAV controller mode when the **Start VAV when previous cool sequence reaches** and **Start VAV when previous heat sequence reaches** settings is applied.

Example: When the room temp is above to the cooling setpoint, the valve starts to open and when the output reaches NN% the second output (VAV) starts to open. This gives the possibility for the battery to be in temperature before increasing the flow with VAV.

The Heating output could be connected to an electric heater. In this case, it is necessary to maintain the VAV output level at NNN % settable during a period (adjustable level and time “afterblow”) before shutdown, or switch to another mode.

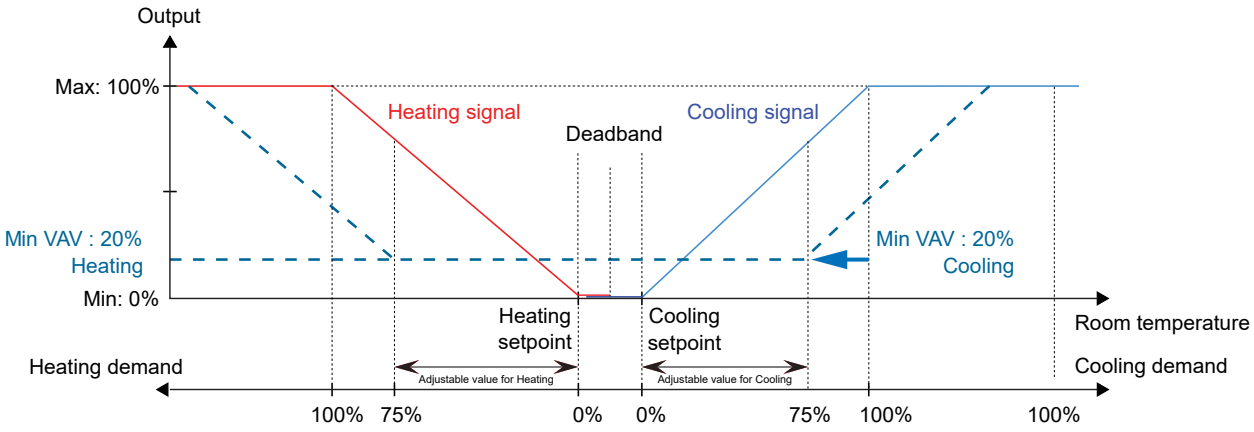


Figure 3-11 Control behaviour for Heating, Cooling + VAV controller mode when cascading VAV max. and min. values is applied

For a controller with a built-in CO_2 sensor, the VAV output will be connected to the higher of the two PI demands, temperature or CO_2.

Change-over

Change-over is a control function that enables the controller to provide both a heating or a cooling signal on the same controller output. This is achieved by shifting the controller *Change-over* state from *Heating* to *Cooling*, and vice versa. The *Change-over* function makes it possible to use the controller in a 2-pipe change-over HVAC system, where warm or cold media flow in the same pipes and one valve is used to regulate both heating and cooling distribution.

The following settings can be made:

- ✓ **Max limit (%)**
- ✓ **Min limit (%)**
- ✓ **Mode** (Always heating/Always cooling/Digital input/Media temperature, simple/Media temperature, advanced)
- ✓ **Change-over temperature (°C)**
- ✓ **Heating hysteresis (°C)**
- ✓ **Cooling hysteresis (°C)**
- ✓ **Valve delay time (s)**

Heating/Cooling via *Change Over* is used when a heating/cooling system uses the same water pipes for heating and cooling. Heat or cool water is produced centrally and distributed in the pipes to the battery. To detect whether there is warm or cool water in the pipes, the controller measures the temperature of the pipes or a digital input is used to select heating or cooling.

Mode Change:

The change between heating and cooling mode can be controlled in different ways:

- ✓ Manual control via communication
- ✓ Digital input
- ✓ Measuring the temperature of the heating/cooling medium and compare it to either a fixed value or the room temperature.

When the valve is closed, the measurement of the media temperature may not be reliable. Therefore, when the output value is less than 20%, the valve is opened fully at regular intervals and kept open for a defined time before the temperature is measured.

For more information, see section *Change-over*.

6-way valve

The 6-way valve is a valve that makes it possible to use a 2-pipe beam in a 4-pipe system. The *6-way valve* sequence can be combined with additional heating or cooling sequences.

The following settings can be made:

- ✓ **Seq 1 fully open (V)**
- ✓ **Seq 1 start opening (V)**
- ✓ **Seq 2 fully open (V)**
- ✓ **Seq 2 start opening (V)**
- ✓ **Center point (V)**
- ✓ **Center point hysteresis (%)**
- ✓ **Sequence order** (Heating 1st sequence/Heating 2nd sequence)

The 6-way valve is closed at centre position (5 V), runs heat water from 5 - 0 V, and cool water from 5 - 10 V. A hysteresis is present in the centre.

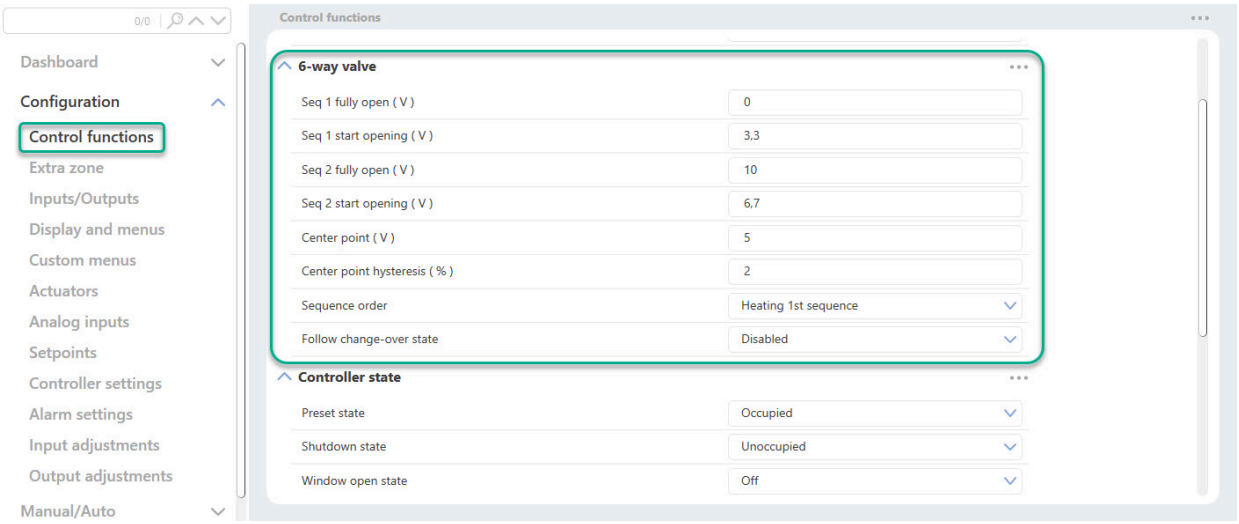


Figure 3-12 6-way valve configuration settings in Application tool 2

At *Heat* sequence the PI-controller output is scaled between the heat water start open and heat water fully open values. Hence, at default settings, the 0 - 100% PI-controller output is scaled form 3.3 V (0% + hysteresis) to 0 V (100%). At *Cool* state the PI-controller output is scaled between the cool water start open and cool water fully open values. Hence, at default settings, the 0 - 100% PI-controller output is scaled from 6.7 V (0% + hysteresis) to 10 V (100%).

Around the centre point there will be a small hysteresis, default ± 0.5 V, but configurative (0 - 2 V). This is to avoid the valve to flicker at small controller outputs. When the PI-control output has passed the hysteresis, the value will immediately go up to the start level and start controlling from PI-controller output + hysteresis. The output is set back to the centre point value when the PI-controller reaches 0% output. This functionality can be set by using the value listed in *Table 3-6 6-way valve configuration setting*.

The sequence of the output could be reversed by configuration so that the *Heat* sequence corresponds to high output levels and vice versa.

The 6-way valve menu group provides a specific setting, listed in *Table 3-6 6-way valve configuration setting*, that is only applicable for the controller modes that include a *6-way valve* sequence. This setting is located in the *Configuration* ▸*Control functions*▸*6-way valve* menu group in the Regin:GO app or the Application tool 2, and is shown when an applicable room control sequence is selected.

Table 3-6 6-way valve configuration setting

Configuration setting	Description
Seq 1 fully open (V)	Voltage for fully open at sequence 1
Seq 1 start opening (V)	Voltage to start open at sequence 1
Seq 2 fully open (V)	Voltage for fully open at sequence 2
Seq 2 start opening (V)	Voltage to start open at sequence 2
Center point (V)	Voltage for centre point, both sequences closed
Center point hysteresis (%)	Minimum output to activate the valve
Sequence order	0: Cool 1st Sequence 1: Heat 1st Sequence

Controller state

Controller state is a control function that makes it possible for the room HVAC system to operate with priority on comfort or energy saving.

The following controller states are available for use and the controller always operates in one of them:

- ✓ **Off**
- ✓ **Unoccupied**
- ✓ **Standby**
- ✓ **Occupied**
- ✓ **Forced ventilation**

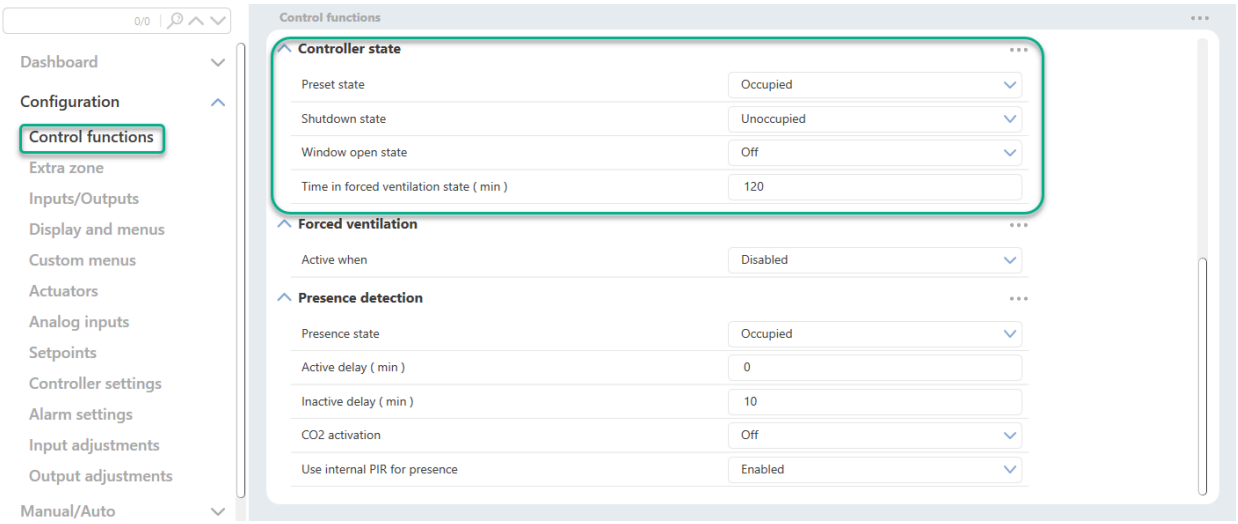


Figure 3-13 Controller state configuration settings in Application tool 2

The different controller states make use of various setpoint and deadband settings to regulate the heating and cooling distribution, as described in section *Control behaviour*.

The *Controller state* configuration settings are described in section *Configuration settings*, and controller state changes are described in section *State changes*.

An overview of the controller states is provided in *Table 3-7*.

Table 3-7 Controller state overview.

Controller state	Description	Priority
Off	This state is typically used for when the room is not in use for an extended period of time, such as during holidays or long weekends. In this state, the controller only provides heating control for frost protection, which keeps the room temperature above 8 °C.	Energy saving and frost protection
Unoccupied	This state is typically used for when the room is not in use for an extended period of time, such as during holidays or long weekends.	Energy saving
Standby	This state is typically used for when the room is not in use, temporarily or for shorter periods of time, such as during evenings, nights, or weekends.	Energy saving
Occupied	This state is typically used for when the room is in use.	Comfort
Forced ventilation	This state is typically used for when the room is in use, and when a temporary maximum flow of fresh air is needed. Such as, when the room needs an extra boost of fresh air prior to a scheduled meeting that is going to fill up the room with a large amount of people, or due to a high CO_2 level. The increase in airflow is achieved by using the *Forced ventilation* function. See section *Forced ventilation*.	Comfort and improved air quality

Control behaviour

This section describes the control behaviour for the different controller states when the controller regulates based on heating and cooling demand.

Off

In this state, the controller does not regulate based on the configured occupied heating and cooling setpoints. Instead, the controller only provides heating control based on the configured frost protection setpoint. Setpoint adjustment is not active in this controller state.

Active setpoint: The configured frost protection setpoint.

Figure 3-14 illustrates the control behaviour when no maximum or minimum limits are set for the output signal.

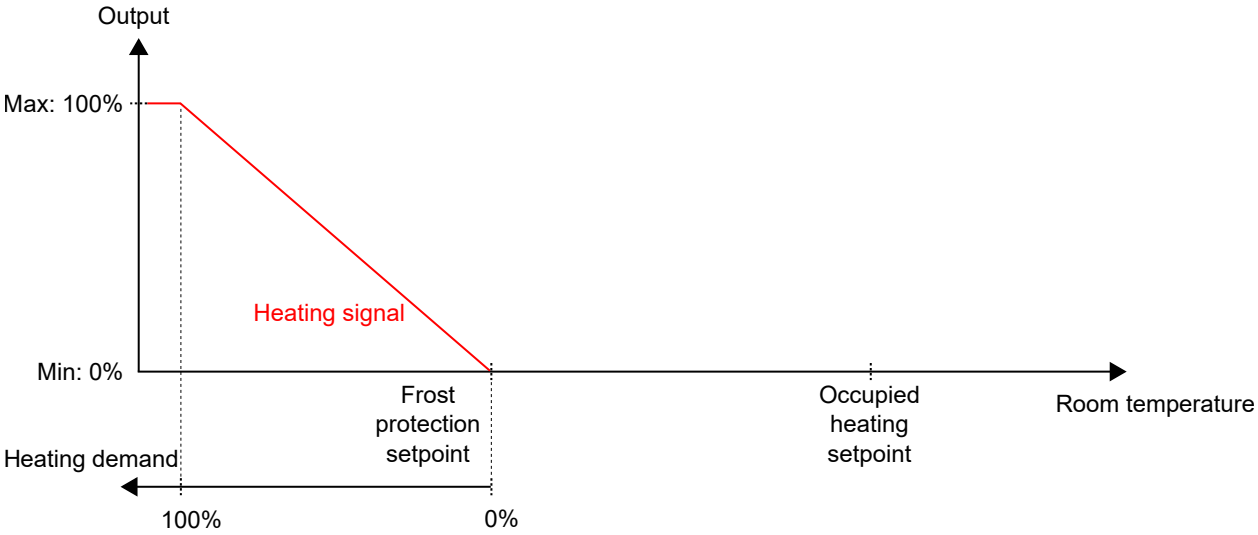


Figure 3-14 Control behaviour for the off controller state

Unoccupied

In this state, the controller does not regulate based on the configured occupied heating and cooling setpoints. Instead, the controller provides heating and cooling control based on the configured unoccupied heating and cooling setpoints. Setpoint adjustment is not active in this controller state.

Active setpoints: The configured unoccupied heating and cooling setpoints.

Figure 3-15 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

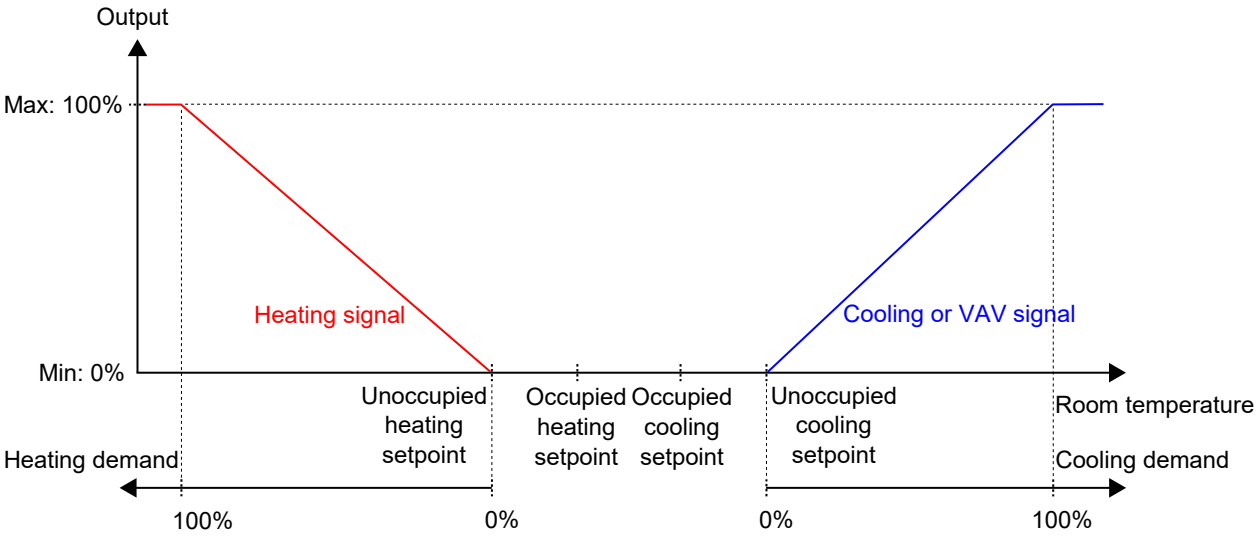


Figure 3-15 Control behaviour for the unoccupied controller state

Standby

In this state, the controller regulates based on the configured occupied heating and cooling setpoints, in combination with the configured **Standby** setting. Setpoint adjustment is active in this controller state.

Active setpoints: The configured occupied heating and cooling setpoints, combined with the configured **Standby** setting and any applied setpoint adjustment.

Figure 3-16 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

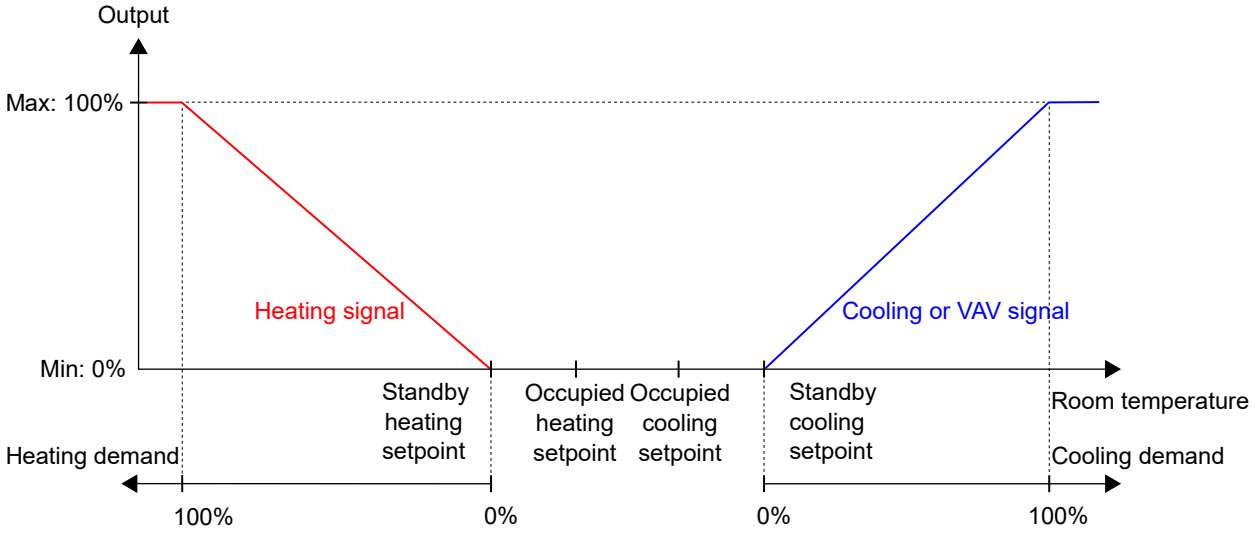


Figure 3-16 Control behaviour for the standby controller state

Occupied and Forced ventilation

In these states, the controller regulates based on the configured occupied heating and cooling setpoints. Setpoint adjustment is active in these controller states.

The *Forced ventilation* function can be used when the controller changes to *Forced ventilation* state. For information about the *Forced ventilation* function, see section *Forced ventilation*.

Active setpoints: The configured occupied heating and cooling setpoints, combined with any applied setpoint adjustment.

Figure 3-17 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

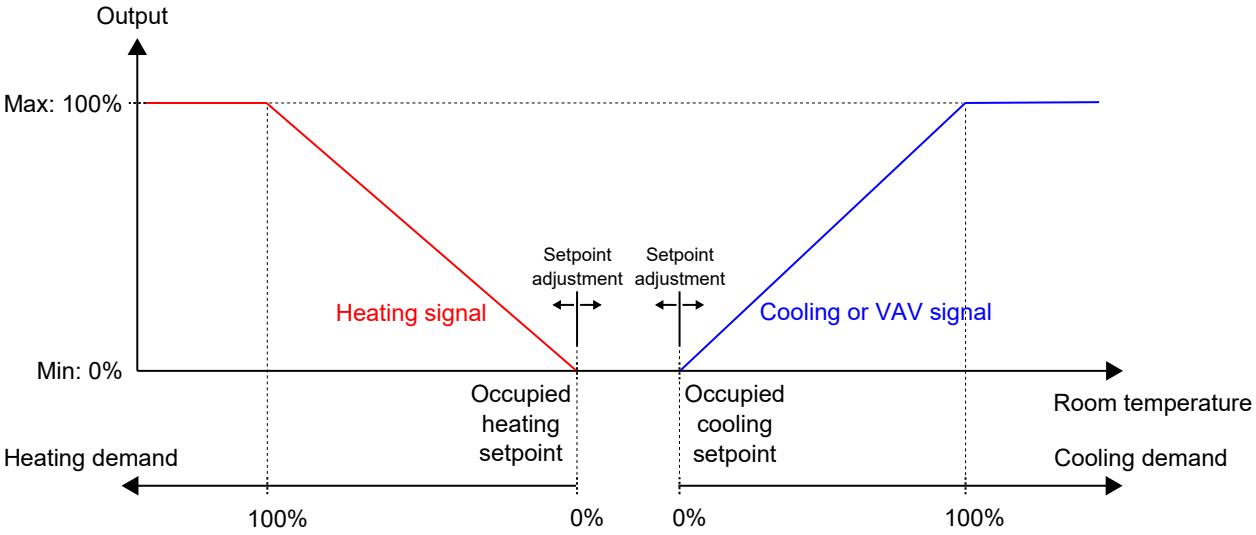


Figure 3-17 Control behaviour for the occupied and Forced ventilation controller state

Configuration settings

The controller state configuration settings are described in *Table 3-8*.

Table 3-8 Controller state configuration settings

Configuration setting	Description
Preset controller state	One of the following controller states is configured as the preset controller state: ✓ **Off** ✓ **Unoccupied** ✓ **Standby** ✓ **Occupied** (default)
Shutdown controller state	One of the following controller states is configured as the shutdown controller state: ✓ **Off** ✓ **Unoccupied** (default) ✓ **Standby** ✓ **Occupied**
Time in Forced ventilation state (min)	The period of time (in minutes) that the controller is in *Forced ventilation* state before the controller changes state to the configured preset controller state. If time is set to 0, the Forced ventilation never switches back automatically. It will need an activating trigger to leave the *Forced ventilation* state. See section *State changes*.

State changes

The controller changes state when one of the following events occur:

- ✓ Presence is detected,
  - ✓ via a presence detector, for example a motion detector, which is connected to the controller, or
  - ✓ due to a high CO_2 level that is detected via a CO_2 sensor, which is connected to the controller.

  For information about the *Presence detection* function and presence detection configuration settings, see section *Presence detection*.
- ✓ The *Forced ventilation* state time out expires.
- ✓ Presence is not detected anymore.
- ✓ A central command is issued via communication, for example, from a SCADA system.

Control function descriptions

This section contains descriptions of and configuration information for the controller's basic control functions.

Sequence outputs

If more than one heating or cooling sequence are selected, the controller output will be split between the sequence steps. When the first step has reached its maximum value, the second step will start increasing according to the tables and graphs in the sections *One Heat/Cool sequence*, *Two Heat/Cool sequences*, and *Three Heat/Cool sequences*.

