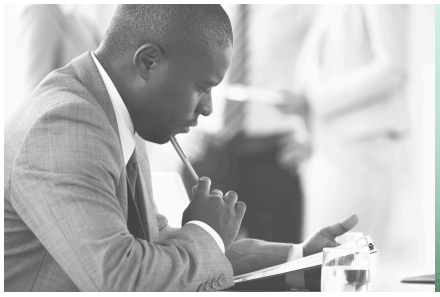


en

MANUAL

REGIO MIDI

REGIN
THE CHALLENGER

THANK YOU FOR CHOOSING REGIN!

Ever since Regin was established in 1947, we have developed and marketed products and systems that create good levels of indoor comfort. Today, we are an important player with one of the market's broadest ranges for building automation.

Our goal is to make real estates in the world more energy efficient. Regin is an international group and our products sells in over 90 countries. Thanks to our global presence with strong local representation, we are well aware of the requirements of the market, as well as of how our products and systems function under the most variable conditions. Every year, Regin makes substantial investments in the development of our systems and HVAC-products.

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.

Some product names mentioned in this document are used for identification purposes only and may be the registered trademarks of their respective companies.

Rev. D, 2023-08-31

REGIN
THE CHALLENGER

1 Introduction

1.1 About this manual

This manual describes the Regio Midi range of controllers.

Special text formats used in the manual:

Note! This box and symbol is used to show useful tips and tricks.

Caution! This type of text and symbol is used to show cautions.

Warning! This type of text and symbol is used to show warnings.

This box is used to show formulas and mathematical calculations

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

Terms used in this manual:

FS: Factory setting

1.2 More information

More information about the product can be found at Regin's website, http://www.regincontrols.com.

2 Introduction to Regio

2.1 Regio zone controllers

Regio is a wide series of room controllers which handle everything from heating, cooling and ventilation to lighting, humidity, CO_2 monitoring and blinds. Regio can be used for creating everything from stand-alone systems for managing the functions in one room, to large, integrated systems with a comprehensive SCADA-system.

2.1.1 Applications

The Regio controllers have a discrete design and are easy to use. They are suitable in buildings where you want optimal comfort and low energy consumption, for example offices, schools, shopping centres, airports, hotels and hospitals.

2.1.2 Mounting

The modular design with a separate bottom plate for wiring makes the whole Regio series easy to install and commission. The controllers are mounted directly on the wall or on a wall box.

2.2 Regio Midi

2.2.1 Communication

The controllers can be connected to a central SCADA-system via RS485 (EXOline, BACnet* or Modbus) and configured for a particular application using the configuration tool Application tool, which can be downloaded free of charge from Regin's homepage www.regincontrols.com. See the manual for Application tool for more information.

* *BACnet is only available in models with display*

The following passwords in Application tool are the default for the different access levels:

Access level	Password
Admin	1111
Service	2222
Operator	3333

3 Control functions

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

3.1 Controller mode

The controller mode 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.

The controller provides the following 14 selectable controller modes:

- ✓ Heating
- ✓ Heating + Heating
- ✓ Heating + Cooling
- ✓ Cooling
- ✓ Cooling + Cooling
- ✓ Heating/Cooling (change-over)
- ✓ Heating + VAV
- ✓ Heating + VAV and forced ventilation
- ✓ Heating + Cooling + VAV
- ✓ Heating + Heating/Cooling (change-over)
- ✓ Heating/Cooling (change-over) + VAV
- ✓ VAV
- ✓ VAV + VAV
- ✓ Change-over with VAV funtion

Note! Controller modes with VAV are only available for RC-C3… and RCC-C3… models.

Controller mode Heating + Heating/Cooling (change-over) is only available for the following models: RC-CF, RC-CFO, RC-CDFO, RC-C3DFOC.

Based on the selected controller mode, the controller outputs one or multiple control signal sequences, denoted Y1, Y2, and Y3. The signal sequences control the heating, cooling, and VAV devices in the room, and are assigned to the different controller outputs via configuration.

Figure 3-1 shows the drop down that is used to select a controller mode in Application tool.