One Heat/Cool sequence

Table 3-9 One Heat/Cool sequence

Heat/Cool demand	Output 1
0%	0%
100%	100%

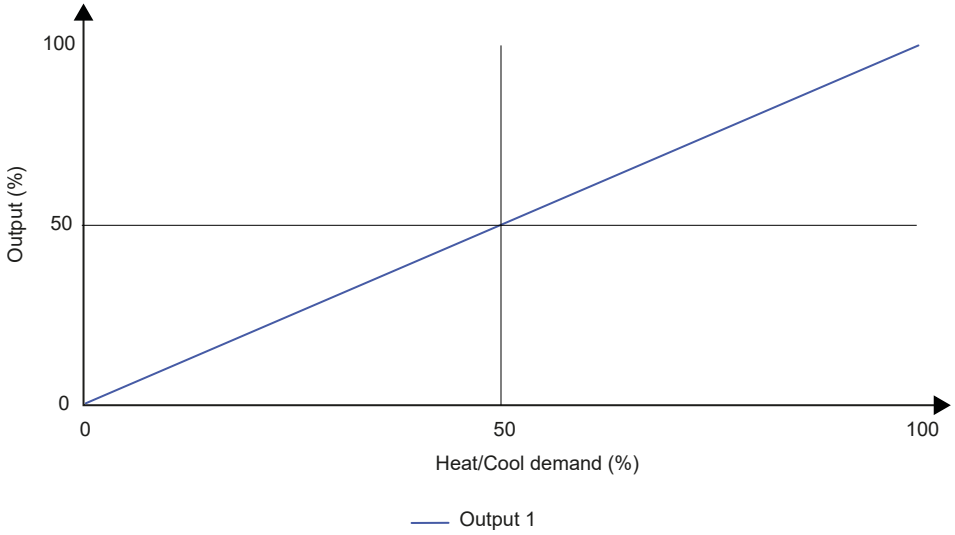


Figure 3-18 One Heat/Cool sequence behaviour

Two Heat/Cool sequences

Table 3-10 Two Heat/Cool sequences

Heat/Cool demand	Output 1	Output 2
0%	0%	0%
49%	100%	0%
51%	100%	0%
100%	100%	100%

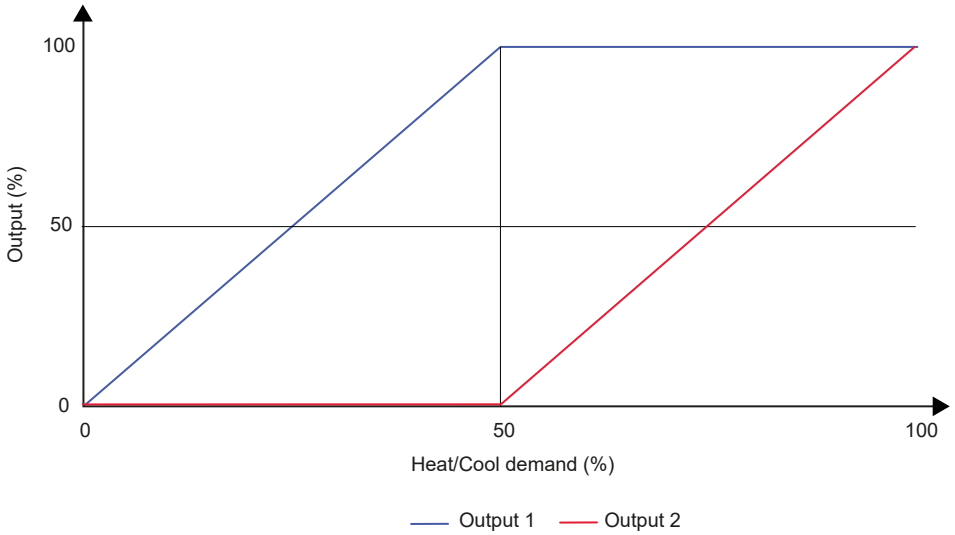


Figure 3-19 Two Heat/Cool sequences behaviour

Three Heat/Cool sequences

Table 3-11 Three Heat/Cool sequences

Heat/Cool demand	Output 1	Output 2	Output 3
0%	0%	0%	0%
32%	100%	0%	0%
34%	100%	0%	0%
66%	100%	100%	0%
68%	100%	100%	0%
100%	100%	100%	100%

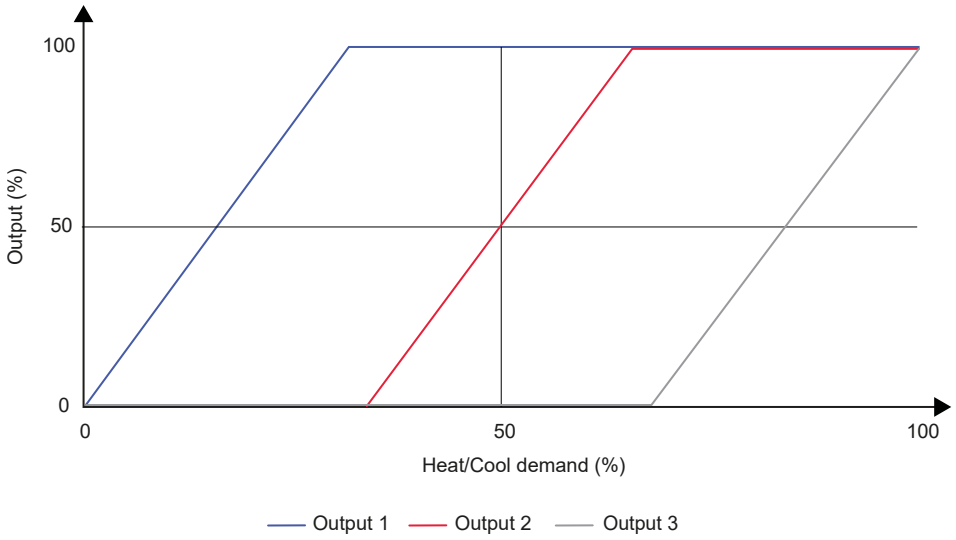


Figure 3-20 Three Heat/Cool sequences behaviour

Change-over

Change-over is a control function that enables the controller to provide both a heating or a cooling signal on the same controller output. This is achieved by shifting the controller *Change-over* state from *Heating* to *Cooling*, and vice versa. The *Change-over* function makes it possible to use the controller in a 2-pipe change-over HVAC system, where warm or cold media flow in the same pipes and one valve is used to regulate both heating and cooling distribution.

The controller *Change-over* state is either *Heating* or *Cooling*, and is managed automatically via change-over detection. See section *Change-over detection*. The controller *Change-over* state can also be set manually via the **Manual/Auto** settings, or via communication. See section *3.4.8 Manual/Auto*.

The *Change-over* function is enabled and the configuration settings for change-over detection are shown in Application tool 2 when the *Change-over* sequence is selected.

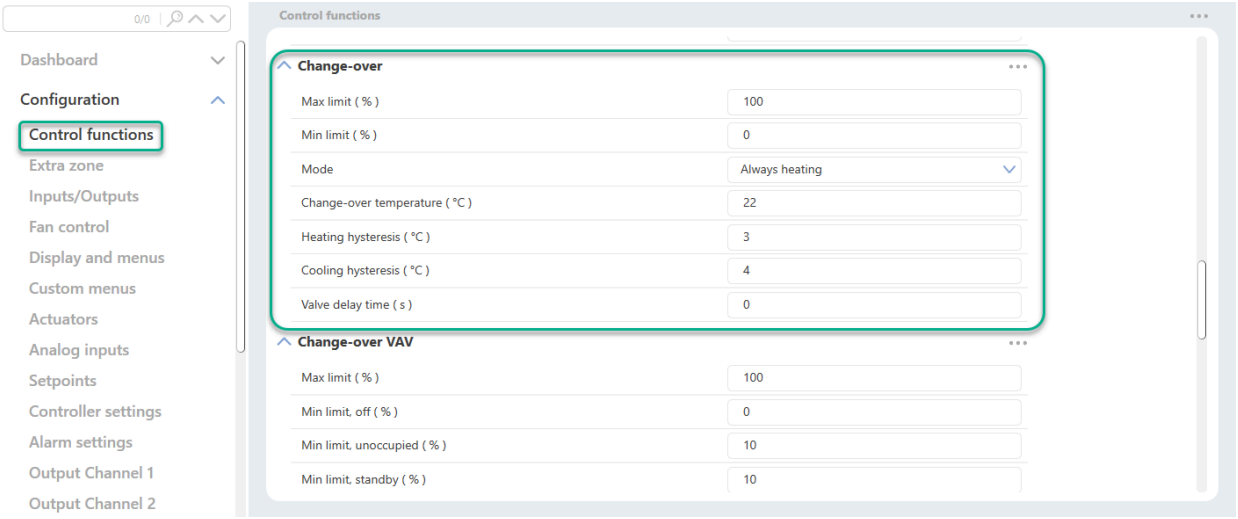


Figure 3-21 Change-over detection configuration settings in Application tool 2

Change-over detection

Change-over detection is performed either by using a PT1000 sensor that is connected to an analogue input, or by using a potential-free contact that is connected to a digital input. The PT1000 sensor is mounted so that it senses the pipe medium temperature.

When using a PT1000 sensor for change-over detection, the shift in controller *Change-over* state is triggered based on the difference between the pipe medium temperature and the room temperature. The controller shifts the *Change-over* state to *Heating* when the pipe medium temperature is 3°C (default) higher than the room temperature. The controller shifts the change-over state to *Cooling* when the pipe medium temperature is 4°C (default) lower than the room temperature.

When using a potential-free contact for change-over detection, the controller shifts the controller change-over state to *Cooling* when the contact is closed. The controller shifts the controller change-over state to *Heating* when the contact is open. This assumes that the digital input is set to **Normally opened**, see the *Configuration -> Inputs / Outputs* page/pane in Application tool 2 or in Regin:GO.

Change-over detection is configured on the controller inputs by using the values listed in *Table 3-12*.

Table 3-12 Change-over detection configuration values and controller input types

Controller input configuration value	Controller input type
Change-over temperature	Analogue
Change-over	Digital

The configuration settings for change-over detection are described in *Table 3-13*.

Table 3-13 Change-over detection configuration settings

Configuration setting	Description
Mode	**Always heating:** *Change-over* state is always heating. **Always cooling:** *Change-over* state is always cooling. **Digital input:** *Change-over* state is controlled by a digital input. **Media temperature, simple:** The media temperature is compared to the **Change-over temperature** setting. **Media temperature, advanced:** The media temperature is compared to the room temperature. The change-over state is set to cooling when the media temperature goes below the reference temperature (setting or room) minus the **Cooling hysteresis** value. The state is set to heating when the media temperature goes above the reference temperature plus the **Heating hysteresis** value. The valve must be more than 20% open for the time specified in **Valve delay time** before the media temperature is measured.
Change-over temperature	The change-over media temperature. Only applicable in **Media temperature, simple** mode.
Heating hysteresis	The hysteresis value that is added to the reference temperature when switching to *Heating* state.
Cooling hysteresis	The hysteresis value that is subtracted from the reference temperature when switching to *Cooling* state.
Valve delay time	The time (in seconds) that the valve is open before the media temperature is measured and compared to the reference temperature. If set to 0, the function is disabled and the valve state is ignored.

Forced ventilation

Forced ventilation is a control function that is used to improve the air quality in a room through increased airflow. This is achieved by fully opening the damper that regulates the airflow into the room, which provides an additional amount of fresh air and decreases the CO_2 level. The forced ventilation function can also be used to boost the heating or cooling distribution when the heating, cooling, or VAV output signal has reached its maximum.

The *Forced ventilation* function can be used in all controller modes, and is enabled by setting the **Forced ventilation** configuration setting to anything other than **Disabled**.

The *Forced ventilation* function is activated when the controller changes to *Forced ventilation* state and the conditions specified by the **Forced ventilation** setting. For more information about *Forced ventilation* state, see section *Controller state*.

When the *Forced ventilation* function is active, a digital controller output that is configured with the **Forced ventilation** value is active, and the analogue VAV output signal is set to its maximum for the controller modes that include a *VAV* sequence. The cooling output signal can be configured to also be set to its maximum when the *Forced ventilation* is active.

The **Forced ventilation** configuration settings in Application tool 2 are shown in *Figure 3-22*.

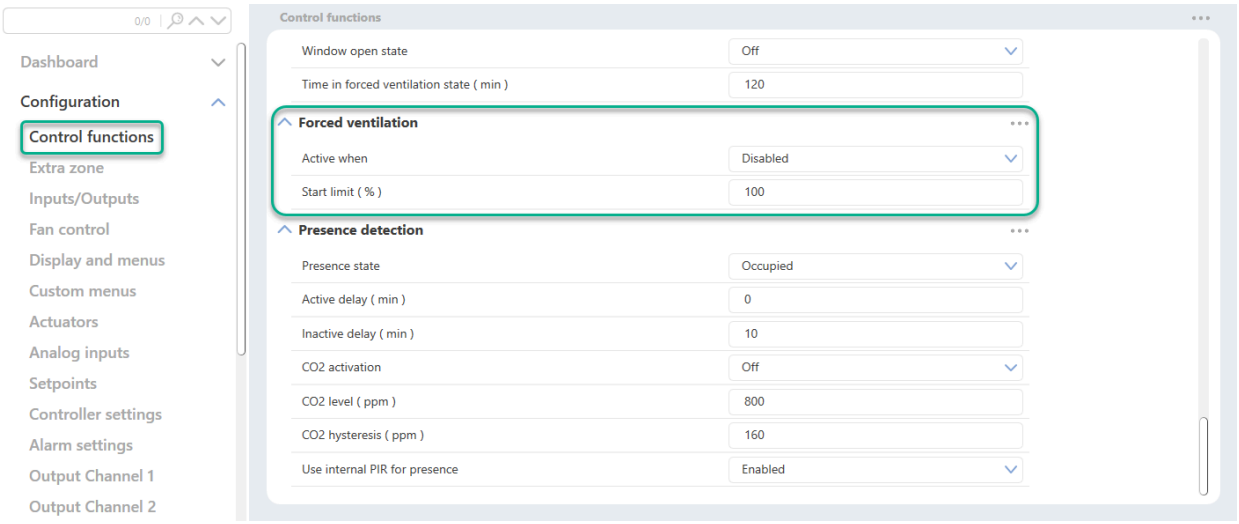


Figure 3-22 Forced ventilation configuration settings in Application tool 2

The **Forced ventilation** configuration settings are described in *Table 3-14*.

Table 3-14 Forced ventilation configuration settings

Configuration setting	Description
Active when	This setting is used to select if forced ventilation should be activated when the controller is in *heating* or *cooling*, or both. This is useful for providing an additional amount of fresh air into the room and for decreasing the CO_2 level. **Disabled**: Forced ventilation is not activated (default). **Cooling or heating demand over limit**: Forced ventilation is activated when the heating or cooling output signal is above the start limit. **Cooling demand over limit**: Forced ventilation is activated when the cooling output signal is above the start limit.
Start limit (%)	0-100

Figure 3-23 illustrates digital output signal behaviour when no maximum or minimum limits are set for the output signals, the controller is in *Forced ventilation* state, and the following configuration setting are applied:

✓ Forced ventilation *Active when*: **Cooling or heating demand above limit**

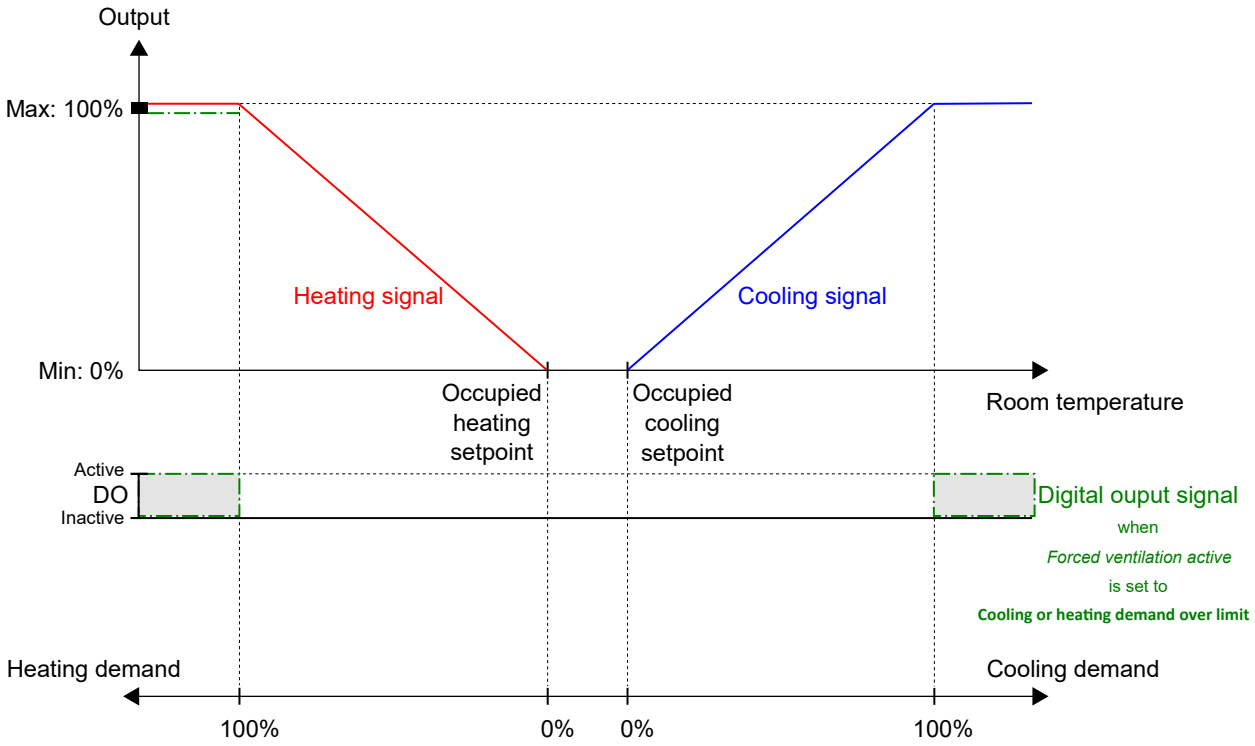


Figure 3-23 Example of forced ventilation control behaviour for the Heating + VAV controller mode when the controller is in the Forced ventilation state

Presence detection

Presence detection is a control function that makes it possible for the controller to automatically switch between controller states based on if someone is present in the room, or if the CO_2 level in the room is too high. Regin's RCX-TP, RCX-TP-D, RCX-TCP-D, RCX-THCVP-D and RCX-THCVP controllers have a built-in motion detector. For more information about controller states, and controller state changes when using presence detection, see section *Controller state*.

Presence detection is performed by using a presence detector, for example, a motion detector, that is connected to and configured on a digital input. Presence can also be detected by using a CO_2 sensor that measures the CO_2 level in the room, and is connected to and configured on an analogue controller input. Regin's RCX-TC, RCX-TC-D, RCX-TCP-D, RCX-THCVP-D, and RCX-THCVP controllers have a built-in CO_2 sensor. When either of these units are used, the controller recognizes the built-in CO_2 sensor automatically, and no configuration is needed.

The controller checks for presence continuously. See *Figure 3-24*.

The *Presence detection* function is enabled and the **Presence detection** configuration settings are shown in the Regin:GO app or the Application tool 2 when any of the configuration values listed in *Table 3-15* are configured on a controller input.

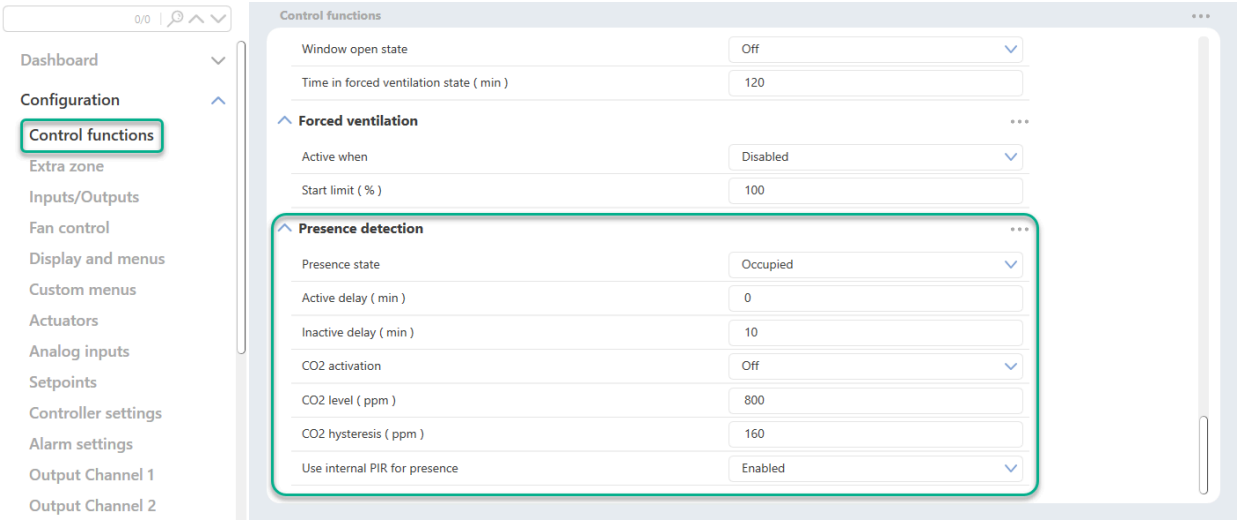


Figure 3-24 Presence detection configuration settings in Application tool 2

Table 3-15 Presence detection configuration values and controller input types

Controller input configuration value	Controller input type
CO_2 sensor	Analogue
Presence state	Digital

The **Presence detection** configuration settings are described in *Table 3-16*.

Table 3-16 Presence detection configuration settings

Configuration setting	Description
Presence state	One of the following controller states is configured as active when presence is detected: ✓ **Occupied** (default) ✓ **Forced ventilation**
Active delay (min)	The controller checks for presence continuously. When presence is detected, a timer starts and the controller waits this delay time (in minutes) before changing to the state specified by the **Presence state** setting. If presence is not detected continuously during this delay time, for example, if a person leaves the room before the delay time has passed, the controller does not change to the presence detected controller state, and the timer is stopped and reset. The motion needs to be detected three (3) times during the set time period instead of continuously during the set time period.
Inactive delay (min)	The controller checks for presence continuously. When no presence is detected anymore, a timer starts and the controller waits this delay time (in minutes) before changing to the state specified by the **Presence state** setting. If presence is detected again during this delay time, for example, if a person re-enters the room before the delay time has passed, the controller stays in the presence detected controller state, and the timer is stopped and reset.
CO_2 activation	You can choose to set the CO_2 activation to: ✓ **Off** (default) ✓ **On**
CO_2 level (ppm)	Presence is detected via the CO_2 sensor when the measured CO_2 level exceeds this value.
CO_2 hysteresis (ppm)	Specifies the hysteresis for when presence is not detected via the CO_2 sensor anymore. For example, if presence has been detected at 800 ppm and this setting is 160 ppm, the controller stops detecting presence at 800-160 = 640 ppm.
Use internal PIR for presence	You can choose to activate or deactivate the internal PIR sensor (if available for the model): ✓ **Enabled** (default) ✓ **Disabled**

3.4.2 Extra zone

Extra zone is a secondary control loop that works independently of the main sequence, but with only one sequence step.

This function allows for more precise control and customization to meet particular comfort or operational requirements. The integration of an *Extra zone* function provides flexibility, adaptability, and efficiency in managing the environment to meet the diverse needs and preferences of occupants in different parts of a room(s). A typical application is heating of a bathroom in a hotel room.

The *Extra zone* function is intended to control the under-floor heating in an extra zone, such as a bathroom, in parallel to the controlling main room. This means that the extra zone control runs with the same presence triggers as the main room (presence sensor, key card switch, remote state, etc.), meaning it always listens to the main room's control state and acts accordingly.

The *Extra zone* control is activated when the main zone controller state is the same or higher than the selection in *Table 3-19*.

The *Extra zone* function acts as a heating or cooling controller and regulates based on its own heating or cooling setpoint and the *Extra zone* temperature sensor.

The digital output *Extra zone* active signal is corresponding to the **Activate Extra zone** setting and does not require any *Extra zone temperature sensor* to work. It only indicates if the main room is in a selected control mode or higher.

The Regio RCX *Extra zone* function can be set to one of the following functions:

- ✓ *Disabled*
- ✓ *Heating*
- ✓ *Cooling*

In **Configuration**▸***Controller settings*** you can set the following:

- ✓ **P-band (°C)**
- ✓ **I-time (s)**

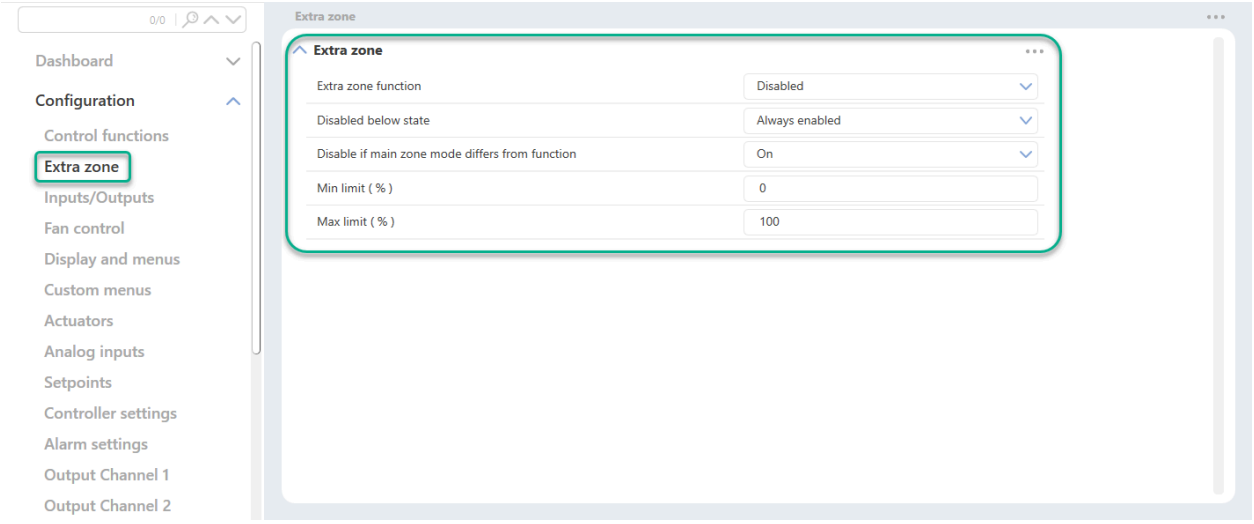


Figure 3-25 Extra zone configuration settings in Application tool 2

The **Extra zone** configuration settings are described in *Table 3-19* .

Table 3-17 Extra zone input signals

Input signal	Controller input type
Extra zone temperature	Analogue

Table 3-18 Extra zone output signals

Output signal	Controller output type
Heating valve Extra zone, thermal (PWM, Pulse Width Modulation)	Analogue
Heating valve Extra zone 0…10 V	Analogue
Extra zone active signal	Digital

Table 3-19 Extra zone configuration settings

Configuration setting	Description
***Extra zone* function**	One of the following controller states can be configured: ✓ **Disabled** (default) ✓ **Heating** ✓ **Cooling**
Disabled below state	One of the following controller states is configured as active when presence is detected: ✓ **Always enabled** (default) ✓ **Unoccupied** ✓ **Standby** ✓ **Occupied** ✓ **Forced ventilation**
Disable if main zone mode differs from function	If the main zone sequence differs in function, the Extra zone can be set separately to: ✓ **On** ✓ **Off**
Min limit (%)	The *Extra zone* output minimum limit (in percentage).
Max limit (%)	The *Extra zone* output maximum limit (in percentage).

Minimum unit state

The *Extra zone* function will turn off if the unit state is lower than this setting.

Disable if main zone mode differs from function

If the *Disable if main zone mode differs from function* is enabled and set to on, the *Extra zone* will turn off if the function is set to heating and the main controller is set to cooling, or vice versa.

3.4.3 Inputs/Outputs

Universal inputs

In *Universal inputs* you can set the UI1 and the UI2 settings, depending on your system configuration needs.

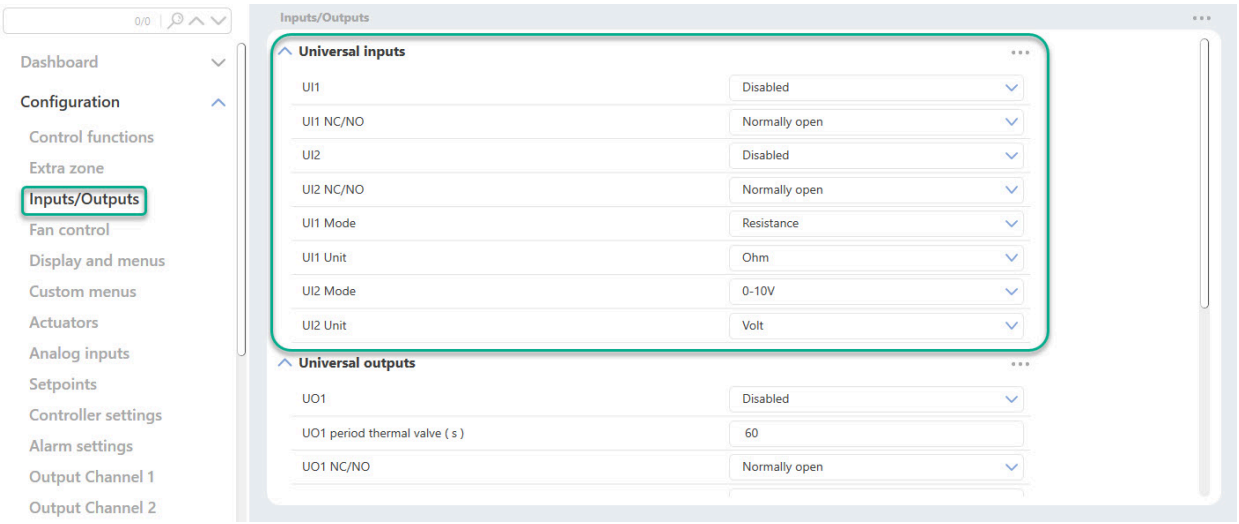


Figure 3-26 Universal inputs configuration settings in Application tool 2

The **Universal inputs** configuration settings are described in *Table 3-20 UI1 settings* and *Table 3-21 UI2 settings*.

Table 3-20 UI1 settings

Setting	Description
Disabled (default value)	No use of UI1
External room temperature	Use of External room temperature sensor, sub-settings available
Change-over temperature	Use of Change-over temperature sensor, sub-settings available
Extra zone temperature	Use of Extra zone temperature sensor, sub-settings available
Supply air temperature	Use of Supply air temperature sensor, sub-settings available
Extract temperature	Use of Extract temperature sensor, sub-settings available
Change-over VAV temperature	Use of Change-over VAV temperature sensor, sub-settings available
CO2 sensor	Use of CO2 sensor
Flow sensor	Use of Flow sensor
RH sensor	Use of RH sensor
External room sensor 0...10V	Use of External room sensor
VOC sensor	Use of VOC sensor
Presence detector	Use of Presence detector, sub-settings available
Open window	Use of Open window sensor, sub-settings available
Change-over	Use of Change-over switch, sub-settings available
Change-over VAV	Use of VAV Change-over switch, sub-settings available
Condensation sensor	Use of Condensation sensor, sub-settings available
External alarm	Use of External alarm, sub-settings available

Table 3-21 UI2 settings

Setting	Description
Disabled (default value)	No use of UI2
CO2 sensor	Use of CO_2 sensor, sub-settings available
Flow sensor	Use of Flow sensor, sub-settings available
RH sensor	Use of RH sensor, sub-settings available
External room temperature 0...10V	Use of External room temperature sensor- (0...10V), sub-settings available
VOC sensor	Use of VOC sensor, sub-settings available
Presence detector	Use of Presence detector, sub-settings available
Open window	Use of Open window sensor, sub-settings available
Change-over	Use of Change-over switch, sub-settings available
Change.over VAV	Use of VAV Change-over switch, sub-settings available
Condensation sensor	Use of Condensation sensor, sub-settings available
External alarm	Use of External alarm, sub-settings available

Universal outputs

In *Universal outputs* you can set the UO1 and the UO2 settings, depending on your system configuration needs. The universal outputs can also serve for digital outputs.

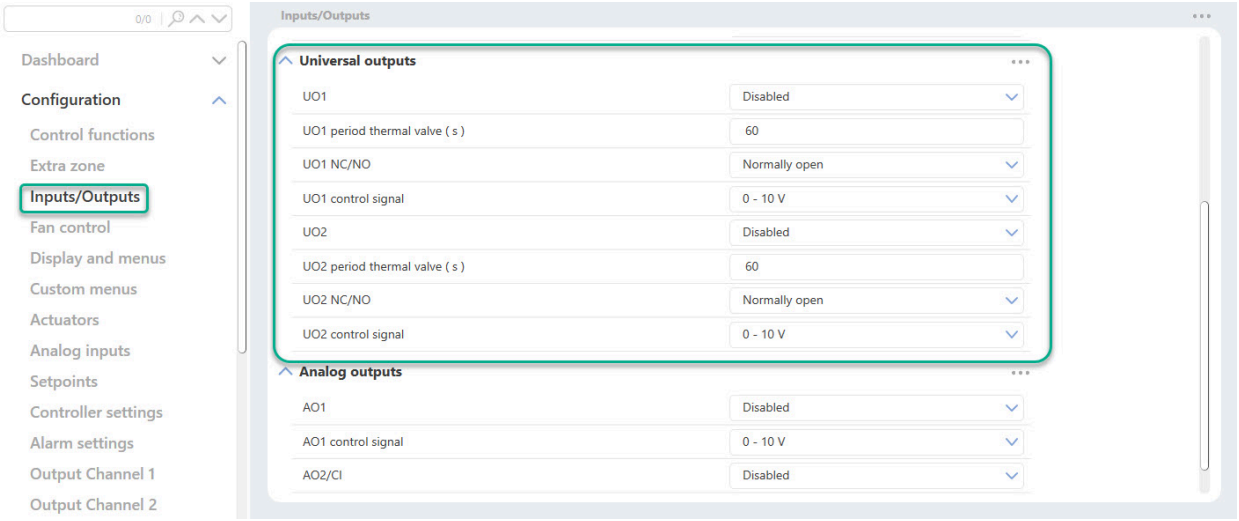


Figure 3-27 Universal outputs configuration settings in Application tool 2

The **Universal outputs** configuration settings are described in *Table 3-22 UO1 and UO2 settings*.

Table 3-22 UO1 and UO2 settings

Setting	Description
Disabled (default value)	No use of UO1 or UO2
Heating	Sends a heating control signal to the connected actuator. Use for systems that regulate heat.
Cooling	Sends a cooling control signal to the connected actuator.
VAV	Sends a VAV signal to adjust damper airflow.
Heating 2	Second-stage heating signal.
Cooling 2	Second-stage cooling signal.
VAV 2	Second-stage VAV airflow signal.
Change-over valve	Controls a valve handling heating and cooling in two-pipe systems.
Change-over VAV	Controls airflow in change-over systems.
6-way valve	Controls a 6-way valve for combined heating and cooling.
Extra zone	Controls an extra zone such as floor heating.
EC fan	Sends a 0–10 V fan speed signal, sub-settings available.
CO2 control	Outputs signal based on CO_2 demand, sub-settings available.
Humidifier	Proportional output for humidifier, sub-settings available.
Dehumidifier	Proportional output for dehumidifier, sub-settings available.
VOC control	Output based on VOC index demand, sub-settings available.
Heating valve, thermal (PWM)	Drives thermal heating actuator using PWM.
Cooling valve, thermal (PWM)	Drives thermal cooling actuator using PWM.
Heating valve 2, thermal (PWM)	Drives second-stage heating actuator.
Cooling valve 2, thermal (PWM)	Drives second-stage cooling actuator.
Extra zone valve, thermal (PWM)	PWM output for extra-zone valve.
Change-over valve, thermal (PWM)	PWM output for change-over valve.

Table 3-22 UO1 and UO2 settings (continued)

Setting	Description
6-way valve, thermal (PWM)	PWM output for 6-way valve.
Heating, on/off	Binary heating output. On/off.
Cooling, on/off	Binary cooling output. On/off.
Heating 2, on/off	Binary second-stage heating output. On/off.
Cooling 2, on/off	Binary second-stage cooling output. On/off.
Change-over valve, on/off	Change-over valve output. On/off. (Valid for RCX 2.1 or later)
Extra zone, on/off	Binary extra-zone output.
Forced ventilation	Digital activation of forced ventilation, sub-settings available.
Extra zone active signal	Digital indication of extra-zone activation.
Sum alarm	Digital signal for active alarms, sub-settings available.

Analogue outputs

In *Analogue outputs* you can set the AO1 and the AO2/CI settings, depending on your system configuration needs.

Note! The analogue outputs can not be used for digital output.

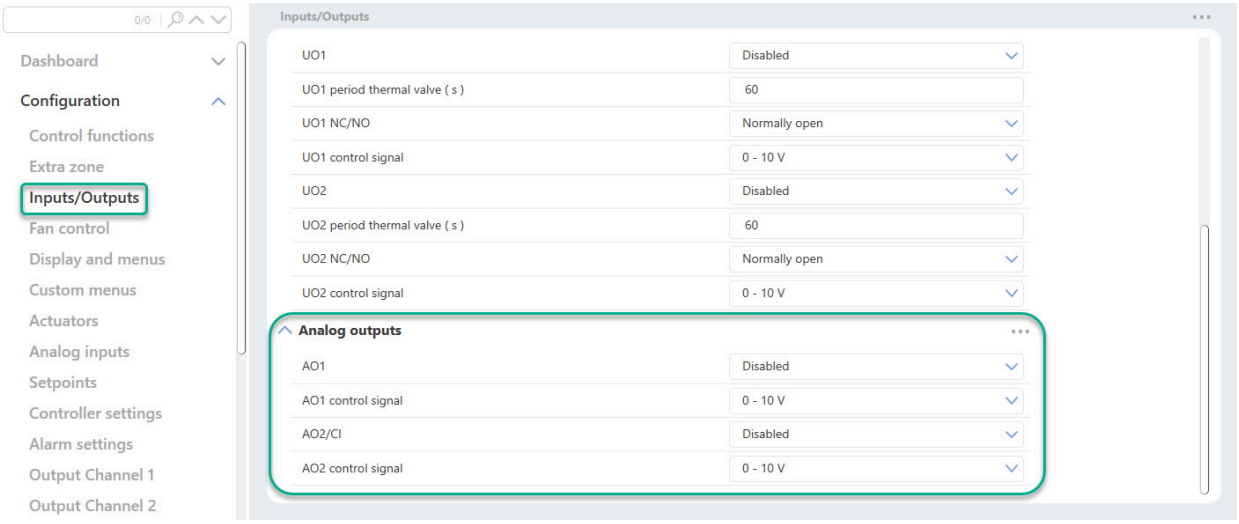


Figure 3-28 Analogue outputs configuration settings in Application tool 2

The **Analogue outputs** and **AO1 and AO2 control signal** configuration settings are described in *Table 3-23 AO1 settings* and *Table 3-24 AO1 and AO2 control signal*.

Table 3-23 AO1 settings

Setting	Description
Disabled (default value)	No use of UO1 or UO2
Heating	Proportional heating signal (0–10 V, etc.).
Cooling	Proportional cooling signal.
VAV	Proportional VAV signal for airflow control.
Heating 2	Second-stage proportional heating.
Cooling 2	Second-stage proportional cooling.
VAV 2	Second-stage proportional VAV output.
Change-over valve	Proportional control for two-pipe change-over valve.
Change-over VAV	Proportional VAV output for change-over systems.
6-way valve	Proportional output to operate 6-way valve.
Extra zone	Proportional signal for extra-zone actuator.
EC fan	0–10 V output for EC fan speed, sub-settings available.
CO2 control	Output based on CO2 demand, sub-settings available.
Humidifier	Proportional humidifier control, sub-settings available.
Dehumidifier	Proportional dehumidifier control, sub-settings available.
VOC control	Proportional output based on VOC index, sub-settings available

Table 3-24 AO1 and AO2 control signal

Setting	Description
0...10 V, 0...5 V, 2...10 V, 10...0 V, 5...0 V, 10...2 V	AO1 and AO2 control signal value ranges selectable.

3.4.4 Fan control

The *Fan control* function is enabled and the **EC-fan control** configuration settings are shown in the Regin:GO app or the Application tool 2 when the configuration value listed in *Table 3-25* is configured on a controller output.

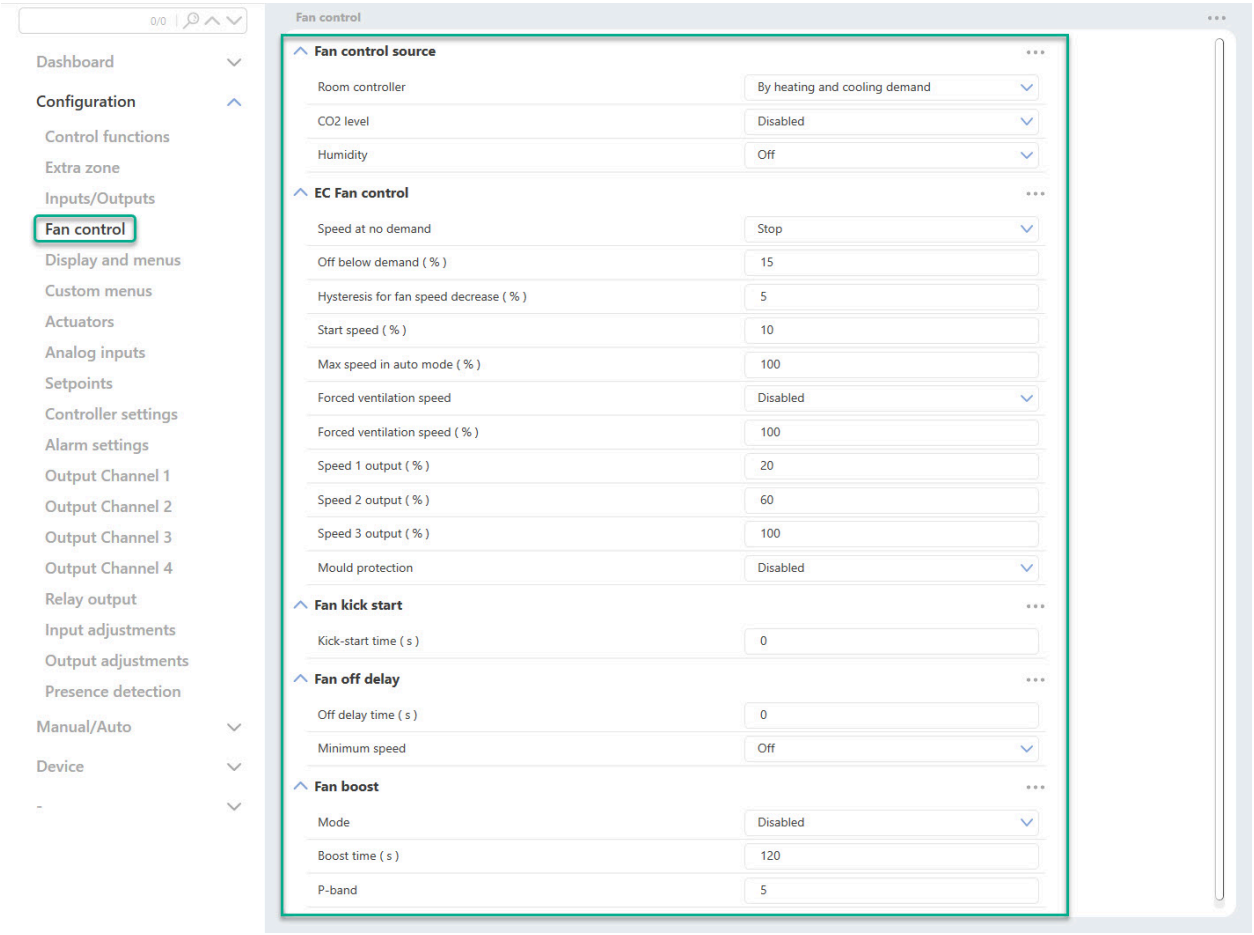


Figure 3-29 Fan control configuration settings in Application tool 2

The controller outputs a fan speed signal, **EC Fan speed (%)**, that is configured on a controller output by using the value in *Table 3-25*.

In auto mode, the **EC Fan speed (%)** signal corresponds to the current heating or cooling demand, as illustrated in *Figure 3-30*.

In manual mode, the **EC Fan speed (%)** signal is independent of the current heating or cooling demand. Instead, the fan speed 1, 2, and 3 signals are defined by the settings **Speed 1 output (%)**, **Speed 2 output (%)**, and **Speed 3 output (%)** respectively.

Table 3-25 EC-fan control configuration value and controller output type

Output signal	Controller output configuration value	Controller output type
EC Fan speed (%)	EC fan	Analog

The **Fan control** configuration settings are described in *Table 3-26*.

Table 3-26 EC fan control configuration settings

Configuration setting	Fan mode applicability	Description
Fan control source	**Room controller**	**Disabled**: Fan control in auto mode is disabled. **By heating demand**: Fan control in auto mode is active at heating demand. **By cooling demand**: Fan control in auto mode is active at cooling demand. **By heating and cooling demand**: Fan control in auto mode is active both at heating and cooling demand (default).
	CO2 level: Fan is controlled by CO_2 output	**Disabled**: Fan not controlled by CO2 output. **Enabled**: Fan is controlled by CO2 output.
	Humidity: Fan is controlled by humidity output	**Disabled**: Fan not controlled by humidity output. **Enabled**: Fan is controlled by humidity or dehumidify output.
EC Fan control	Auto and manual	**Speed at no demand**: Fan never stops in auto mode **Off below demand (%)**: Fan is off when the heat or cool demand is lower than this setting **Hysteresis for fan speed decrease (%)**: Hysteresis for fan speed outputs **Start speed (%)**: min. EC fan speed in % **Max speed in auto mode (%)**: max. EC fan speed in % **Forced ventilation speed**: Enable or disable fan to run when forced ventilation is active **Forced ventilation speed (%)**: Forced ventilation EC fan speed **Speed 1 output (%)**: EC fan speed for manual speed 1 **Speed 2 output (%)**: EC fan speed for manual speed 2 **Speed 3 output (%)**: EC fan speed for manual speed 3
Fan kick start	Auto and manual	**Kick-start time (s)**: Fan kick start time
Fan off delay	Auto and manual	**Off delay time (s)**: Fan afterblow run time. 0 = Not active **Minimum speed**: Fan afterblow min. speed.
Fan boost	**Mode**: Fan start boost heat cool select 0=heat, 1=cool, 2=both.	**Disabled**: Fan boost is disabled. **By heating demand**: Fan boost is active at heating demand. **By cooling demand**: Fan boost is active at cooling demand. **By heating and cooling demand**: Fan boost is active both at heating and cooling demand (default).
	Auto and manual	**Boost time (s)**: Fan boost run time. 0 = Not active
	Auto and manual	**P-band**:Fan boost P band

Figure 3-30 illustrates the EC fan control behaviour in auto mode when a 90% maximum limit is set for the fan speed output signal, and a 10% heating and cooling demand threshold value for when the fan should start is set.

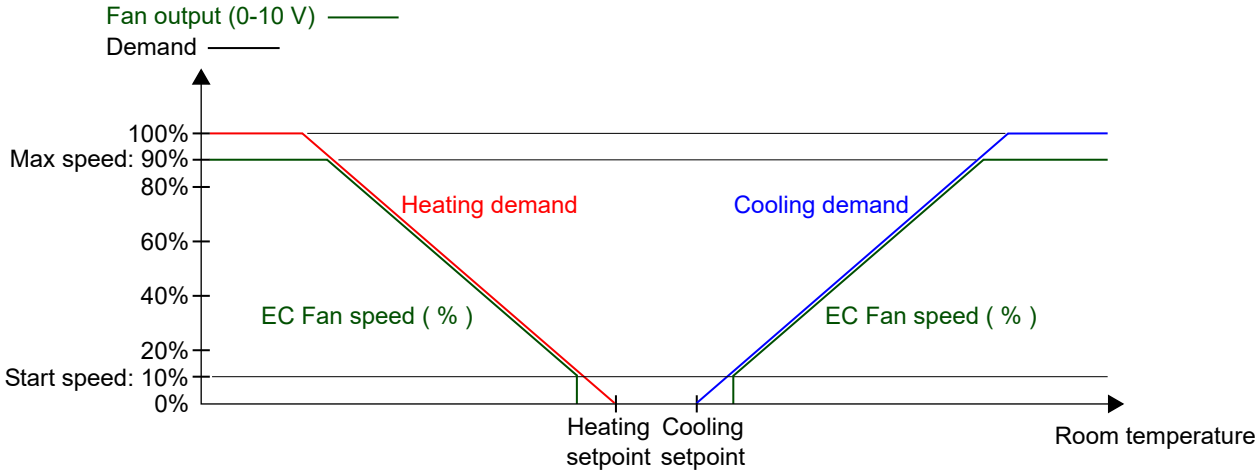


Figure 3-30 EC fan control behaviour in auto mode

Figure 3-31 illustrates the EC fan control behaviour in manual mode when a 90% maximum limit is set for the fan speed output signal.

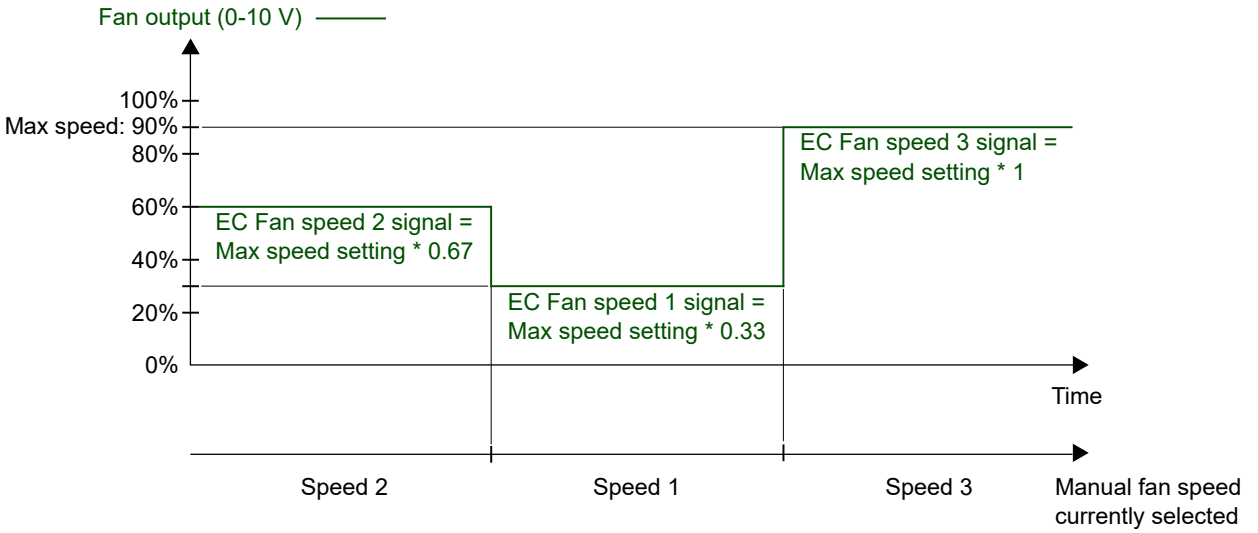


Figure 3-31 EC fan control behaviour in manual mode (fan speed 1, 2, or 3)

Fan boost

Fan boost is a control function that can be used to acknowledge to the person in the room that the fan is started when the controller detects presence. This is useful when the initial heating or cooling demand is low (the difference between the room temperature and setpoint is small), since the fan then typically runs at a low speed.

Another use case for the *Fan boost* function is to temporarily run the fan at an increased speed to provide a perceived cooling effect, until the cooling distribution from the cooling valve establishes.

The fan boost is achieved by the use of a separate fan boost controller that operates in parallel with the temperature controller, and temporarily increases the fan speed for a configured period of time (the fan boost time). **P-band** and **I-time** settings for the different controllers are located in the *Configuration*▸*Controller settings* menu page in the Regin:GO app or the Application tool 2.

The *Fan boost* function is enabled by configuring the *Fan boost time* setting to a value that is greater than zero.

The *Fan boost* function is activated when presence is detected, or when the controller changes to *Forced ventilation* state. The fan boost time is independent of the **Time in Forced ventilation state** configuration setting. See sections *Presence detection* and *Controller state*.

When the *Fan boost* function is active, the fan runs at maximum speed for the first 10 seconds of the fan boost time. For the remainder of the fan boost time, the fan speed output signal corresponds to whichever of the fan boost or temperature control signal that has the greatest value.

After the fan boost time has expired, the fan speed output signal corresponds to the temperature control signal, regardless if the fan boost control signal is greater than the temperature control signal. That is, the controller reverts to normal fan control, which is either auto or manual mode.

The fan boost configuration settings are described in *Table 3-27*.

Table 3-27 Fan boost configuration settings

Configuration setting	Description
Fan boost mode	**Disabled:** Fan boost is disabled (default). **By cooling demand:** Fan boost is active at cooling demand. **By heating demand:** Fan boost is active at heating demand. **By heating and cooling demand:** Fan boost is active at both heating and cooling demand.
Boost time (s)	The period of time (in seconds) that the *Fan boost* function is active.
P-band	Fan boost P band Default value: 5°C For more information, see theRCX-... Variable list to be downloaded at www.regincontrols.com.

Figure 3-32 illustrates how the *Fan boost* function can be used to provide a perceived cooling effect until the cooling distribution from the cooling valve is established.

In this example, the control behaviour for an EC fan in auto mode is described. It is assumed that the room temperature is 28°C and the cooling setpoint is 24°C at 0 seconds, resulting in an error value of 4, and that the error value is reduced to 0 at 300 seconds. The fan boost time is set to 90 seconds. The P-band for the fan boost controller is set to 5°C, and the P-band and I-time for the temperature controller is set to 10°C and 300 seconds, respectively.

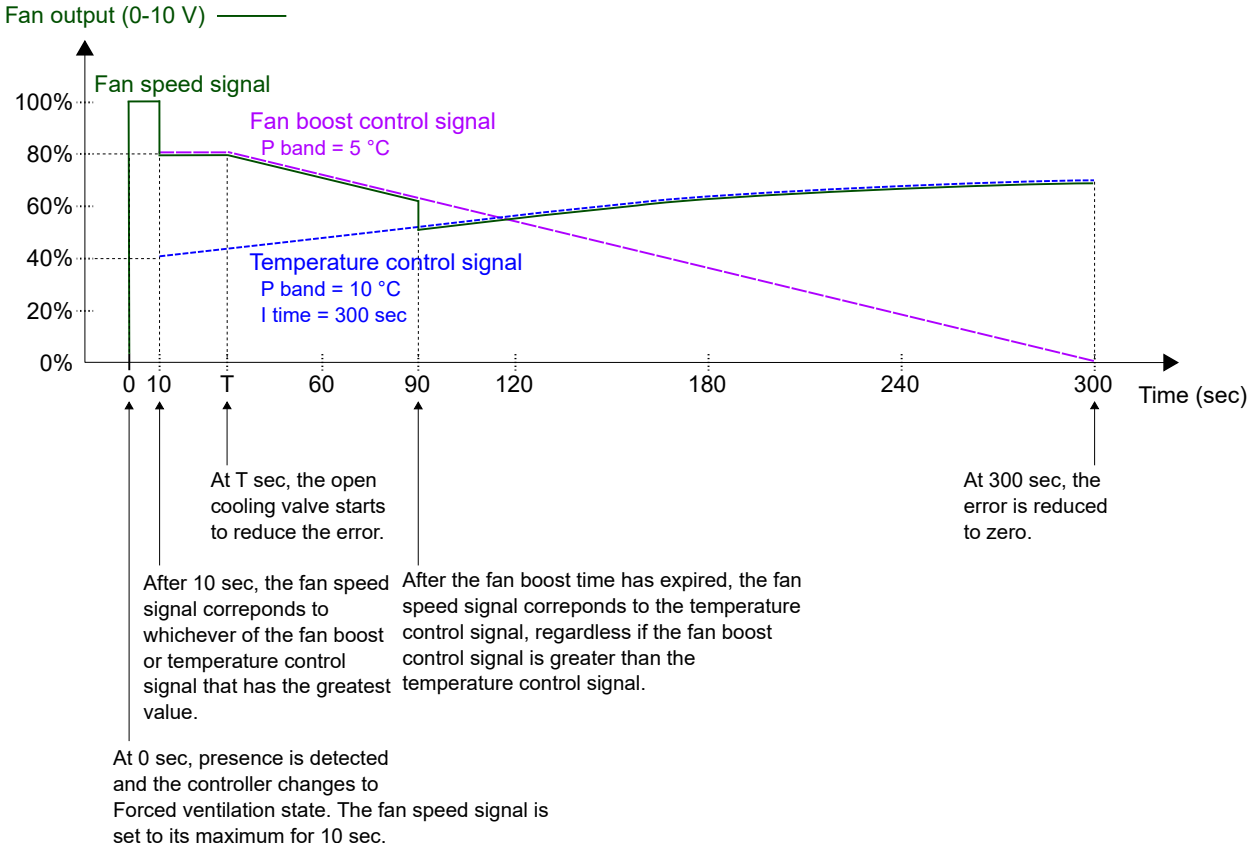


Figure 3-32 An example of fan boost control behaviour for an EC fan in auto mode, which provides a perceived cooling effect until the cooling distribution from the cooling valve establishes. The P-band for the fan boost controller has a lower value (higher gain) than the P-band for the temperature controller.

Fan kick-start

Fan kick-start is a control function that can be used to ensure that the EC fan starts even when the controller outputs a low-voltage control signal.

When using today's energy-saving EC fans, there is always a risk that the fan does not start due to a too low control voltage that prevents the fan from exceeding its starting torque. The fan then remains at a standstill while power still flows through it, which may damage to the fan. The *Fan kick-start* function ensures that the fan output is at its maximum for a set period of time, thereby making sure that the starting torque is exceeded.

The *Fan kick-start* function is enabled by configuring the **Fan kick-start time** setting to a value that is greater than zero.

The *Fan kick-start* function is activated when the fan starts from standstill in manual- or auto-mode.

When the *Fan kick-start* function is active, the controller sets the fan speed output signal to its maximum for the period of time specified by the **Fan kick-start time** configuration setting.

After the fan kick-start time has expired, the controller reverts to normal fan control, that is, Manual- or Auto-mode.

The **Fan kick-start** configuration settings are described in *Table 3-28*.

Table 3-28 Fan kick-start configuration settings

Configuration setting	Description
Fan kick-start time (s)	The period of time (in seconds) that the *Fan kick-start* function is active.

Mould protection

Mould protection is a control function that can be used to ensure that the EC fan always will run at least at Fan start speed.

When enabled, the fan operates independently of the controller state, whether in Auto-, or Manual-modes, or even Open window- or Presence-signals.

The minimum speed should be adjusted case by case. It is the installer's responsibility to ensure that the minimum speed is adequate to proper ventilate the room and prevent mould to appear and grow.

The *Mould protection* function is enabled by setting **Mould protection** to **On**.

3.4.5 Display and menus

Display settings

In *Display* you can set the default display settings in terms of the default shown view, alternating view of temperature and CO_2 value, the setpoint mode, round off of CO_2 value, display brightness, dim functions, and light time outs.

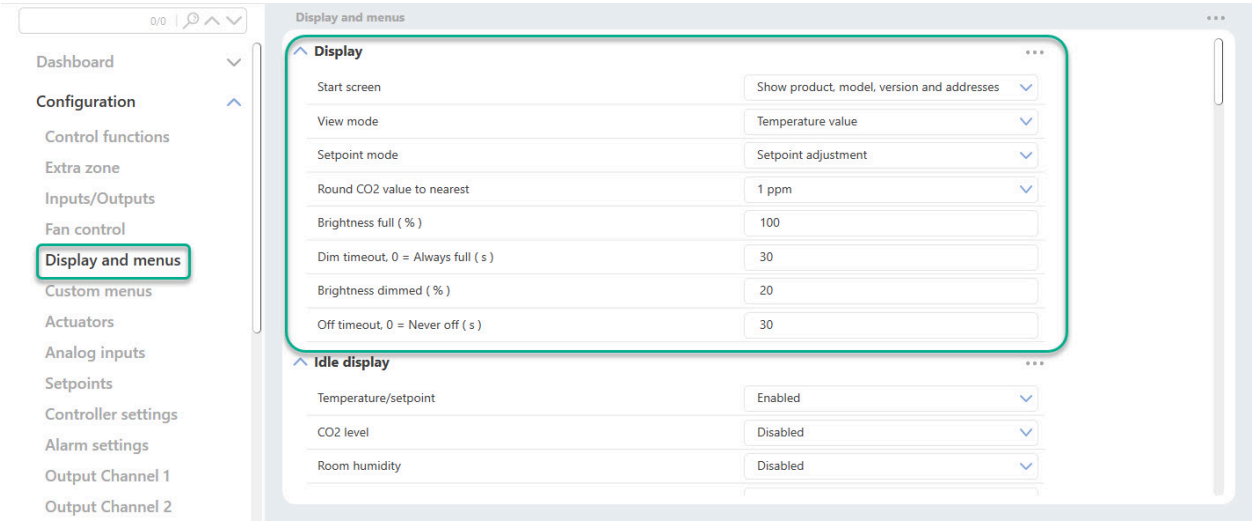


Figure 3-33 Display configuration settings in Application tool 2

The **Display configuration settings** are described in *3-29 Display settings*, *3-30 View mode settings*, *3-31 Setpoint mode settings* and *3-32 Other settings*.

Table 3-29 Display settings

Configuration setting	Description
Start screen	Setting for what values are shown at start-up. The selectable values are: **No startup screen** **Show product** **Show product and model** **Show product, model and version** **Show product, model, version, and addresses** (default)

Table 3-30 View mode settings

Mode setting	Description
Temperature value	Temperature value shown on the display. (default)
Actual setpoint	Actual setpoint value shown on the display.
Heating setpoint	Actual heating setpoint value shown on the display.
Cooling setpoint	Actual cooling setpoint value shown on the display.
Average cooling/heating setpoint	When setting the setpoint adjustment, the value shown on the display is configurable with **[Up]**-arrow button or **[Down]** arrow button.
Setpoint adjustment only	When setting the setpoint adjustment, the value shown on the display is configurable with **[Up]**-arrow button or **[Down]** arrow button.
Heating setpoint + adjustment	When setting the setpoint adjustment, the value shown on the display is configurable with **[Up]**-arrow button or **[Down]** arrow button.

Table 3-30 View mode settings (continued)

Mode setting	Description
Cooling setpoint + adjustment	When setting the setpoint adjustment, the value shown on the display is configurable with **[Up]**-arrow button or **[Down]** arrow button.
Average setpoint + adjustment	When setting the setpoint adjustment, the value shown on the display is configurable with **[Up]**-arrow button or **[Down]** arrow button.
Calculated flow in the duct in l/s	When an air flow sensor is connected, this mode shows the air flow value on the display.

Table 3-31 Setpoint mode settings

Mode setting	Description
Setpoint adjustment	Select the setpoint mode to be a setpoint adjustment. (default)
Actual setpoint	Select the setpoint mode to be the actual setpoint..
Heating setpoint	Select the setpoint mode to be the heating setpoint.
Cooling setpoint	Select the setpoint mode to be the cooling setpoint.
Heating setpoint Occupied + adjustment	Select the setpoint mode to be the heating setpoint as occupied, plus an adjustment.
Cooling setpoint Occupied + adjustment	Select the setpoint mode to be the cooling setpoint as occupied, plus an adjustment.
Average cooling/heating setpoint	Select the setpoint mode to be the average cooling or heating setpoint.

Table 3-32 Other settings

Setting	Description
Round CO2 value to nearest	Setting the CO_2 value to be rounded of in set range. 1, 50, or 100 ppm (default value = 1)
Brightness full (%)	Setting of the brightness (in %) 0-100 (default value = 100)
Dim timeout (s)	Setting of time (in seconds) Free value, 0 = Always full (s), (default value = 30)
Brightness dimmed (%)	Setting of the dimmed brightness (in %) 0-100, (default value = 20)
Off timeout, 0 = never off (s)	Setting of the LED brightness timeout (in seconds) Free value, 0 = never off (s), (default value = 30)

Idle display - (valid for version 2.1 or later)

In the Regin:GO app or Application tool 2 you can configure the idle mode display to show no value, a single value, or cycle between two or more values. See *Table 3-33 Idle display settings*. The time delay between showing different values is fixed to five (5) seconds (s).

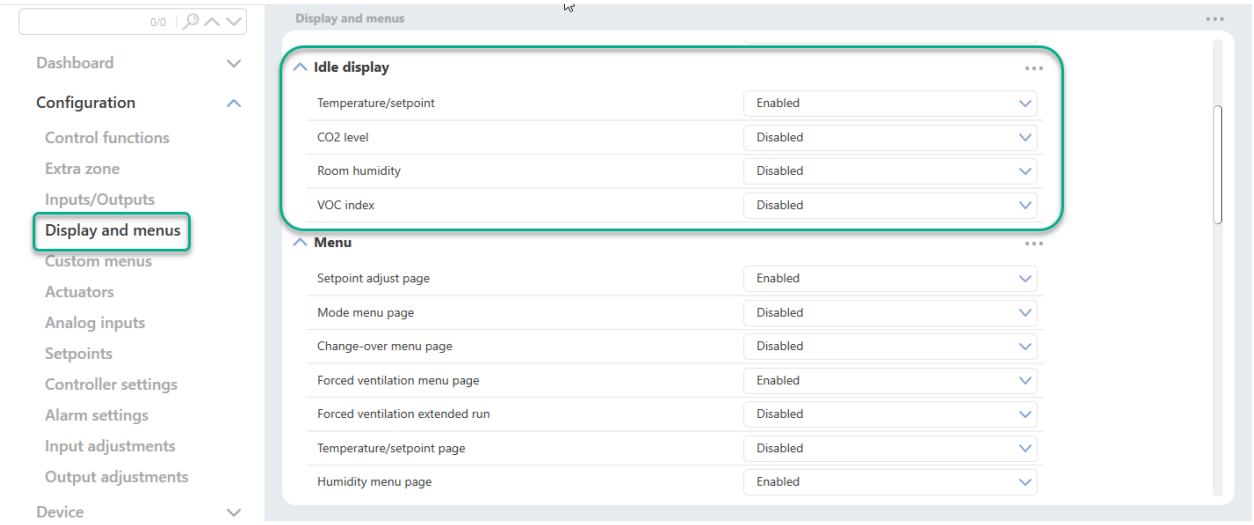


Figure 3-34 Idle display settings in Application tool 2

Table 3-33 Idle display settings

Setting	Description
Temperature/setpoint	Actual temperature and setpoint value shown on the display, when enabled and the device is in idle mode. (Default = Enabled)
CO2 level	Actual CO2 level value shown on the display, when enabled and the device is in idle mode. (Default = Disabled)
Room humidity	Actual room humidity value shown on the display, when enabled and the device is in idle mode. (Default = Disabled)
VOC index	Actual VOC index value shown on the display, when enabled and the device is in idle mode. (Default = Disabled)
Controller state	Actual set controller state value shown on the display, when enabled and the device is in idle mode. (Default = Disabled)

Note! If all settings are disabled, the display will still show the temperature value only.

LED indication

In the Regin:GO app or Application tool 2 you can set the RGB *Led indication* configuration for the CO_2 level.

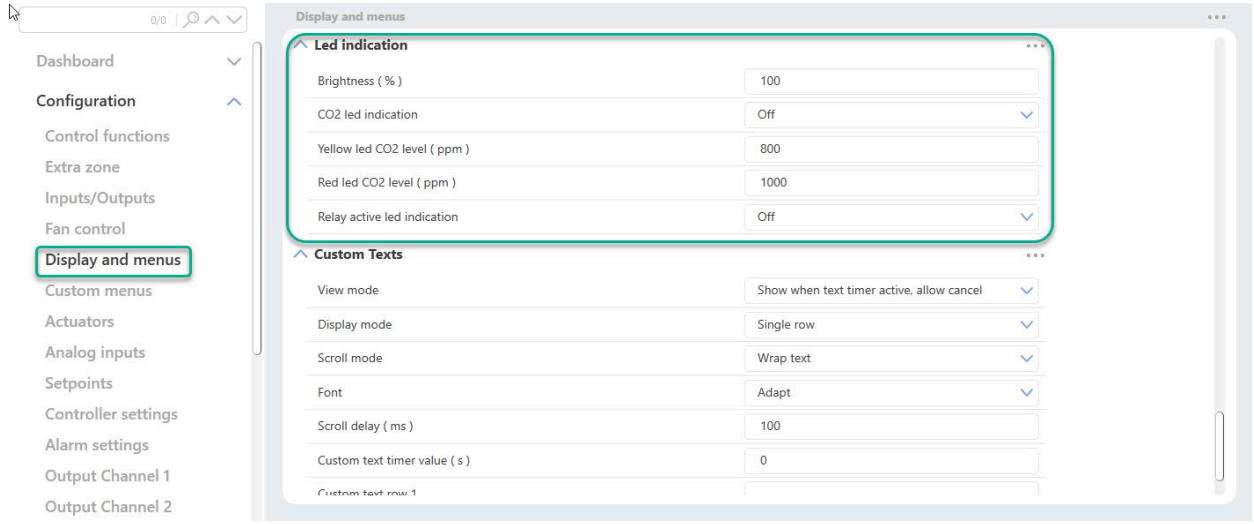


Figure 3-35 Led indication configuration settings in Application tool 2

The **Led indication settings** are described in *Table 3-34 Led indication settings*.

Table 3-34 Led indication settings

Setting	Description
CO2 led indication	Set Off/On for *CO_2 led indication* function, (default value - Off)
Yellow led CO2 level (ppm)	Free value threshold for yellow led warning, (default value - 800 ppm)
Red led CO2 level (ppm)	Free value threshold for red led warning, (default value - 1000 ppm)

Menu

In the Regin:GO app or Application tool 2 you can set the *Mode menu page* to enable Mode menu options. See section *Mode menu options*.

Mode menu options

In *Table 3-35 Mode menu page settings* you find descriptions of the available configuration settings in the *Display and menu* menu, where yo can choose what functions to enable when you press the **[Menu]** button. When you set the *Mode menu page* to **Enabled**, you will get the option to set **[Menu]** button options, which enables to configure *Controller state* of the device directly via the **Menu** button. See *Figure 2-5 Indications in the controller display 3* for display indications.

When the *Mode menu page* is enabled there are two settings for each state:

- ✓ an *Enable mode* setting to select if the controller state is present in the menu
- ✓ a corresponding menu Text mode for the controller state display text

There is also a Title text mode (first Menu level) and a text for the *Auto* option.

Note! The menu uses the same parameter as the remote controller state setting, so a setting made from the menu can be changed remotely via communication.

The text mode values are set as free text.

To select an enabled mode, see *Changing controller state from the device mode menu*.

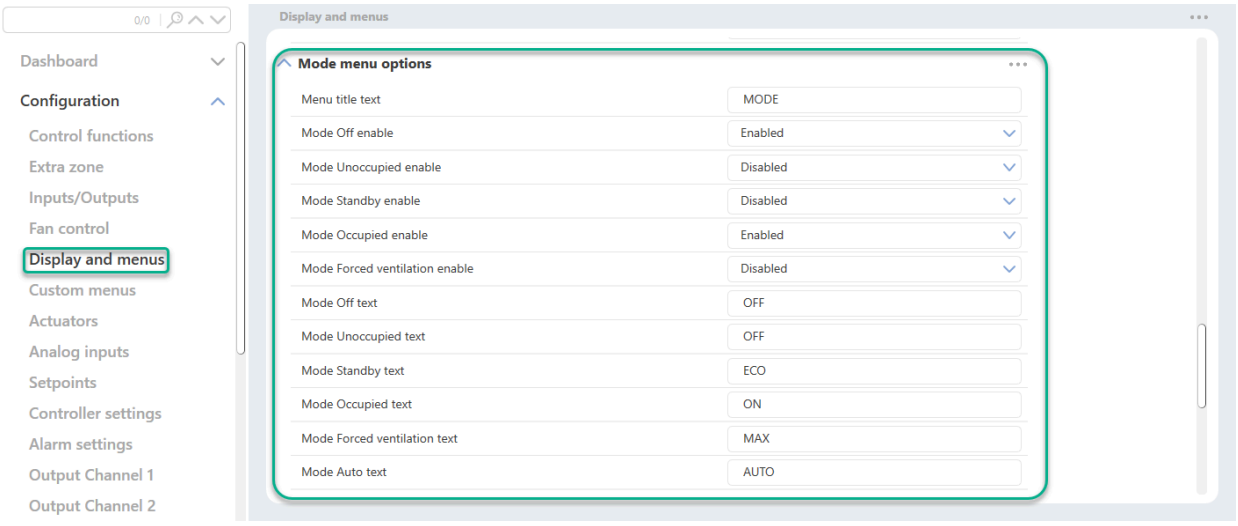


Figure 3-36 Mode menu options settings

Table 3-35 Mode menu page settings

Configuration setting	Description
Mode menu page	When enabled this makes it possible to choose what menu items to configure. Enabled, Disabled
Menu title text	Text field. Write text for menu title. Default value MODE.
Enable mode Off	When enabled the mode controller state *Off* is present and can be selected in the device display. Enabled, Disabled
Enable mode Unoccupied	When enabled the mode controller state *Unoccupied* is present and can be selected in the device display. Enabled, Disabled
Enable mode Standby	When enabled the mode controller state *Standby* is present and can be selected in the device display. Enabled, Disabled
Enable mode Occupied	When enabled the mode controller state *Occupied* is present and can be selected in the device display. Enabled, Disabled
Enable mode Forced ventilation	When enabled the mode controller state *Forced ventilation* is present and can be selected in the device display. Enabled, Disabled
Text mode Off	Text field. Write text for mode *Off*. Default value OFF.
Text mode Unoccupied	Text field. Write text for mode *Unoccupied*. Default value UNOCC.
Text mode Standby	Text field. Write text for mode *Standby*. Default value ECO.
Text mode Occupied	Text field. Write text for mode *Occupied*. Default value OCC.
Text mode Forced ventilation	Text field. Write text for mode *Forced ventilation*. Default value MAX.
Text mode Auto	Text field. Write text for mode *Auto*. Default value AUTO.
Forced ventilation menu page	When enabled the Forced ventilation menu selections are available. Enabled, Disabled, or Read only
Forced ventilation extended run	When enabled the *Extended run* (timer) function is present and can be selected in the device display. Enabled, Disabled

Changing controller state from the device mode menu

To choose an enabled controller state from the device mode menu:

1. Make sure the controller state mode is enabled in the device mode menu.
2. Press the **[Menu]** button on the device.
3. Press the **[Up]** or **[Down]** button on the device to toggle to one of the enabled and desired controller state modes.
   The mode shown in the display is now selected.

See *Figure 2-5 Indications in the controller display 3* for display indications.

Display Custom text - (valid for version 2.0 or later)

You can configure two (2) display custom text variables to show your own custom text in the display. The below character map below is implemented in the device. See *Figure 3-37 Display character map, 5 px, 7 px &10 px*.

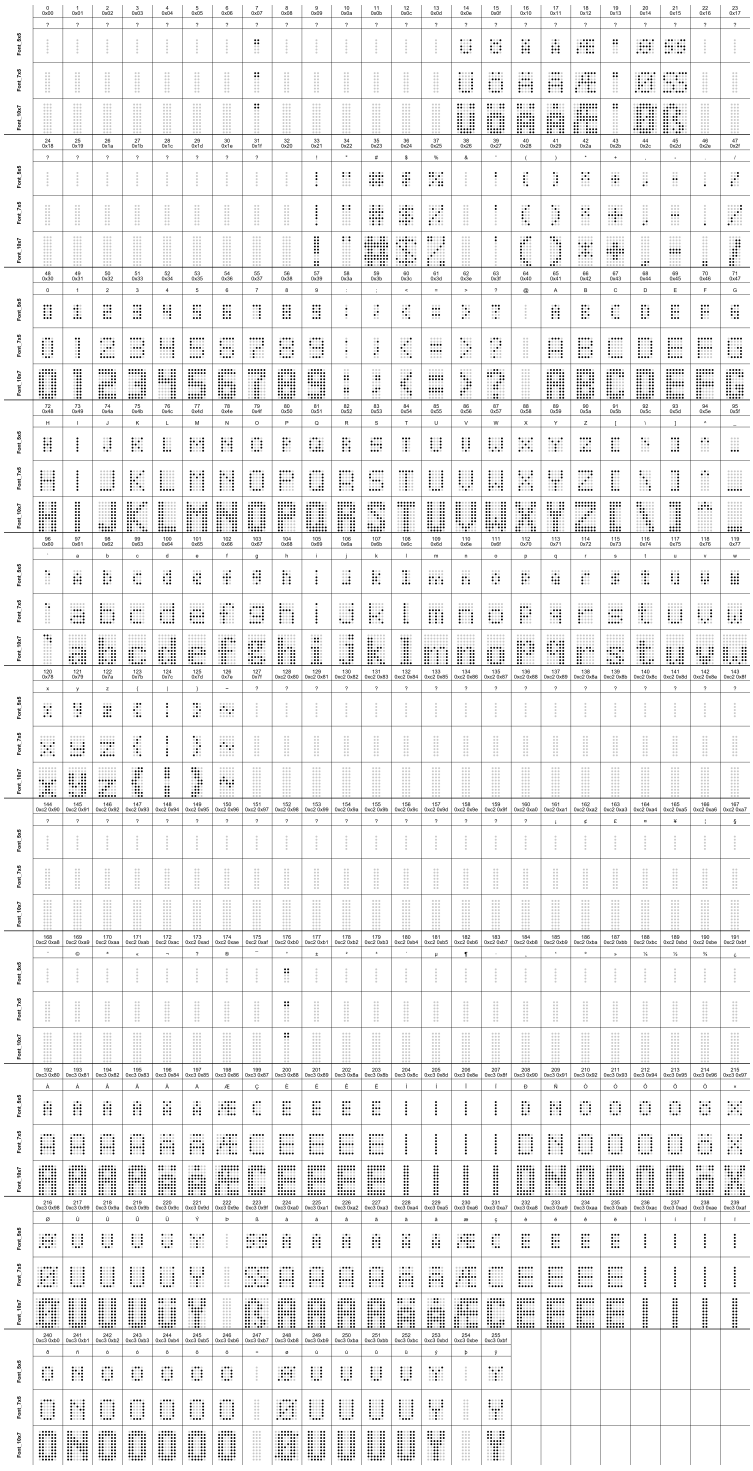


Figure 3-37 Display character map, 5 px, 7 px &10 px

You can set the texts for two separate strings in the display by configure variables. The text string can be up to 64 characters in length. You can also set the visibility time and text scroll parameters, if needed.

Note! If both custom text strings (variable *rt_text_row_1* and *rt_text_row_2*) are selected together, they will show after each other.

The font used in single row mode is always 5 px. However, the font size can also be set to a 7 px high or a 10 px high font, for dual rows.

Table 3-36 Custom text variables

Setting values	Variable name	Description
View mode	*rt_text_visability*	When to show the custom text: 0 = *ACTIVETIME_ALLOW_CANCEL*: Show when remaining time is > 0. Show as menu item, if a button has been pressed until remaining time is 0. 1 = *ACTIVETIME*: Force display until remaining time is 0. 2 = *AS_MENU*: Show as a menu item as long as text is not empty.
Display mode	*rt_text_mode*	How to show the custom string in the display: 0 = *SINGLEROW*: Show only one row of text. 1 = *DUALROW*: Show two rows of text.
Scroll mode	*rt_text_display_scroll_mode*	When to show the custom text 0 = *SCROLL_WRAP*: Scroll text if needed, wrap from end to beginning. 1 = *SCROLL_BOUNCE*: Bounce text in the end positions, if needed. 2 = *SCROLL_WRAP_SYNC*: Bounce text in the end positions, if needed. Sync row 1 and 2. 3 = *SCROLL_BOUNCE_SYNC*: Bounce text in the end positions, if needed. Sync row 1 and 2.
Font	*rt_text_font*	The font to use in single row mode (dual row mode is always 5px): 0 = *AUTO*: Adapt font to fit on screen, use as large as possible, if it does not fit, use scrolling and smallest font 1 = 5 px, 5 px high font. 2 = 7 px, 7 px high font. 2 = 10 px, 10 px high font
Scroll delay (ms)	*rt_text_display_scroll_speed*	Time in milliseconds (ms) between scrolling one pixel. Decrease value to scroll faster.
Custom text timer value (s)	*rt_text_timeleft*	Time in seconds (s) to show the custom text in the display. This variable will count down to 0. Set to any value to enable the custom text for that time.
Custom text row 1	*rt_text_row_1*	String to show as **Custom text 1** in the display, when the text timer (*Active timer value*) is active. The string can be up to 64 characters (if special characters are used it might be less due to the UTF8 encoding).
Custom text row 2	*rt_text_row_2*	String to show as **Custom text 2** in the display, if selected and when the text timer (*Active timer value*) is active. The string can be up to 64 characters (if special characters are used, it may be less due to the UTF8 encoding).

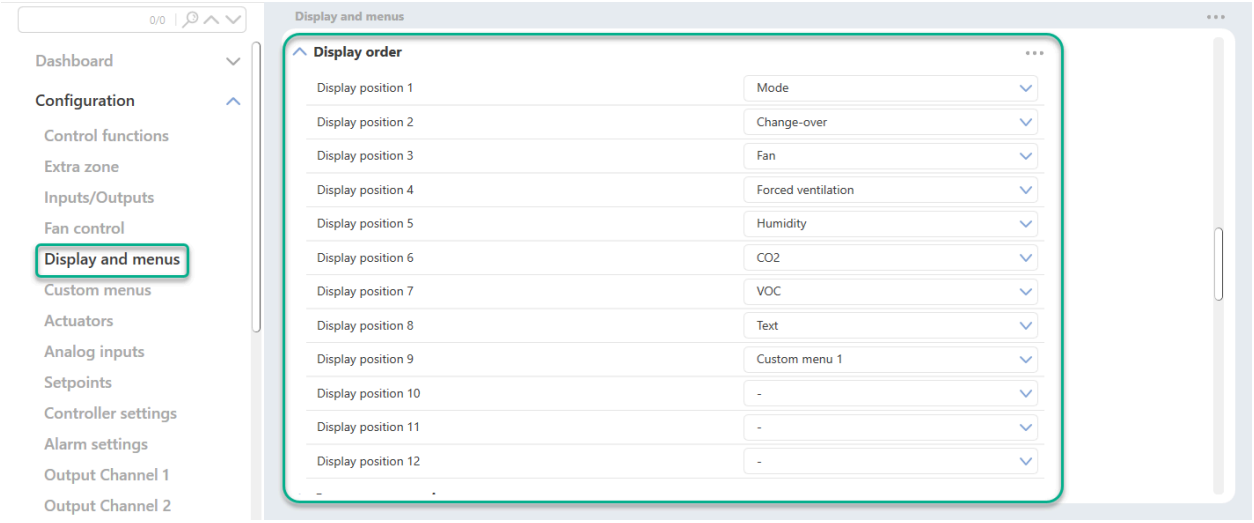
Special characters

There are some special character sequences that can be used to insert measurement values from the device into the custom text. See *Table 3-37 Special characters*.

Table 3-37 Special characters

Special string	Description
@00#	Current room temperature
@01#	Current room humidity
@02#	Current room CO_2 level
@03#	Current room VOC index
@04#	Universal input 1 value
@05#	Universal input 2 value
@06#	Controller name

Display order - (valid for version 2.1 or later)



The *Display order* feature lets you arrange which sensor readings and functions appear in the display, and set the display position. Up to 12 positions are available, and an additional 13 positions are reserved for future use. You can also apply the display order to any custom menu that you configure. For more information, see *3.4.6 Custom menus - (valid for version 2.1 or later)*.

If a sensor is not present—for example, VOC or humidity—the corresponding menu type is not selectable and appears as an empty position. Each function can be selected more than once. Any unassigned display positions are not presented, and the controller moves to the next position that contains a selection. See *Table 3-38 Display order functions available (if supported by the device)* for the options available.

Table 3-38 Display order functions available (if supported by the device)

Function	Description
Mode	Shows the currently selected mode.
Change-over	Displays the change-over value.
Fan	Shows the fan setting value.
Forced ventilation	Displays the forced-ventilation value.
Humidity	Shows the humidity reading value.
CO2	Displays the CO_2 reading value.
VOC	Shows the VOC reading value.
Text	Displays the custom text value.
Temperature/setpoint	Shows the temperature reading value. It is also possible to perform a temperature setpoint adjust.
Custom menu 1 - 8	Displays the selected custom menu value. See *3.4.6 Custom menus - (valid for version 2.1 or later)* for more information.

3.4.6 Custom menus - (valid for version 2.1 or later)

The *Custom menus* feature provides a configurable, generic menu interface available in both the Regin:GO app and in Application tool 2. This interface enables the user to monitor and control any function exposed by an external, standalone controller. The external device must then poll the **Current value**. Each custom menu consists of a title and a list of selectable alternatives. Each alternative includes a text label and an associated integer value. External systems interpret these values to perform an action, such as setting light levels.

You press the **[Up]** or **[Down]** button for the controller to change the alternative. A long press scrolls to the end alternatives (1 or 21), and a short press changes one step at a time.

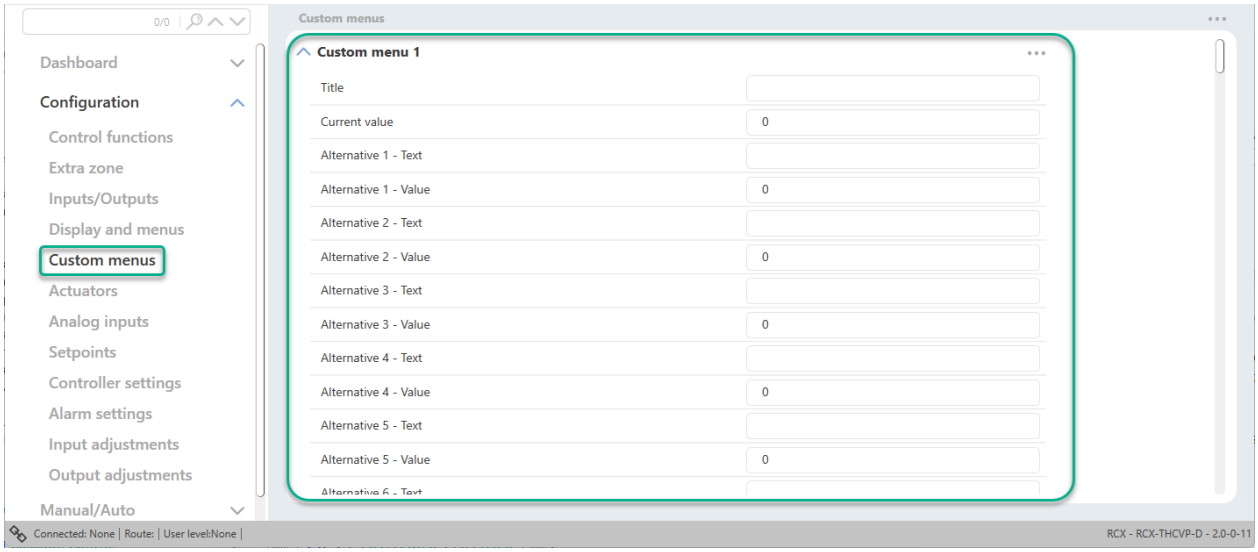
If the title or an alternative exceeds five (5) characters, the display scrolls the full text once, shows the visible portion for a few seconds, and then repeats the scroll. The title and alternative scroll independently, which can make the view difficult to read when their lengths differ. To improve readability, use scrolling for only one of them and keep either the title or the alternatives short enough to fit on the display.

Typically, you can use Regio RCX as a general-purpose remote control with this feature. For example the user wants to control the ceiling lights in the room. *Custom menu 1* is set up with the title LIGHT and alternatives are set to LOW, NORMAL, HIGH. Each text alternative is connected to an integer value that will be used by the external controller to set the brightness of the lamp. See *Table 3-39 Custom menu use case example*. What values should be used is up to the user to decide, since it is the external controller that will interpret them and act on it.

Table 3-39 Custom menu use case example

Alternative text	Integer value
LOW	10 (The external controller could interpret this as 10%)
NORMAL	60 (The external controller could interpret this as 60%)
HIGH	100 (The external controller could interpret this as 100%)

Custom menu configuration



A dedicated configuration tab is available under **Configuration** for managing all *Custom menu* settings.

The controller supports up to eight (8) custom menus. Each menu must meet these conditions to appear on the device:

- ✓ The menu is enabled
- ✓ A title and at least one alternative (text and value) are configured
- ✓ The menu is added to the display order list

Each menu can contain up to 21 alternatives. This allows configurations such as percentage steps (0%, 5%, 10%, …, 100%).

For each of the eight (8) custom menus the following Dpac parameters can be set/read. See table *3-40 Custom menu Dpac parameters*.

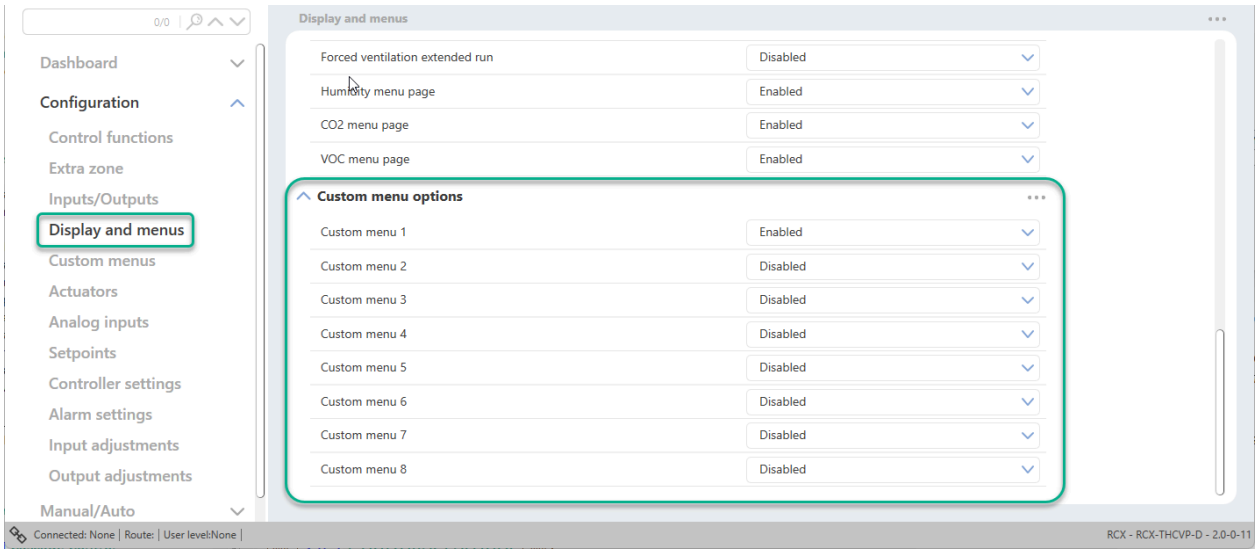
Table 3-40 Custom menu Dpac parameters

Dpac parameter	Description
CUSTOM_MENU_<N>_TITLE	Text title to display.
CUSTOM_MENU_<N>_ALT_<M>_TEXT	Text for alternative <N> to display.
CUSTOM_MENU_<N>_ALT_<M>_VALUE	The value that the external controller will use for alternative <M>.
CUSTOM_MENU_<N>_CURRENT_ALT	The text assiociated with the selected alternative.
CUSTOM_MENU_<N>_CURRENT_VALUE	The integer value associated with the selected alternative.
CUSTOM_MENU_<N>_ENABLE	1 if custom menu <N> is enabled, otherwise 0.

External systems can set the current value directly. If the external value does not match one of the configured alternatives via the Regin:GO app or the Application tool 2, the controller displays the closest alternative. The underlying integer value remains unchanged until the user steps to a configured value.

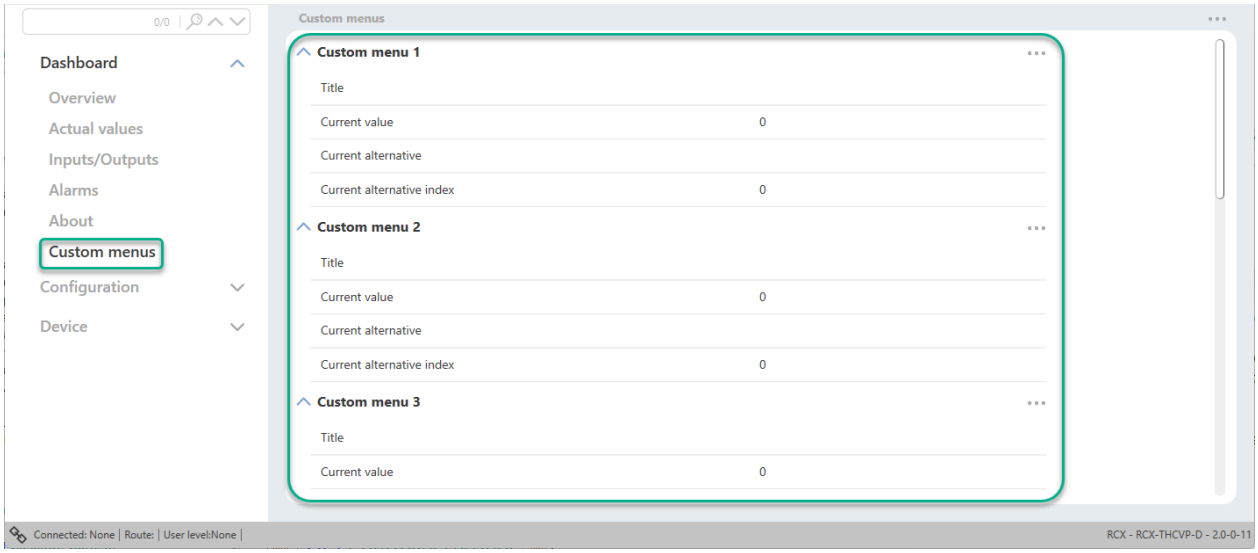
If the externally provided value does not exactly match one of the configured alternatives, the controller displays the alternative with the closest configured value. In this case, the actual CUSTOM_MENU_CURRENT_VALUE is not adjusted to match that predefined value. When the user steps through the available alternatives, the CUSTOM_MENU_CURRENT_VALUE is updated to the integer value associated with the alternative text shown on the room controller.

Custom menu enabling and disabling



Up to eight (8) custom menus can be configured and individually enabled or disabled. These menus are integrated with other menu-related features under the **Display and Menus** tab.

Custom menus overview



For monitoring purposes, a read-only overview tab is available under the **Dashboard**, displaying the currently active *Custom Menu N* settings.

The **Current alternative index** indicates which *Current Alternative* configuration is active. For example, if you enter a value that does not map to a specific alternative, an alternative will still be displayed in Regio RCX based on the **Current alternative index**.

Users can freely define the order of both built-in menus and custom menus through Display order, to create an optimal and intuitive navigation structure. See section *Display order - (valid for version 2.1 or later)*.

Custom menu communication

User selections made at runtime within the *Custom Menu* are accessible through external communication interfaces. The configured *Custom menu* settings can be retrieved via the following protocols:

- ✓ BACnet
- ✓ EXOline
- ✓ Modbus

You will have to map the values you enter as *Custom menu* alternatives in Regin:GO or Application tool 2 to the values you act on in the external device.

3.4.7 Controller settings

Cascade Control

A supply air sensor can be configured on any analogue input, AI. It limits the supply air between a set min./ max. limitation. The supply air limitation works as a cascade controller with the Primary/Outer loop controlling the room temperature and the Secondary/Inner loop controlling the supply air temperature. The limits of the supply air that is possible to configure for the supply air temperature controller will act as limits for the setpoint of the supply air temperature controller.

The following settings can be made:

- ✓ **Control active** (Disabled/Heating/Cooling/Both Heating and Cooling)
- ✓ **Cascade factor**
- ✓ **Max heating temperature (°C)**
- ✓ **Min heating temperature (°C)**
- ✓ **Max cooling temperature (°C)**
- ✓ **Min cooling temperature (°C)**
- ✓ **Frost protection temperature (°C)**

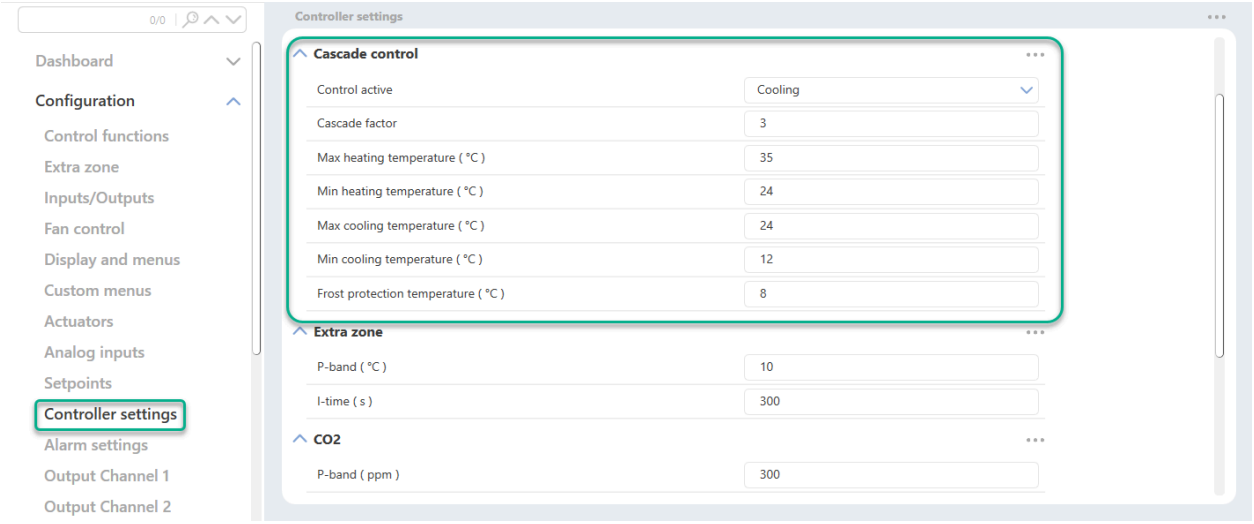


Figure 3-38 Cascade control configuration settings in Application tool 2

Control active - Heating

At *Heating* mode, the room controller works as a standard heat controller trying to keep the heat setpoint of the room. It feeds its control signal to the supply air temperature controller with the formula:

$Setpoint_{sup.air} = HeatMin_{sup.air} + (HeatMax_{sup.air} - HeatMin_{sup.air}) \times Output_{roomctrl}$

The supply air temperature controller works as a heat controller trying to keep the setpoint that is provided by the room controller.

Control active - Cooling

At *Cool* mode the room controller works as a standard cool controller trying to keep the cool setpoint of the room. It feeds the reverse of its control signal to the supply air temperature controller with the formula:

$Setpoint_{sup.air} = CoolMax_{sup.air} - (CoolMax_{sup.air} - CoolMin_{sup.air}) \times Output_{roomctrl}$

The supply air temperature controller works as a cool controller trying to keep the setpoint that is provided by the room controller.

Cascade factor

For the system to perform properly, the secondary/inner controller has to be faster than the primary/outer controller, meaning the supply air temperature controller has to respond to changes much faster than the room controller. For this reason, and for ease of tuning, a cascade factor is implemented. This cascade factor defines how much faster the secondary/inner controller is compared to the primary/outer controller. If the factor is set to two, the secondary controller is twice as fast as the primary. The factor affects both the P-band and the I-time of the secondary controller. This means that P-band and I-time are only configurable for the primary controller and the P-band and I-time for the secondary are calculated with regard to the cascade factor.

Example: P-band = 10 °C and I-time = 300 seconds for the primary controller. A cascade factor of 3 => P-band = 3 °C and I-time = 100 seconds for the secondary controller.

The default value for the cascade factor is 3.

Frost protection temperature

In addition to the frost protection of the room, there is also a frost protection of the supply air. In contrary to the frost protection of the room, this is always active as long as the controller is in cooling mode. It works in a way that when the controller enters cooling mode, the heat setpoint for the secondary controller is set to 8 ° C (the configured value). When the supply air falls below the minimum limit and continues to fall, the secondary controller switches to frost protection mode and becomes a heat controller. The switch is made in the same way as when the room controller switches between Heat and Cool mode, i.e. the switch is made roughly in the middle between the minimum limit and the frost protection temperatures, when all valves are closed. When switched to the frost protection mode the secondary controller tries to keep the frost protection setpoint with the heat output.

As the frost protection setpoint has to be lower than the minimum limit of the supply air controller for the switch to frost protection mode to work, a check is made when configuring the frost protection setpoint and minimum limit for the supply air temperature. If the minimum supply air temperature is set below the current frost protection setpoint, the active frost protection setpoint is set to 1 °C lower than the supply air limit.

This function is active in all controller states (*Forced ventilation*, *Occupied*, …).

In frost protection, the fan runs at the speed configured for lowest allowed speed (EC-fan). If the room calls for higher fan speed, this has precedence.

Valid control modes

The *Supply air limitation* function is valid in all control modes. If used with VAV control, the minimum limit of the cascade controller has precedence over the normal minimum limits for VAV control. The cascade control is not very well suited for VAV control, and the recommendation is that cascade control is used only for heating in those cases.

Fan control

The fan is running with regards to the output of the primary controller, except when the controller has entered frost protection mode. The fan runs dependent on the highest output of the room temperature controller and the supply air temperature controller.

Heat/cool select

The function can be set to run the fan in heat mode, cool mode and both heat and cool mode.

CO_2 control

CO_2 control is an extra control loop that is controlled by the room CO_2 level. It can work independently of the main sequence or in combination with the *VAV* function. In that case the highest output level takes precedence.

The measurement of CO_2 is typically expressed in parts per million (ppm), or as a percentage (%). Elevated levels of CO_2 can indicate inadequate ventilation, which may lead to discomfort, drowsiness, impaired cognitive function, and can even impact overall productivity and well-being.

Common indoor air CO_2 levels are :

- ✓ Typical indoor air: 400-1,000 ppm
- ✓ Elevated indoor air: >1,000 ppm

Levels significantly higher can be a cause for concern, especially for occupant health and well-being.

External CO_2 sensors

Any type of external CO_2 sensor can be connected to Regio RCX controllers, as long as they have a 0…10 V output.

CO_2 control is a function that enables the controller to regulate based on fresh air demand. CO_2 control is performed by connecting a CO_2 sensor, and by letting the controller control the VAV output signal based on the CO_2 setpoint and the current CO_2 level in the room.

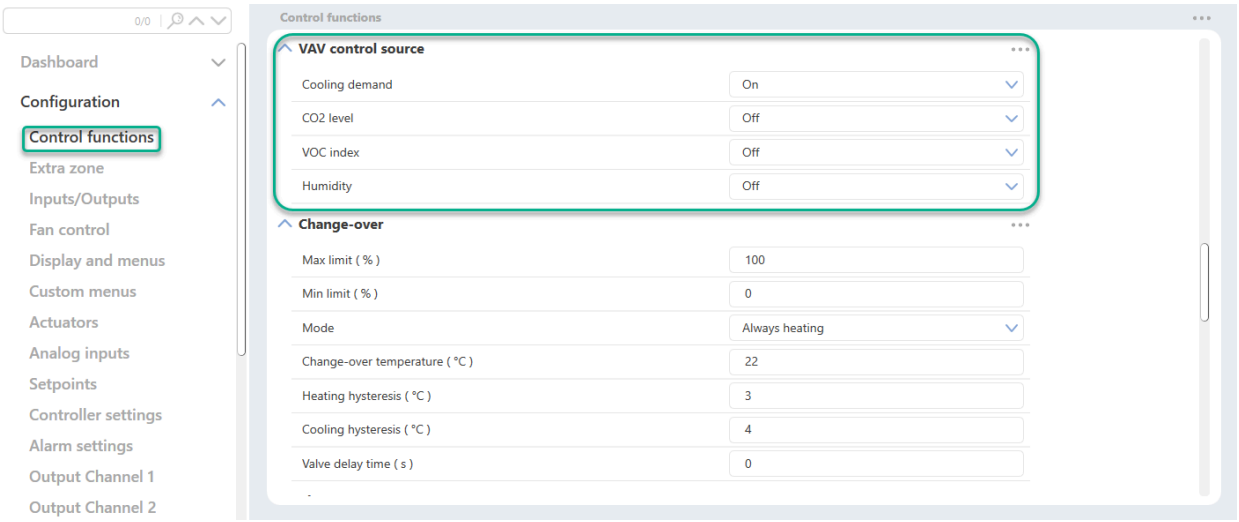


Figure 3-39 CO_2 configuration settings in Application tool 2

CO_2 control is managed via the *VAV control source* function, by applying the **VAV control source** configuration setting. See section *VAV control source*.

The CO_2 sensor is connected to and configured on an analogue controller input by using the value listed in *Table 3-41*. Regin's RCX-TC, RCX-TC-D, RCX-TCP-D, RCX-THCVP and RCX-THCVP-D.controllers have a built-in CO_2 sensor. When either of these units is used, the controller recognizes the built-in CO_2 sensor automatically, and no configuration is needed.

Table 3-41 CO_2 control configuration value and controller input type

Configuration value	Controller input type
CO_2 sensor	Analogue

CO_2 control provides a specific setting, listed in *Table 3-42*, that is only applicable for the controller modes that include a VAV sequence. This setting is located in the *Configuration* ▸*Control functions*▸*VAV control source* menu group in the Regin:GO app or the Application tool 2, and is shown when an applicable room control sequence is selected.

Table 3-42 CO_2 control configuration setting

Configuration setting	Description
CO_2 level	The VAV output signal is controlled by the CO_2 level.

Figure 3-40 illustrates the control behaviour for CO_2 control when a minimum limit is set for the VAV output signal.

The demand for fresh air increases as the CO_2 level in the room rises. When the CO_2 level rises above the CO_2 setpoint, the *VAV signal* increases to respond to the fresh air demand. At a fresh air demand of 100%, the *VAV signal* reaches its maximum.

When the CO_2 level in the room is lower than the CO_2 setpoint and no fresh air demand exists, the *VAV signal* is at its minimum.

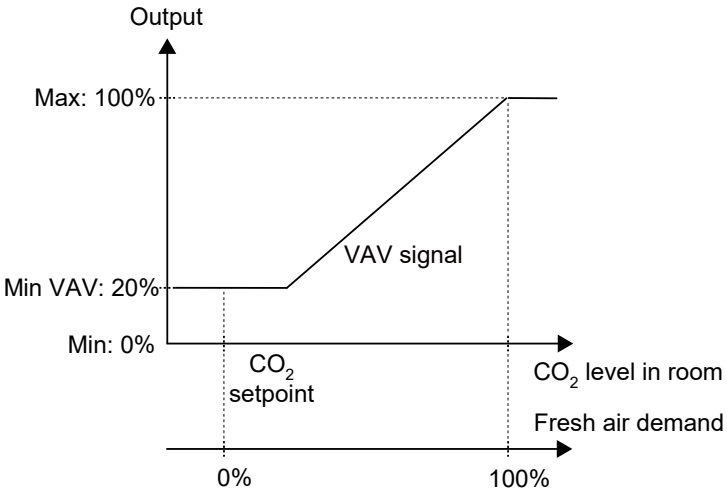


Figure 3-40 CO_2 control behaviour

Humidity control

An extra control loop that is controlled by a humidity input. It can work independently of the main sequence or in combination with the *VAV* function. In that case, the highest output level takes precedence.

The humidity control helps to maintain an optimal indoor environment. The controller uses the information from the humidity sensor to regulate the HVAC system, ensuring that the relative humidity is within a desired range for comfort and health.

For example, during colder seasons, heating systems can dry out the indoor air, leading to low humidity levels. The humidity sensor detects this and signals the HVAC system to add moisture to the air if needed, maintaining a comfortable humidity level.

Integration with a room controller allows for automated and precise control over the humidity level in a room, contributing to occupant comfort, preventing issues like mold growth, and optimising energy usage by the HVAC system.

External Humidity sensors

Any type of external Humidity sensor can be connected to Regio RCX controllers, as long as they have a 0… 10 V output.

VOC Control

An extra control loop that is controlled by the room volatile organic compounds (VOC) level. It can work independently of the main sequence or in combination with the *VAV* function. In that case, the highest output level takes precedence.

VOC's (Volatile Organic Compounds) are measured using specialized devices known as VOC monitors or VOC detectors. VOC detectors are designed to quantify the concentration of VOC's in the air, for RCX controllers expressed in a index number, VOC Index. This index is relative, and does not measure the actual level of VOC's (tVOC).

VOC air pollutants can be breath, cosmetics, and other body odours from people, as well as different gases and fumes from furniture, paint, plastic, or gases from cleaning or cooking activities, or similar.

Examples of air pollutants and sources can be:

Exhalation

- ✓ breath gases (sulphur gases)
- ✓ CO_2 (carbon dioxide)

Harmful gases

- ✓ from paint and gluing compounds (acetone)
- ✓ from furniture, mattresses, or building products (toluene)

Other gases

- ✓ from alcohol, cleaning compounds, perfume (ethanol)

Odours

- ✓ from rotten food, farts (hydrogen sulphide, volatile sulfuric compounds)
- ✓ from pet pee (ammonia, amines)

Smoke

- ✓ from cigarettes (benzene, nitrosamines)

The VOC Index is a valuable tool for monitoring indoor air quality, specifically related to VOC's.

The VOC Index describes the current VOC status in a room relative to the sensor's recent history. Think of it like a human nose: When we enter a room, our nose uses the air composition outside as a baseline and alerts us if it detects higher or lower levels of VOC's indoors.

The VOC algorithm processes the raw signal from the sensor. It calculates an average value over the past 24 hours and assigns it a baseline VOC Index of 100. The VOC Index then maps measured values to a range from 0 to 500. This means that in a start-up phase of a sensor, or when a sudden big change in air quality, such as re-painting of a room or similar, will leave the VOC Index with a higher average value for some time before it will be stabilized.

The VOC algorithm initializes in two phases:

- ✓ 0…1.5 h: fast adaptation to the environment. Signal always initializes in level "typical". From the beginning, sensor-to-sensor-variation is excellent and fast VOC events are shown.
- ✓ >1.5 h: final, slow adaptation. Even very slow changes in chemical air pollution are now visualized for best user experience.

When the VOC sensor indicates poor air quality, individuals may be advised to take precautionary measures to reduce exposure to pollutants. VOC monitoring is crucial in various settings, including indoor environments (homes, offices, schools) to assess indoor air quality, industrial facilities to monitor emissions and comply with regulations, and environmental monitoring to understand outdoor air quality and potential health impacts on communities. Regular monitoring and control of VOC levels help ensure a safe and healthy environment for both humans and ecosystems.

The VOC sensor used in Regio RCX controllers is a MOX (Metal Oxide technology) based gas sensor for indoor air quality measurement.

Interpreting the VOC Index

A VOC Index above 100 indicates more VOC's than the average (e.g., due to cooking, cleaning, or other events). A VOC Index below 100 suggests fewer VOC's than average (e.g., fresh air from an open window). The VOC Index adapts its gain based on past 24-hour events, allowing consistent quantification on the same limited scale.

You can use the VOC index to trigger a higher amount of fresh air. Such as, by activating the *VOC Control* function with a setpoint for VOC index.

External VOC sensors

Any type of external VOC sensor can be connected to Regio RCX controllers, as long as they have a 0…10 V output.

3.4.8 Manual/Auto

Manual output settings

All outputs offer the possibility to be set manually, overriding any application layer. This to handle special functions from, for example, a SCADA system.

There are two ways to manually control the outputs: Controlling the output function or directly control the physical output hardware.

Output function control

When controlling an output function, such as *Heat 2*, the corresponding value variable will be affected as well as any output configured to this function.

The **ManSelect** variables have three allowed values:

- ✓ **0: Off** - The output is off. Valve exercise is disabled.
- ✓ **1: Manual** - The output value is taken from the corresponding Manual variable. Valve exercise is enabled.
- ✓ **2: Auto** - Normal function. The output value is taken from the corresponding value variable.

Output hardware control

When controlling the output hardware the physical output is controlled directly, regardless of which function is configured for the output. This overrides any other control of the output, including valve exercise.

Remote input values

If the controller is part of a bigger system, sensor values can be written from a master controller or a SCADA system over the communication bus, using Modbus, BACnet or EXOline. If the sensor value is set in remote mode, it overrides all local sensors.

The following values can be set remotely:

- ✓ Room temperature
- ✓ Supply air temperature
- ✓ Extra zone temperature
- ✓ Change-over temperature
- ✓ Change-over VAV temperature
- ✓ CO_2 level
- ✓ Room humidity
- ✓ Air flow
- ✓ VOC input
- ✓ Digital inputs
  - ✓ Presence detection
  - ✓ Open window
  - ✓ Condensation
  - ✓ External alarm (DI)

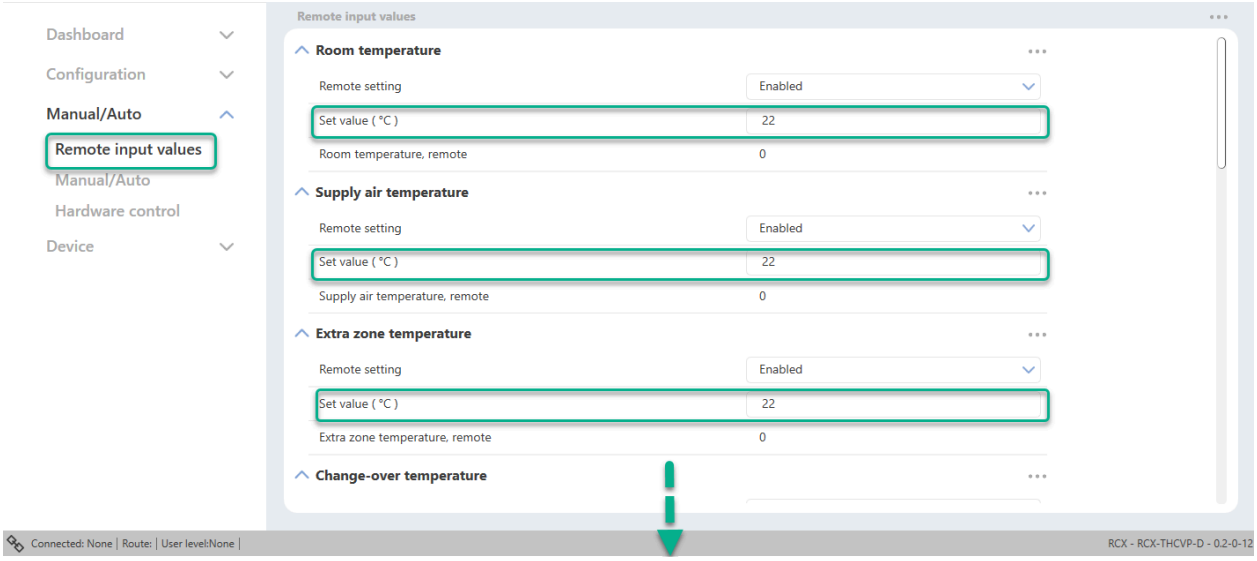


Figure 3-41 Remote input values settings in Application tool 2

For more information, see section *3.9 Sensor values via communication*.

3.5 Regin:GO - Menu structure

The Regin:GO menu structure for the Regio RCX application can be found in the RCX - Menu Structure document, available at www.regincontrols.com.

3.6 Control function examples - Regio RCX series

3.6.1 Hotel 1 - Heating (actuator radiator)+ VAV and Extra Zone (control of bathroom w. floor heating)

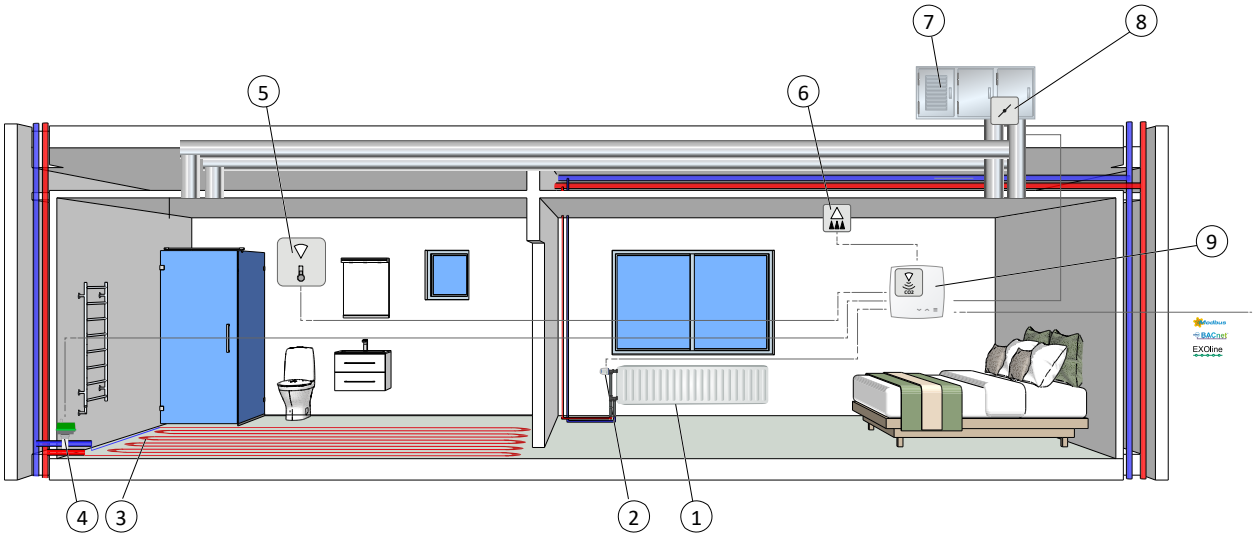


Figure 3-42 Illustration of application example - Hotel 1

① *Radiator*
② *Thermal actuator*
③ *Floor heating*
④ *Actuator*
⑤ *Temperature sensor, for Extra zone*
⑥ *Presence detector*
⑦ *AHU*
⑧ *Damper / damper actuator*
⑨ *RCX controller, w. temperature and CO_2 sensor*

This control sequence is suitable for room HVAC systems that use a radiator as a heating device, and low supply air temperature that is distributed into the room via a diffuser to provide cooling and fresh air. The air must be pretreated in the AHU.

The desired room temperature is achieved by controlling the thermal actuator (2) and the VAV damper (8). In addition, the VAV damper can be opened via the CO_2 function to increase the fresh air in the room, see section *CO_2 control*.

If the temperature drops below the heating setpoint, the controller will go into heating mode and open the valve to the actuator to increase the temperature in the room.

If the temperature rises above the cooling setpoint, the controller will go into cooling mode and open the damper to lower the temperature in the room.

Table 3-43 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
***Heating* signal**	Heating	Analog
	Heating valve, thermal (PWM, Pulse Width Modulation)	Digital
***VAV* signal**	VAV	Analog

Figure 3-43 illustrates the control behaviour when the controller regulates based on the heating and cooling demand, when no maximum or minimum limits are set for the heating output signal.

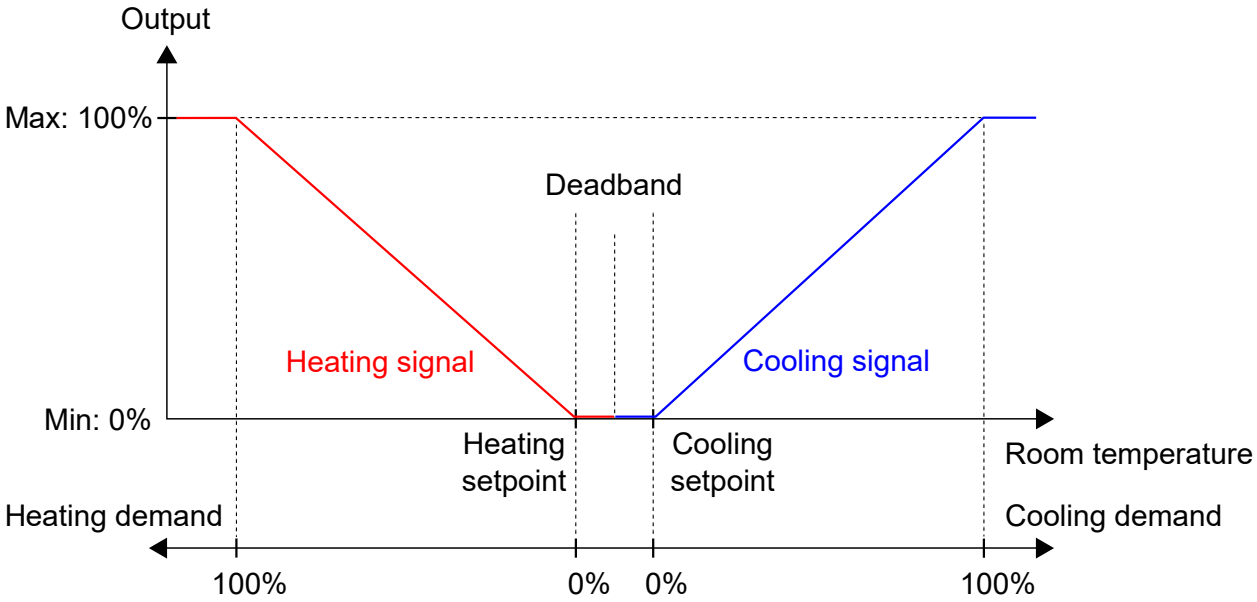


Figure 3-43 Control behaviour for the Heating + Cooling controller mode

For specific wiring examples, based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

Extra zone

In this example, the *Extra zone* function is used to control the under floor heating in a bathroom. For more information, see section *3.4.2 Extra zone*.

3.6.2 Hotel 2 - Heating (battery) + Cooling (battery) + Fan Control (EC-Fan)

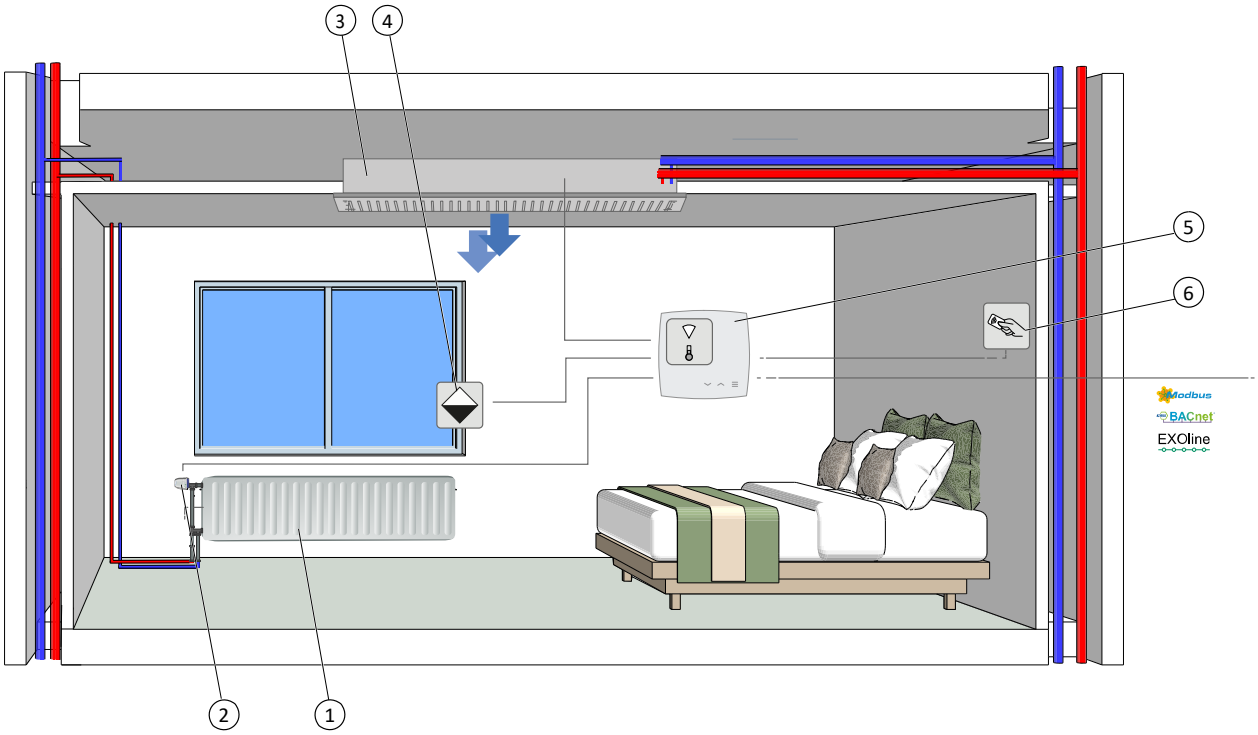


Figure 3-44 Illustration of application example - Hotel 2

① *Radiator*
② *Thermal actuator*
③ *Fan coil cooling*
④ *Window contact*
⑤ *RCX controller, temperature sensor*
⑥ *Key card switch*

This controller sequence is suitable for room HVAC systems that use a radiator or fan coil unit as a heating device, and a fan coil unit as a cooling device.

The controller acts as a heating and cooling controller and regulates based on the heating setpoint, cooling setpoint, and the current room temperature.

The temperature range between the heating and cooling setpoints is defined as the deadband. The controller is in heating mode when the room temperature is lower than heating setpoint plus half the deadband, and in cooling mode when the room temperature is higher than [*cooling setpoint minus half the deadband*].

When in heating mode, the controller outputs a heating signal, **Heating** signal, that is configured on the controller outputs by using the values listed in *Table 3-44*.

When in cooling mode, the controller outputs a cooling signal, **Cooling** signal, that is configured on the controller outputs by using the values listed in *Table 3-44*.

Table 3-44 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
Heatingl signal	Heating	Analog
	Heating valve, thermal (PWM, Pulse Width Modulation, Pulse Width Modulation)	Digital
Cooling signal	Cooling	Analog
	Cooling valve, thermal (PWM, Pulse Width Modulation, Pulse Width Modulation)	Digital
6-way valve signal	6-way valve	Analog

Figure 3-45 illustrates the control behaviour for this controller mode when no maximum or minimum limits are set.

The heating demand increases as the room temperature falls. When the room temperature falls below the heating setpoint, *Heat* sequence increases to respond to the heating demand. At a heating demand of 100%, *Heat* sequence reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre and no heating demand exists, *Heat* sequence is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Cool* sequence increases to respond to the cooling demand. At a cooling demand of 100%, *Cool* sequence reaches its maximum. When the room temperature is in the range between the cooling setpoint and the deadband centre and no cooling demand exists, *Cool* sequence is at its minimum.

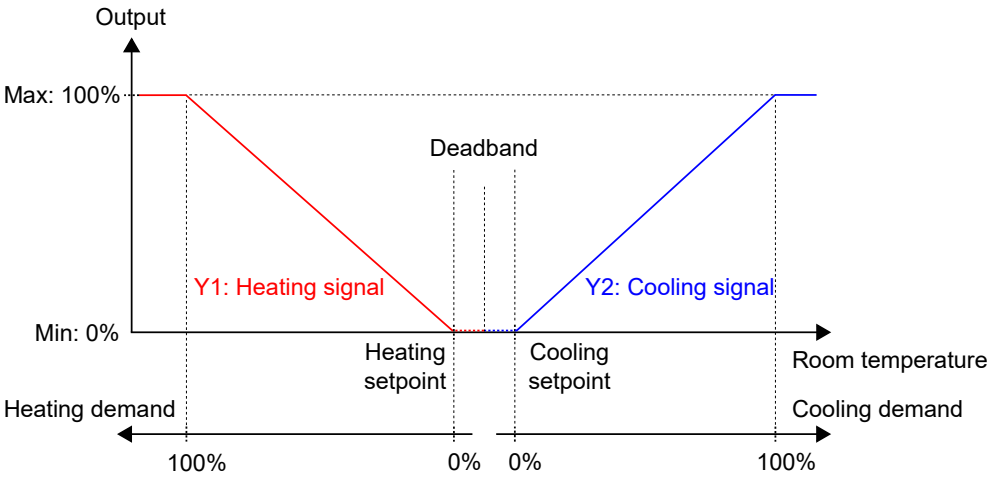


Figure 3-45 Control behaviour for the Heating + Cooling controller sequence

For specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

Fan Control

The controller outputs a fan speed signal, **Fan speed output**, that is configured on a controller output by using the value in *Table 3-45*.

In auto mode, the **Fan speed output** signal corresponds to the current heating or cooling demand, as illustrated in *Figure 3-30*.

In manual mode, the **Fan speed output** signal is independent of the current heating or cooling demand. Instead, the fan speed 1, 2, and 3 signals are defined by a number of equal thirds relative to the **Limit maximum EC fan speed to (%)** configuration setting, as illustrated in *Figure 3-31*. For example, the fan speed 1 signal is equal to 0.33 times the set maximum fan speed value, and the **Fan speed 2** signal is equal to 0.67 times the set maximum fan speed value.

Table 3-45 EC fan control configuration value and controller input type

Output signal	Controller output configuration value	Controller output type
Fan speed output	EC fan	Analogue

The **Fan control** configuration settings are described in *Table 3-26*.

See section *4.1.5 Wiring - Control function examples* for specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*.

3.6.3 Office - Heating/Cooling (change-over) + Fan Control

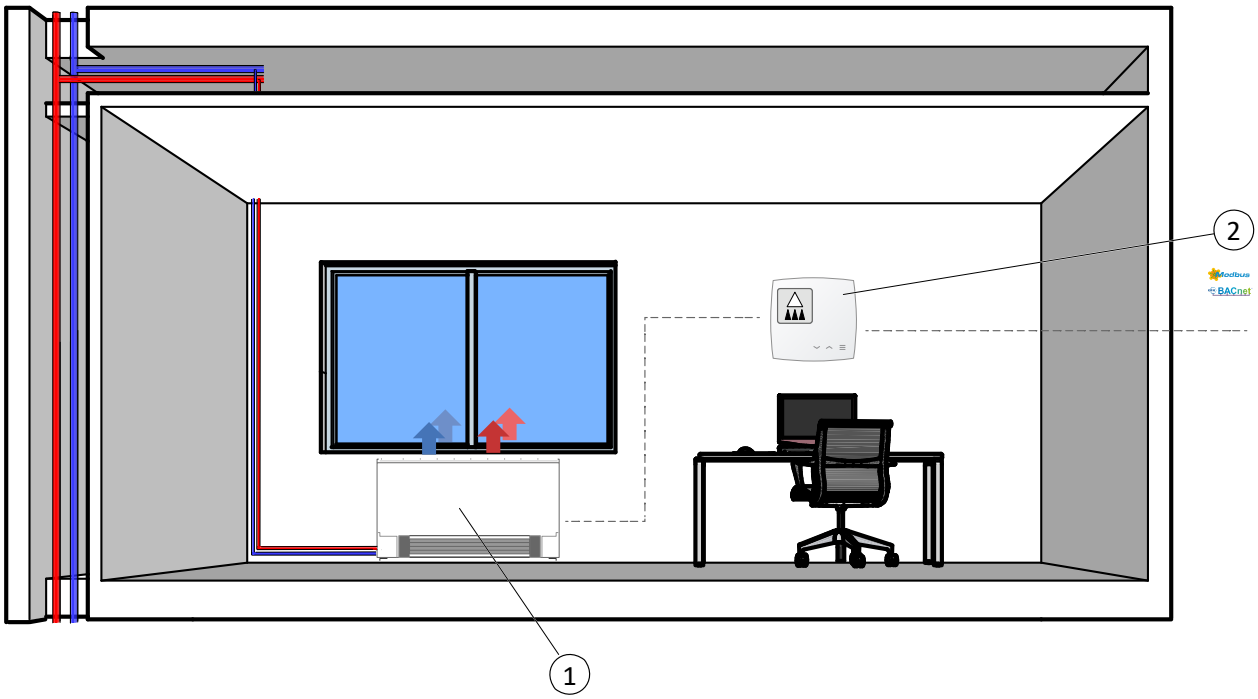


Figure 3-46 Illustration of application example - Office

① *2-pipe fan coil (heating/cooling)* ② *RCX controller, presence detector*

This control sequence is suitable for room HVAC systems that use a 2-pipe fan coil as a heating and cooling device. The *Change-over* function makes it possible to use the controller in a 2-pipe change-over system, where warm or cold media flow in the same pipes and one valve is used to regulate both heating and cooling distribution.

The controller acts as a heating or cooling controller and regulates based on the heating setpoint, cooling setpoint, and the current room temperature.

The controller is either in heating or cooling mode, and switches between the modes according to its current *Change-over* state.

For more information, see section *Change-over*.

When the controller is in heating or cooling mode, the controller outputs a heating or cooling signal, that is configured on the controller outputs by using the configuration values listed in *Table 3-46*.

Maximum and minimum limits for the output signal can be set.

Table 3-46 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
Change-over valve (heating or cooling mode) signal	Change-over valve	Analog
	Change-over valve, thermal (PWM, Pulse Width Modulation, Pulse Width Modulation)	Digital

Figure 3-47 illustrates the control behaviour in heating mode, and when no maximum or minimum limits are set.

The heating demand increases as the room temperature falls. When the room temperature falls below the heating setpoint: **Change-over (heating mode)** signal increases to respond to the heating demand. At 100% heating demand: **Change-over (heating mode)** signal reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists: **Change-over (heating mode)** signal is at its minimum.

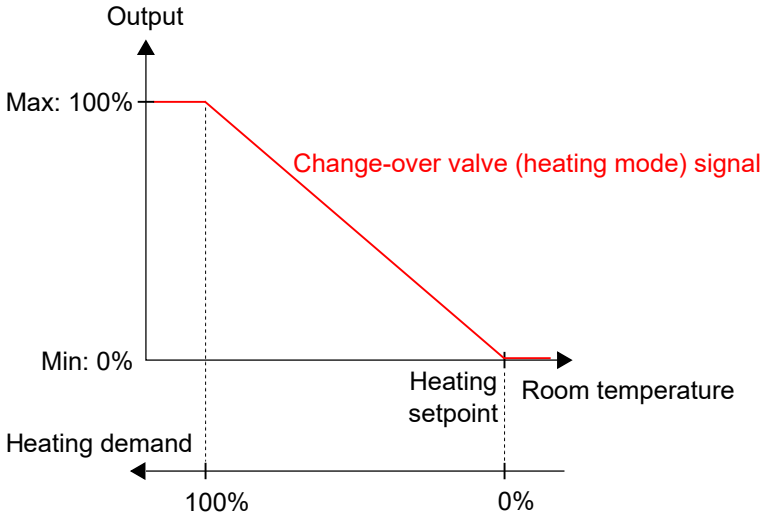


Figure 3-47 Control behaviour for the Heating/Cooling (change-over) controller sequence when the controller is in heating mode

Figure 3-48 illustrates the control behaviour in cooling mode, and when no maximum or minimum limits are set.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, the **Change-over (cooling mode)** signal increases to respond to the cooling demand. At 100% cooling demand, the **Change-over (cooling mode)** signal reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, the **Change-over (cooling mode)** signal is at its minimum.

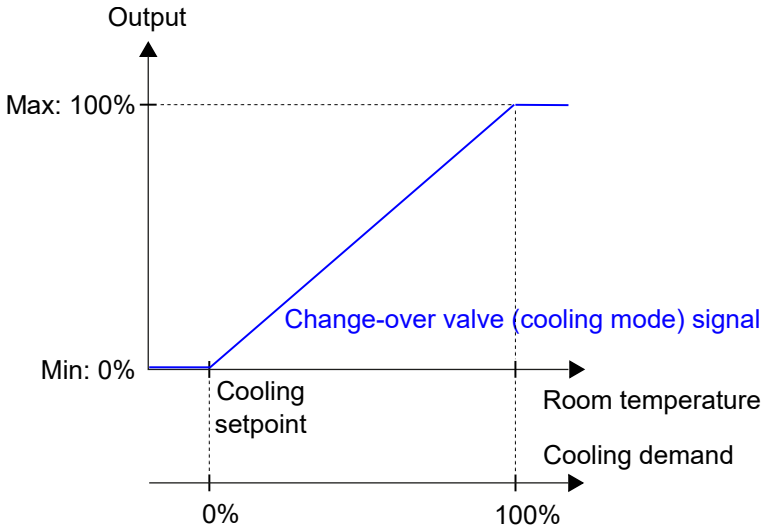


Figure 3-48 Control behaviour for the Heating/Cooling (change-over) controller sequence when the controller is in cooling mode

For specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

Fan Control (façade unit)

The controller outputs a fan speed signal, that is configured on a controller output by using the value in *Table 3-45*.

In auto mode, the signal corresponds to the current heating or cooling demand, as illustrated in *Figure 3-30*.

In manual mode, the signal is independent of the current heating or cooling demand. Instead, the fan speed 1, 2, and 3 signals are defined by a number of equal thirds relative to the **Limit maximum EC fan speed to (%)** configuration setting, as illustrated in *Figure 3-31*. For example, the fan speed 1 signal is equal to 0.33 times the set maximum fan speed value, and the fan speed 2 signal is equal to 0.67 times the set maximum fan speed value.

The **Fan control** configuration settings are described in *Table 3-26*.

For specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

3.6.4 Conference - Heating (actuator radiator) + Cooling (chilled ceiling) + VAV (CO_2)

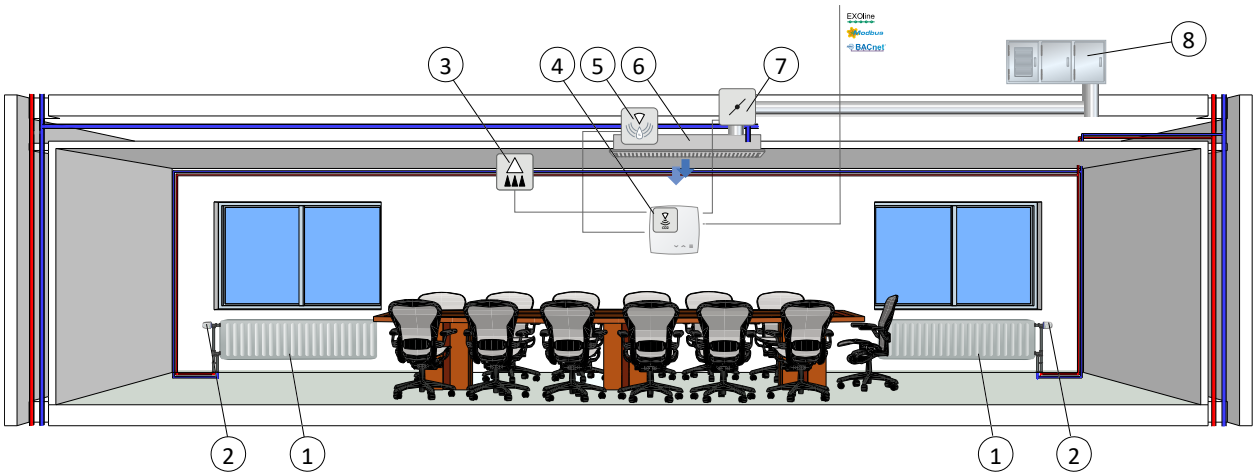


Figure 3-49 Illustration of application example - Conference

① *Radiator*
② *Thermal actuator*
③ *Presence detector*
④ *RCX controller, with CO_2 sensor*
⑤ *Condensation sensor*
⑥ *Chilled beam*
⑦ *Damper, damper actuator*
⑧ *AHU*

The room control sequences Sequence 1 - Heat, Sequence 2 - Cool, and Sequence 3 - VAV are suitable for room HVAC systems that use a radiator as a heating device and a chilled beam as a cooling device, where the beam contains a cooling valve and a damper that regulates low supply air temperature that is distributed into the room to provide cooling and fresh air. The air must be pretreated and cooled since the damper itself does not have any cooling capacity.

The controller acts as a heating and cooling controller and regulates based on the heating setpoint, cooling setpoint, and the current room temperature. In addition, the controller can be set to also regulate based on fresh air demand, or based on the cooling demand and fresh air demand simultaneously. See section *VAV control source*.

The controller regulates based on the fresh air demand by using CO_2 control. See section CO_2 *control*.

The temperature range between the heating and cooling setpoints is defined as the deadband. The controller is in heating mode when the room temperature is lower than heating setpoint minus half the deadband, and in cooling mode when the room temperature is higher than cooling setpoint plus half the deadband.

When in **Heat** sequence, the controller outputs both a heating signal and a VAV signal. These are configured on the controller outputs by using the values listed in *Table 3-47*.

When in cooling mode, the controller outputs a cooling signal and a VAV signal, in sequence, that are configured on the controller outputs by using the configuration values listed in *Table 3-47*.

The signal sequence order is configurable.

Maximum and minimum limits for the heating and cooling output signals can be set. Maximum and minimum limits for the VAV output signal are set via the VAV sequence. See section *VAV control source*.

Table 3-47 Controller output configuration values and controller output types

Output signal	Controller output configuration value	Controller output type
Heating signal	Heating	Analog
	Heating valve, thermal (PWM, Pulse Width Modulation, Pulse Width Modulation)	Digital
Cooling signal	Cooling	Analog
	Cooling valve, thermal (PWM, Pulse Width Modulation, Pulse Width Modulation)	Digital
Heating signal + **Cooling** signal	6-way valve	Analog
VAV signal	VAV	Analog

Figure 3-50 illustrates the control behaviour when the controller regulates based on heating and cooling demand, when no maximum or minimum limits are set for the heating or cooling output signals, and when a minimum limit is set for the VAV output signal.

The heating demand increases as the room temperature falls. When the room temperature falls below the heating setpoint, *Heating signal* increases to respond to the heating demand. At a heating demand of 100%, the *Heating signal* reaches its minimum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, the *Cooling signal* increases to respond to the cooling demand. At a cooling demand of 49%, the *Cooling signal* reaches its maximum. When the room temperature rises further and the cooling demand exceeds 51%, the*VAV signal* increases while the *Cooling signal* stays at its maximum. At a cooling demand of 100%, the *VAV signal* reaches its maximum. When the room temperature is in the range between the cooling setpoint and the deadband centre, and no cooling demand exists, both the*Cooling signal* and the *VAV signal* are at their minimum.

The*VAV signal* never goes below its set minimum limit.

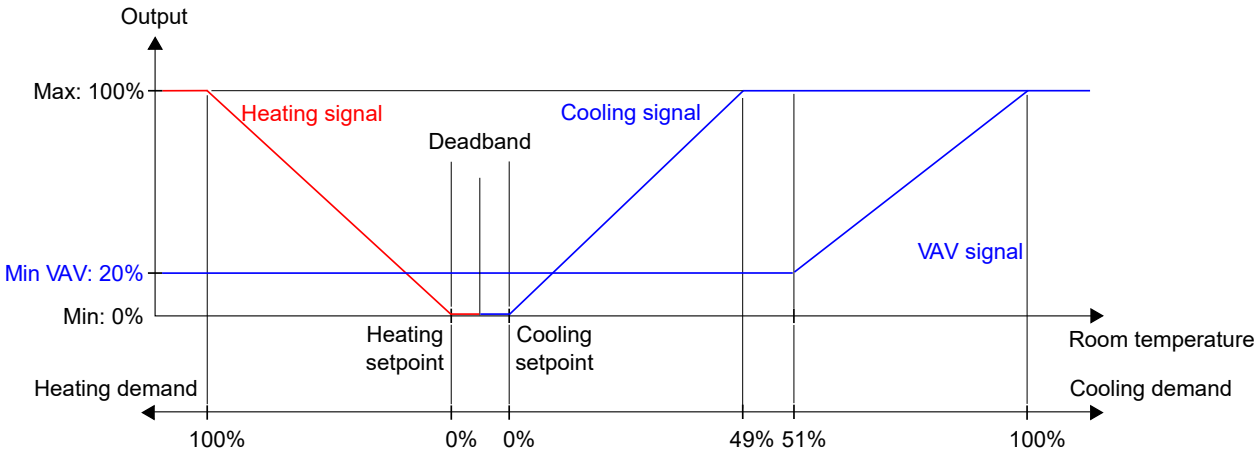


Figure 3-50 Control behaviour for the Heating + Cooling + VAV controller mode when the controller regulates based on heating and cooling demand

For specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

CO_2

CO_2 control is a function that enables the controller to regulate based on fresh air demand. CO_2 control is performed by connecting a CO_2 sensor, and by letting the controller control the VAV output signal based on the CO_2 setpoint and the current CO_2 level in the room.

CO_2 control is managed via the *VAV control* function, by applying the **VAV control** configuration setting. See section *VAV control source*.

The CO_2 sensor is connected to and configured on an analogue controller input by using the value listed in *Table 3-48*. Regin's RCX-TC,RCX-TC-D,RCX-TCP-D, RCX-THCVP and RCX-THCVP-D. controllers have a built-in CO_2 sensor. When either of these units is used, the controller recognizes the built-in CO_2 sensor automatically, and no configuration is needed.

Table 3-48 CO_2 control configuration value and controller input type

Configuration value	Controller input type
CO_2 sensor	Analogue

CO_2 control provides a specific setting, listed in *Table 3-49*, that is only applicable when the Room Control Sequence includes a VAV sequence. This setting is located in the *Configuration*►*Control functions* pane in the Regin:GO app or the Application tool 2, and is shown when a VAV sequence is selected.

Table 3-49 CO_2 control configuration setting

Configuration setting	Description
Configuration►Control functions►VAV control source	The VAV output signal is controlled by CO_2 level in addition to other selected sources, the highest demand controls the output.

Figure 3-51 illustrates the control behaviour for CO_2 control when a minimum limit is set for the VAV output signal.

The demand for fresh air increases as the CO_2 level in the room rises. When the CO_2 level rises above the CO_2 setpoint, *VAV signal* increases to respond to the fresh air demand. At 100% fresh air demand, *VAV signal* reaches its maximum.

When the CO_2 level in the room is lower than the CO_2 setpoint and no fresh air demand exists, *VAV signal* is at its minimum.

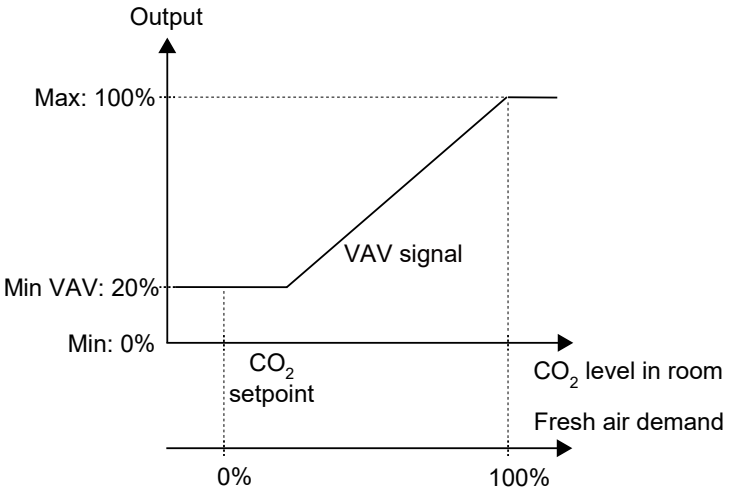
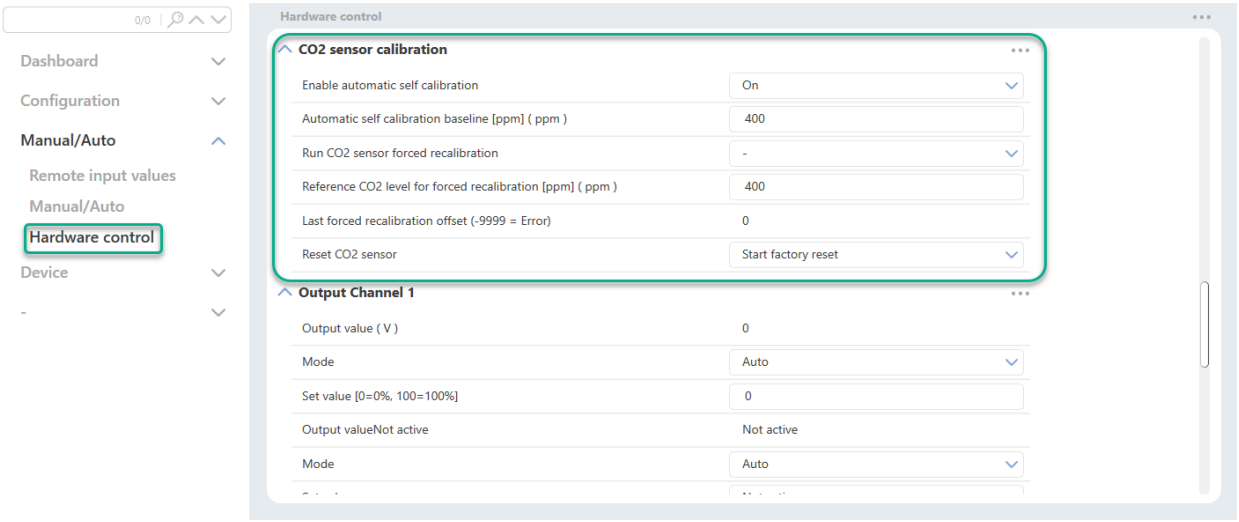


Figure 3-51 CO_2 control behaviour

For specific wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*, see section *4.1.5 Wiring - Control function examples*.

3.7 CO_2 sensor calibration



The Automatic Sensor Calibration (ASC) algorithm ensures long-term measurement stability without requiring manual recalibration. It analyses historical sensor data and assumes exposure to a known minimum CO_2 concentration at least once during each calibration cycle. By default, the algorithm presumes the sensor is exposed to outdoor air with a CO_2 concentration of 400 ppm for a minimum of three (3) minutes every seven (7) days.

Setting values	Variable	Description
Enable automatic self calibration	*SCD40_ASC_enable*	Activates or deactivates the automatic calibration function for the CO_2 sensor. 0 = Off 1 = On (default)
Automatic self calibration baseline [ppm]	*SCD40_ASC_target*	Defines the baseline CO_2 concentration (in ppm) used by the ASC algorithm as the expected minimum background level during each calibration cycle. This value represents the lower bound to which the sensor is assumed to be regularly exposed. Value 300 to 1200 (ppm), 400 (default)
Run CO2 sensor forced recalibration	*SCD40_FRC_enable*	Forced Recalibration (FRC) allows the sensor to be manually calibrated using a known reference CO_2 concentration. This method is recommended when ASC is not sufficient or when immediate correction is required. Before initiating FRC, ensure the sensor is placed in an environment with a stable and homogeneous CO_2 concentration for at least three (3) minutes. Set this parameter to 1 to begin a manual recalibration of the CO_2 sensor. The value will automatically reset to 0 upon completion. 0 = Off (default) 1 = Run calibration
Reference CO2 level for forced recalibration [ppm]	*SCD40_FRC_target*	Specifies the CO_2 concentration (in ppm) to be used as the reference value during forced recalibration. This should reflect the actual CO_2 level at the sensor's location during calibration. Value 300 to 1200 (ppm), 400 (default)

Setting values	Variable	Description
Last forced recalibration offset (-9999 = Error)	*SCD40_FRC_result*	Displays the correction value applied during the most recent FRC operation (in ppm). A value of -9999 indicates that the calibration attempt failed. Value = 0 (default) Value = -9999 (calibration attempt failed)
Start factory reset	*SCD40_factory_reset*	Set this parameter to 1 to reset the CO_2 sensor to its original factory configuration. The value will revert to 0 once the reset is complete. This command erases all user-defined settings and clears the history of both ASC and FRC algorithms. 0 = Off (default) 1 = Reset to factory default

3.8 External sensors

The following external sensors can be connected to an AI. A connected external sensor will replace the internal sensor if one of those are available. PT1000 sensors must be connected to UI1, and 0…10 V sensors to UI1 or UI2.

All 0…10 V sensor inputs are scalable, 0V = XX: 10V= YY to get it in the correct unit.

Table 3-50 Sensor types and variables

Sensor	Type	Value variable
Room sensor [1]	PT1000	*RC_RoomTemp*
Change-over media temperature	PT1000	*RC_ChangeOverTemp*
Change-over VAV media temperature	PT1000	*RC_ChangeOverVAVTemp*
Extra zone temperature	PT1000	*RC_ExtraZoneTemp*
Supply air temperature	PT1000	*RC_SupplyAirTemp*
Room Sensor[1]	0…10 V	*RC_RoomTemp*
CO_2 sensor [1]	0…10 V	*RC_CO2Level*
Humidity sensor [1]	0…10 V	*RC_Humidity*
VOC sensor [1]	0…10 V	*RC_VOC*
Air Volume	0…10 V	*RC_AirFlow*
Presence detector	Digital	*RC_DIPresence*
Open window	Digital	*RC_DIOpenWindow*
Change-over	Digital	*RC_DIChangeOver*
Change-over VAV	Digital	*RC_DIChangeOverVAV*
Condensation sensor	Digital	*RC_DICondensation*
External alarm	Digital	*RC_AlarmDI*

1. Replace the internal sensor, if one of those are available.

3.9 Sensor values via communication

If the controller is part of a bigger system, sensor values can be written from a master controller or a SCADA system over the communication bus, using Modbus, BACnet or EXOline. If the sensor value is set in remote mode, it overrides all local sensors.

The following sensor values can be set remotely:

- ✓ Room temperature (°C)
- ✓ CO_2 (ppm)
- ✓ Air flow
- ✓ Change-over temperature (°C)
- ✓ Extra zone temperature (°C)
- ✓ Supply air temperature (°C)
- ✓ Relative humidity (%)
- ✓ VOC (Volatile Organic Compounds), (VOC Index, range 0-500, 100 = 24 h average)

For more information, see also section *3.4.8 Manual/Auto*.

3.10 Special functions

3.10.1 Condensation sensor

You can use the analogue output connection (AO2) as a condensation sensor input (*CI driver*) on all Regio RCX controllers. This input is intended for Regin's condensation sensor, KG-A/1, and function as a digital input for condensation or no condensation detection internally. For more information, see section *4.1.4 Wiring*.

When the condensation sensor is activated, the cooling control is blocked and the controller is set in neutral position. When condensation ceases, the controller will start controlling from the neutral position.

3.10.2 Window contact

When the *Window contact* function has been configured, the controller is set to **Normal** mode on *Closed window*. On *Open window*, the controller is set to off mode and the *Frost protection* function is activated.

3.11 Communication

3.11.1 Networks, interfaces and protocols - Factory default

In *Table 3-51 Networks and interfaces, factory default status* and *Table 3-52 Protocols, factory default status* you find the supported network interfaces and protocols, including the factory default settings.

Table 3-51 Networks and interfaces, factory default status

Network/Interface	Status from factory default	Description
RS485	ON	Serial interface with differential signal levels, allowing for reliable data exchange between controllers, sensors, and actuator over a bus with multiple other devices. Connection for SCADA configurations.
Bluetooth® Low Energy	Activated by button	The Bluetooth® Low Energy interface is a wireless interface used to temporarily connect to the device from a mobile phone, or tablet. The interface is used with the Regin:GO app for installation, configuration and maintenance of the device.

Caution! When you configure the device exclusively via RS485 using Application tool 2, it is recommended to disable Bluetooth® Low Energy (BLE) during setup. If BLE remains enabled, the device may still be accessed and reconfigured via Regin:GO using the default password. Please note that this password can only be changed within the Regin:GO interface.

Table 3-52 Protocols, factory default status

Protocol	Status from factory default	Used in interface	Description
EXOline	ON	RS485	Regin specific protocol. EXOline is used for communication and reliable, real-time data exchange between controllers, sensors, and other field devices within Regin's EXO system and SCADA. Here used for device configuration, system maintainance, communication with other devices, SCADA etc. The difference compared to Modbus and BACnet, is that EXOline allows more configuration and is used by Regin's own tools (such as, Application tool 2).
Modbus	OFF	RS485	Modbus standardized protocol. Used for communication with other devices and/or SCADA systems.
BACnet	OFF	RS485	BACnet standardized protocol. Used for communication with other devices and/or SCADA systems.

3.11.2 Communication settings

In the **Device - Communication** page, you can set port settings, the Modbus address, and the Bluetooth® function settings.

The port 1 settings can be altered between the EXOline, Modbus, BACnet communication protocols, or be disabled.

For EXOline, you can set the PLA and ELA addresses (in Regin:GO) [1].

For the Modbus protocol, the Modbus address can be set here. And for BACnet the properties can be set. You can also change the Bluetooth® connection settings, for how and when the connection is made.

Communication fail settings can also be set from this page. For more information, see *Table 3-53 Communication settings*.

Table 3-53 Communication settings

Setting values	Variable name	Description
Port 1 function	*RC_Port1Mode*	Setting of the port 1 function: **Disabled** **EXOline slave** (default) **Modbus slave** **EXOline/Modbus slave** **BACnet**
Port 1 baudrate	*RC_Port1Baud*	Setting of the port 1 baudrate: **9600** (default) **19200** **38400** **76800**
Port 1 parity	*RC_Port1Format*	Parity bit settings: **No parity, 1 stop bit** **Odd parity, 1 stop bit** (default) **Even parity, 1 stop bit** **No parity, 2 stop bits** **Odd parity, 2 stop bits** **Even parity, 2 stop bits**
PLA	*QSystem.PLA*	Address according to the PLA address on the device label.[1]
ELA	*QSystem.ELA*	Address according to the ELA address on the device label.
Modbus address	*QServices.ModbusUnitID*	The same setting as ELA (default)
BACnet MSTP address	*QServices.BACnetMstpMAC_Port_1*	Setting of the BACnet MSTP address. Default set to a number between 64 and 127 (default).
MSTP max master address	*QServices.BACnetMstpMax-MasterAddr_Port_1*	Setting of the MSTP max. master address. (default = 127)
BACnet device ID	*QServices.BACnetDeviceID*	Setting of the BACnet Device ID. Set to the last 6 digits of the serial number (default).
BACnet device object name	*QServices. BACnetDeviceObjectName*	Setting of the BACnet device object name. Device name with the serial number appended to the end, “RCX012509111234” (default).
Password	*QServices.BACnetPassword*	Setting of a BACnet password. Need to be set by user (default).
Bluetooth® function	*BleButtonMode*	Setting on when the Bluetooth® function is activated or inactivated: **Off** **Always on** **On after startup** **Activated by button** (default)
Turn off after (s)	*BleButtonTimeout*	Setting of when the Bluetooth® connection is turned off. 120 = (default)

Table 3-53 Communication settings (continued)

Setting values	Variable name	Description
Fail action	*RC_OfflineFunction*	Setting of action(s) if communication fails: **No action** (default) **State to fallback state** **Outputs to default values** **Outputs to default, start offline**
Timeout (s)	*RC_OfflineTimeout*	Setting of an offline timeout threshold. 10 = (default)
Fallback state	*RC_ControllerStateFail*	Setting of desired fallback state (at loss of communication): **Off** **Unoccupied** **Standby** (default) **Occupied** **Forced ventilation**
Status	RC_Offline	Status description of the current communication status.

1. Note! In Application tool 2, the EXOline PLA and ELA addresses are changed from the Tools menu, in Change controller address.

3.12 Update software

When there is a software update available for the device, you will be prompted to update the software. You can also manually update the device software in Regin:GO whenever you need through the **Action** menu in , if you are connected to the device. See section *3.12.1 Updating the device software in Regin:*GO.

3.12.1 Updating the device software in Regin:GO

1. In the Regin:GO menu, tap the **[Actions]** button.
2. In the dropdown menu, tap **[Update software]**.
3. In the **Update software** page, tap **[Available software]**.
4. Select the desired software version.
5. Tap the **[Update software]** button.
6. In the **Update software** dialog, choose **[Save settings]**, **[Continue with update]**, or **[Cancel]**.

Note! Regin recommend to save your settings before a software update. The update can cause the settings to be reset to default, and then you can use the saved file to restore your settings.

7. To continue with device software update, tap **[Continue with update]**. You will be prompted with the update process progression.

Note! Do not leave the **Update software** page during the update process.

8. When the software update is finished, in the **Update software** dialog, tap **[Return to device]** list.

3.13 Factory reset

You can reset the device to factory settings with use of the touch buttons (available also for devices without visible buttons). To reset the device with the touch buttons, follow the procedure *3.13.1 Resetting the device to factory settings* within the first 60 seconds after starting the device.

3.13.1 Resetting the device to factory settings

1. Make sure that the device has been turned off
2. Start the device
3. Press and hold on the upper right part of the device (keep active during the full sequence), within the first 60 seconds after starting the device
4. Press and hold the lower right part of the device (**[Menu]** button) for approximately 10 seconds. During this time the indication will be green, when done it will change to red.
5. Release the lower right part of the device (**[Menu]** button)
6. Press (and release) the lower right part of the device (**[Menu]** button) three (3) times in 10 seconds
7. The LED flashes in green for a short time to confirm a successful factory reset, and the device restarts with default settings

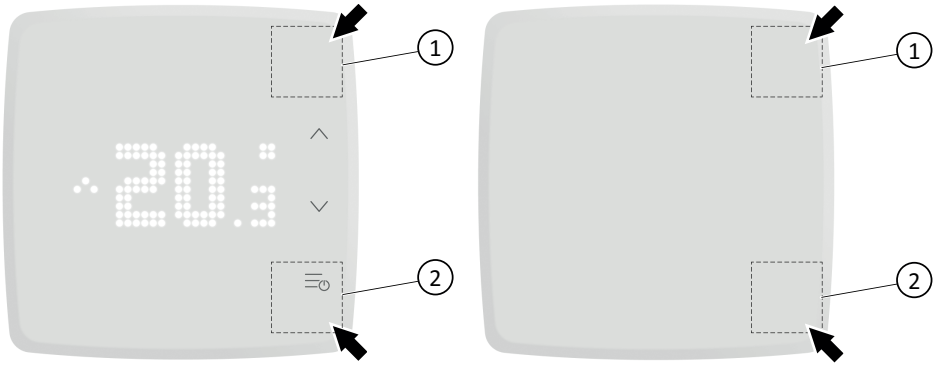


Figure 3-52 Factory reset press areas (with/without display)

① *Upper right part of the device*

② *Lower right part of the device,* ***[Menu]*** *button*

If you have not succeeded in pressing the lower right part of the device (2)(**[Menu]** button) three (3) times during ten (10) seconds in step 6., or you release the upper right part of the device (1), the reset operation is interrupted and the LED returns to what it showed before. Start with step 3. anew, if you still want to make a factory reset.

4 Information for the installer

4.1 Installation

4.1.1 Installation preparations

See the Regio RCX-... Instruction, to be found at www.regincontrols.com.

4.1.2 Using labels

On the back of the electronics cassette, there is a set of labels which make it easier to install a large number of Regio RCX controllers. By using the labels as carriers of information for the installation engineer, much time will be saved and you can keep wiring errors at a minimum.

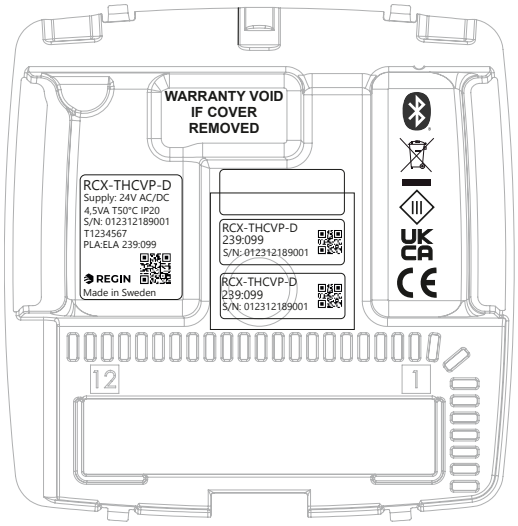


Figure 4-1 Labels on the back of the controller (example label illustrated, may vary)

The three-piece label can be split and the two (2) smaller label parts to the right can be fastened to the installation drawing and the backplate of the controller. The labels carry information on the communication address etc., and have QR codes and a note area where you can enter a reference number to the connection diagram.

4.1.3 Mounting

Caution! If the unit is mounted over electrical installation pipes, it is important that the airflow is obstructed. If there is a risk for this, you need to plug the pipe.

1. With surface-mounted cabling, break out suitable holes from the marks in the plastic
2. Find a location that has a temperature representative for the room. A suitable location is approximately 1.6 m above floor level in a place with unobstructed air circulation
3. Select suitable holes and mount the backplate onto the wall or a connection box with fastening screws, so that the arrows on the backplate point upwards
   The backplate has several fixing hole combinations

Note! Do not tighten the fastening screws too hard

4. Place the terminal in the sliding slots on the backplate
5. Connect the cables needed to the terminal, according to the terminal list

For more information, see the Regio RCX-... Instruction, to be found at www.regincontrols.com.

4.1.4 Wiring

All units that share the same transformer and communication loop must use the same transformer-pole for G (terminal 1) and G0 (terminal 2). On the communication loop, the A-terminal (terminal 3) should only be connected to another A-terminal, and the B-terminal (terminal 4) to another B-terminal. Otherwise, the communication will not work.

The communication cable must be a screened twisted pair cable. The shield must be connected to G0 on one (and only one) controller in each separate power supply loop with 24 V AC. If the length of the loop exceeds 300 m, a repeater is required. See *Figure 4-2 Wiring example - communication cable*.

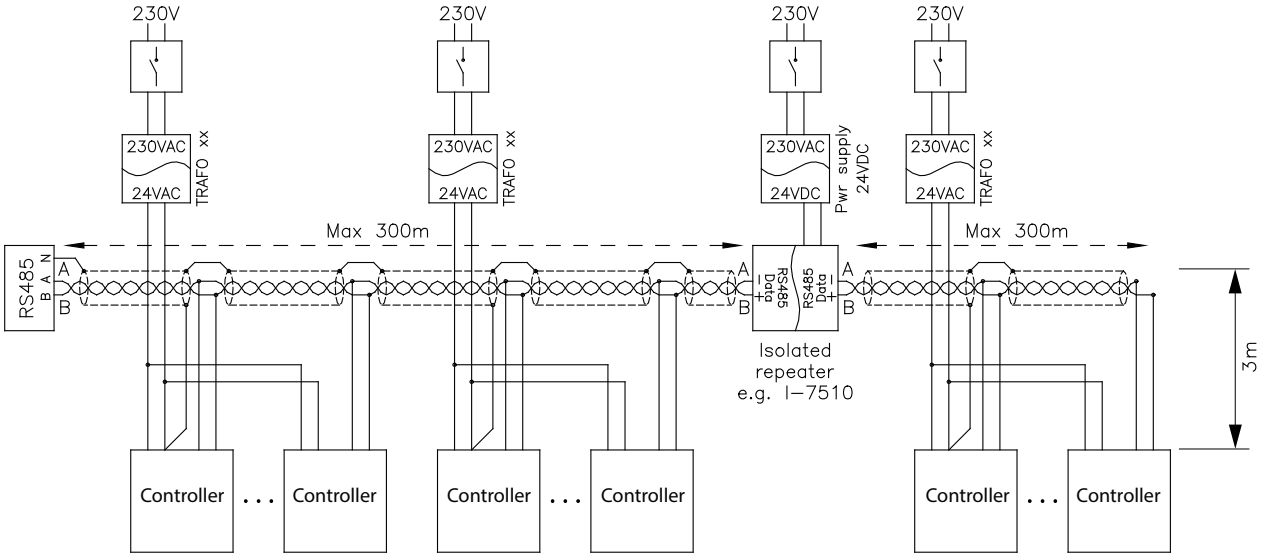


Figure 4-2 Wiring example - communication cable

Caution! In installations with wires entering the device from the side, the wires must be firmly attached to the surrounding wall to relieve the wires from strain and twisting, as there are no internal strain relief.

Figure 4-3 Example of terminal locations below shows an example of the location of the terminals.

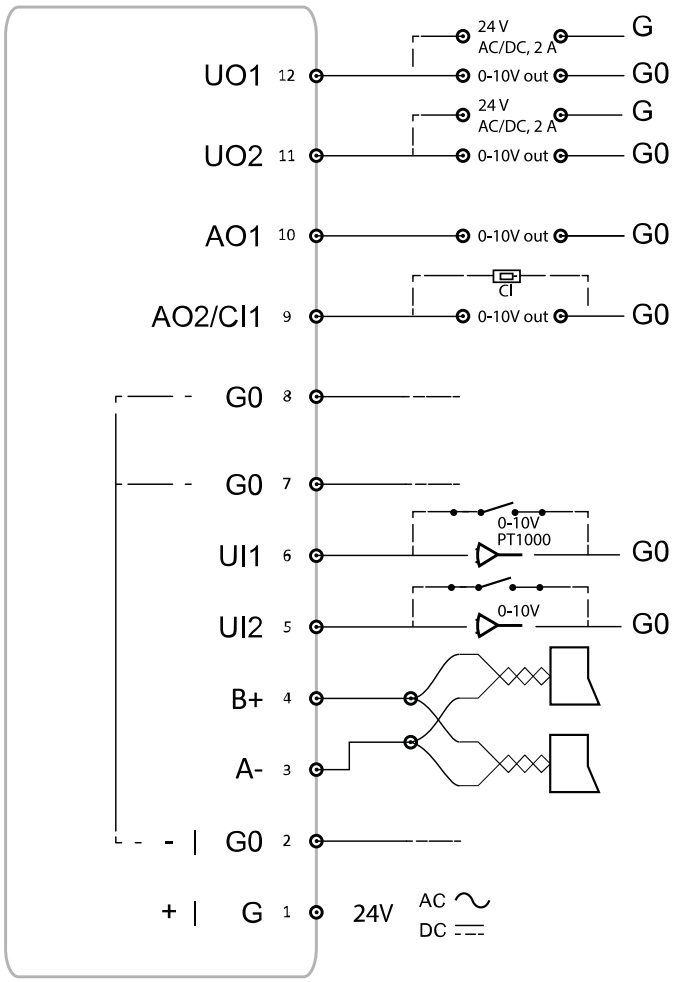


Figure 4-3 Example of terminal locations

4.1.5 Wiring - Control function examples

Below you find wiring examples based on the application examples in section *3.6 Control function examples - Regio RCX series*. See sections *Wiring - Hotel 1*, *Wiring - Hotel 2*, *Wiring - Office* and *Wiring - Conference*.

Wiring - Hotel 1

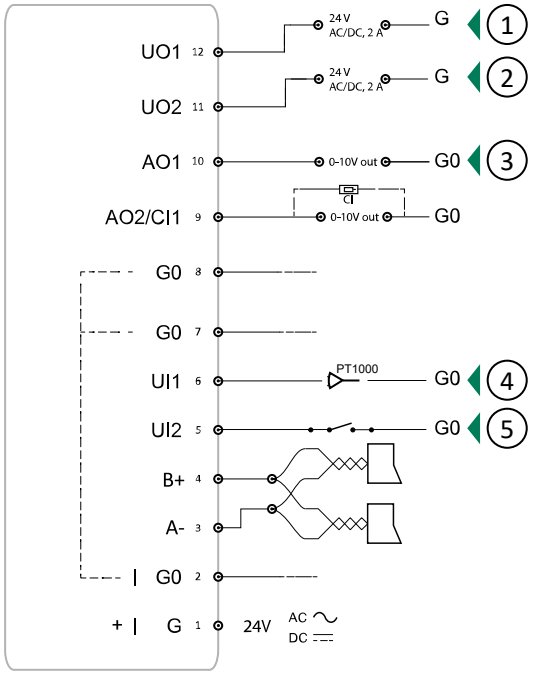


Figure 4-4 Wiring example - for application example Hotel 1

① *Heating valve, thermal (PWM)*
② *Extra zone valve, thermal (PWM)*
③ *VAV*
④ *External room temperature*
⑤ *Presence detector*

For more information, see section 3.6.1 Hotel 1 - Heating (actuator radiator)+ VAV and Extra Zone (control of bathroom w. floor heating).

Wiring - Hotel 2

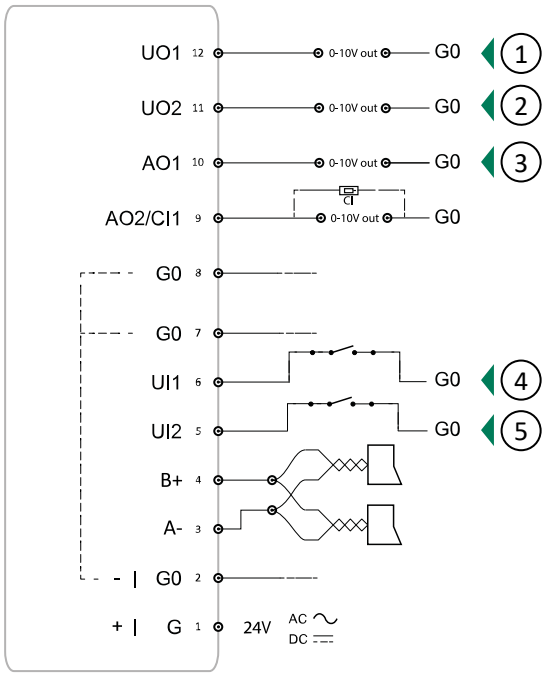


Figure 4-5 Wiring example - for application example Hotel 2

① *Heating*
② *Cooling*
③ *EC Fan*
④ *Open window*
⑤ *Presence detector*

For more information, see section 3.6.2 Hotel 2 - Heating (battery) + Cooling (battery) + Fan Control (EC-Fan).

Wiring - Office

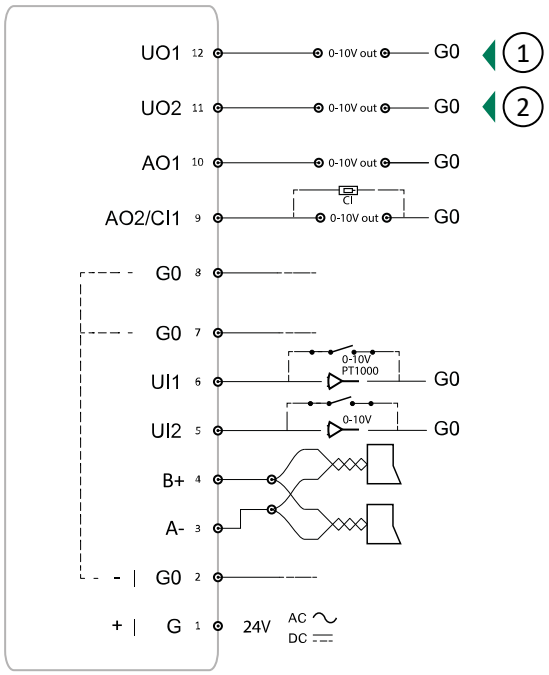


Figure 4-6 Wiring example - for application example Office

① *Change-over cooling* ② *EC Fan*

For more information, see section 3.6.3 Office - Heating/Cooling (change-over) + Fan Control.

Wiring - Conference

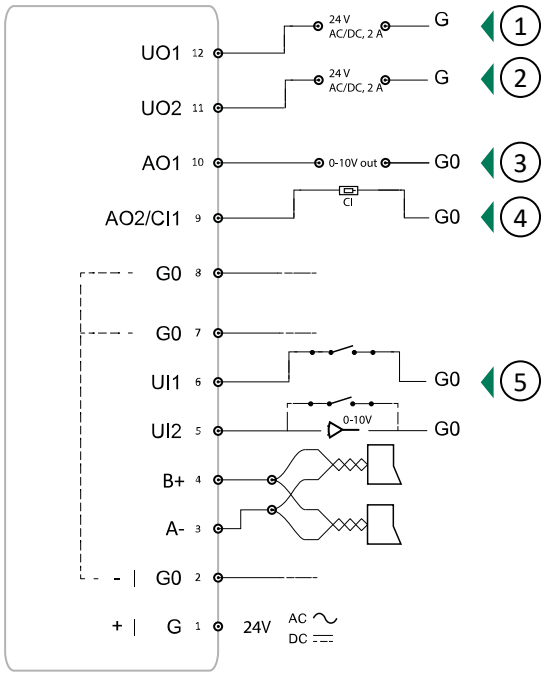


Figure 4-7 Wiring example - for application example Conference

① *Heating valve, thermal (PWM)*
② *Cooling valve, thermal (PWM)*
③ *VAV*
④ *CI driver*
⑤ *Presence detector*

For more information, see section 3.6.4 Conference - Heating (actuator radiator) + Cooling (chilled ceiling) + VAV (CO_2).

4.1.6 Troubleshooting

It is possible to detach the terminal from the backplate when troubleshooting, and perform measurements on the terminal while the controller is connected.

5 Conformity

Hereby, Regin declares that the radio equipment type Regio RCX series is in compliance with Directive 2014/53/EU.

Regio RCX series complies with EN IEC 60730-1, as a class A control.

This radio equipment device is approved for use in all countries within the European union.

CE

This product carries the CE-mark. More information is available at www.regincontrols.com.

Appendix A Technical data

A.1 General data

Supply voltage	24 V AC (50 - 60 Hz) or DC
Display	25 x 11 pixels
Power consumption	2.5 VA
Ambient temperature	0...50 °C
Ambient humidity	max.. 90 % RH
Storage temperature	-20…+70 °C
Terminal blocks	Lift type for cable cross-section 2.1 mm^2
Protection class	IP30
Material casing	Polycarbonate (PC), signal white Acrylonitrile Butadiene Styrene (ABS), jet black
Colour	Cover: RAL9003 (signal white), RAL9005 (jet black) Backplate assembly: RAL9003 (signal white), RAL9005 (jet black)
Modbus RTU	8 bits, 1 or 2 stop bits. Odd, even or no parity.
Communication speed	9600, 19200, 38400, or 76800 bps (for all protocols)
Measuring range, temperature	0…50 °C
Temperature accuracy	±0.5°C at 15…30 °C[1]
Humidity sensor accuracy	Typical: 2 % RH (10-90 %), 3 % RH (<10 or >90), max.: 3.5 % RH (10-90), 5 % RH (<10 or >90)
CO_2 sensor	0…2000 ppm Update frequency: 5 s
CO_2 sensor accuracy	±50 ppm + 5% (measured value,MV) @400-2000 ppm
PIR sensor, detection range	Detection angle 110°, distance 5 m at 8 °C temp. difference between object and room temp. = up to 7 m at 4 °C temp. difference between object and room temp. = up to 5 m (Target conditions: movement 1.9 m/s, object size approx. 700x250 mm) **Note!** Depending on the temperature difference between the target and the surroundings, detection range will change.
VOC sensor	VOC Index, range 0-500 (100 = 24 h average)
Mounting	Room/Wall
Weight	115 g
Dimensions	Low (RCX-BL) backplate assembly: 94.6 x 94.6 x 21 mm Medium (RCX-BM) backplate assembly: 94.6 x 94.6 x 31 mm

1. 0.5 K is valid if current on UO1 and UO2 is lower than 1.5 A, for currents between 1.5 A and 2 A the accuracy is 0.6 K.

A.2 Communication

RS485	For EXOline (with automatic detection), Modbus (with automatic detection), or BACnet.
Communication cable length, maximum	1200 m, with repeater
Bluetooth® Low Energy	Bluetooth® communication.

A.3 Inputs & outputs

All controllers have the possibility of two (2) universal inputs (UI), two (2) universal outputs (UO), and two (2) analogue outputs (AO).

Universal Output 1	AO: 0…10 V, 2 mA DO: 24 V /max. 2 A (switches to G0) **Note!** The maximum current is 2 A in total for output 1 and output 2.
Universal Output 2	AO: 0…10 V, 2 mA DO: 24 V /max. 2 A (switches to G0) **Note!** The maximum current is 2 A in total for output 1 and output 2.
Analogue Output 1	0…10 V out, 2 mA
Analogue Output 2 / Condensation Input 1	0…10 V out, 2 mA Condensation input (same pin as analogue output)
Universal Input 1	0…10 V PT1000 (0…50 °C) DI: Closing potential free contact
Universal Input 2	0…10 V DI: Closing potential free contact

Appendix B Model overview

Table B-1 Controller models

Article	Display	Buttons	Temperature sensor	Humidity sensor	CO_2 sensor	VOC sensor	PIR sensor
RCX-T			✓				
RCX-TC			✓		✓		
RCX-TP			✓				✓
RCX-THCVP			✓	✓	✓	✓	✓
RCX-T-D	✓	✓	✓				
RCX-TH-D	✓	✓	✓	✓			
RCX-TC-D	✓	✓	✓		✓		
RCX-TP-D	✓	✓	✓				✓
RCX-TCP-D	✓	✓	✓		✓		✓
RCX-THCVP-D	✓	✓	✓	✓	✓	✓	✓
RCX-T-D-BLACK	✓	✓	✓				
RCX-TC-D-BLACK	✓	✓	✓		✓		
RCX-THCVP-D-BLACK	✓	✓	✓	✓	✓	✓	✓

Table B-2 Backplate assembly models

Article	Comments
RCX-BL	Backplate Low (signal white)
RCX-BM	Backplate Medium (signal white)
RCX-BL-BLACK	Backplate Low (jet black)
RCX-BM-BLACK	Backplate Medium (jet black)

Appendix C Alarm list

There is a simple alarm function for the Regio RCX series controllers. There are a number of logic variables that can be read from a SCADA system, and in addition a sum alarm that is set when any of the other alarms are active.

C.1 Alarms

Alarm name	Description
RC_SumAlarm	Active if any of the other alarms are active.
RC_AlarmRoomTempHigh	Room temperature is over the high alarm limit.
RC_AlarmRoomTempLow	Room temperature is under the low alarm limit.
RC_AlarmCO2High	CO_2 level is over the high alarm limit.
RC_AlarmSensorError	An internal or external sensor is not working properly.
RC_AlarmDI	A DI set up as an alarm input is active.
RC_AlarmManualOutput	An output is controlled manually.

Appendix D Terminal list

D.1 Wiring - Terminal list

See also section *4.1.4 Wiring*.

Terminal	I/O
1	Power supply G+
2	Power supply G0–
3	Communication A–
4	Communication B+
5	Universal input 2
6	Universal input 1
7	G0
8	G0
9	Analogue output 2 / Condensation input 1
10	Analogue output 1
11	Universal output 2
12	Universal output 1

Appendix E Licenses

E.1 Cube MX

E.2 FreeRTOS

The FreeRTOS kernel is released under the MIT open source license, the text of which is provided below.

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E.4 JSMN

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