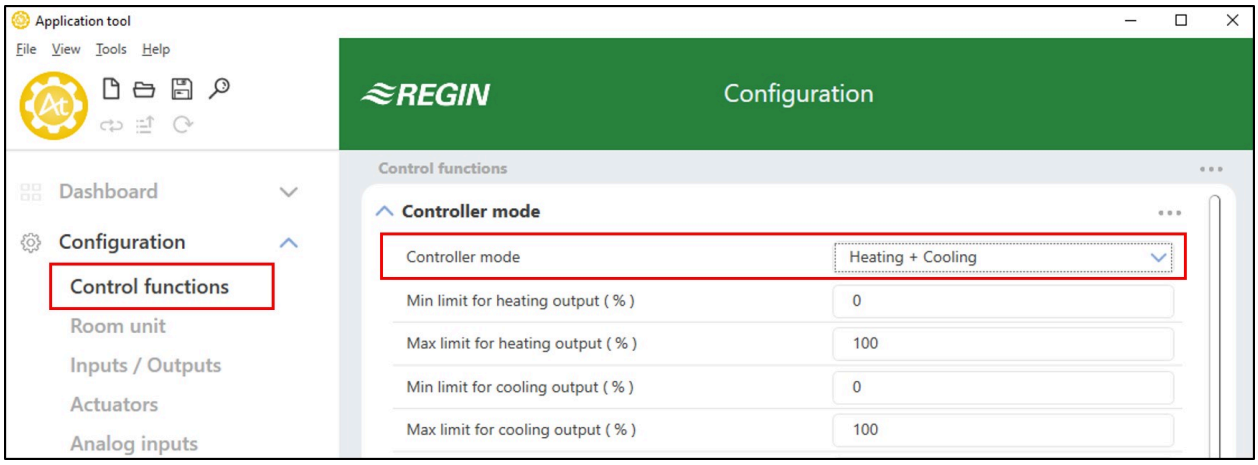


Figure 3-1 Controller mode selection in Application tool.

3.1.1 Heating

This controller mode is suitable for room HVAC systems that use a radiator or fan coil as heating device.

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, Y1, that is configured on the controller outputs by using the configuration values listed in *Table 3-1*.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-1 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-2 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, *Y1: Heating signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Heating signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, *Y1: Heating signal* is at its minimum.

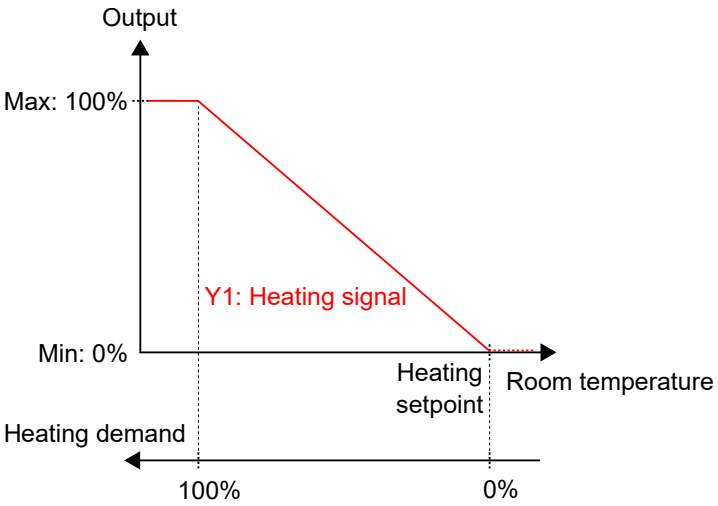


Figure 3-2 Control behaviour for the Heating controller mode.

3.1.2 Heating + Heating

This controller mode is suitable for room HVAC systems that use a combination of two heating devices in sequence, such as radiators or fan coils.

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 two heating signals, Y1 and Y2, in sequence that are configured on the controller outputs by using the configuration values listed in table *Table 3-2*.

The Y1 and Y2 signal sequence order is configurable.

Maximum and minimum limits for the output signals can be set, see section *3.2*.

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

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital
Y2	Heating 2	Analog
	Heating 2 valve, increase Heating 2 valve, decrease	Digital Digital
	Heating 2 valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-3 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, *Y1: Heating signal* increases to respond to the heating demand. At 49% heating demand, *Y1: Heating signal* reaches its maximum. When the room temperature falls further and the heating demand exceeds 51%, *Y2: Heating 2 signal* increases while *Y1: Heating signal* stays at its maximum. At 100% heating demand, *Y2: Heating signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, both *Y1: Heating signal* and *Y2: Heating 2 signal* are at their minimum.

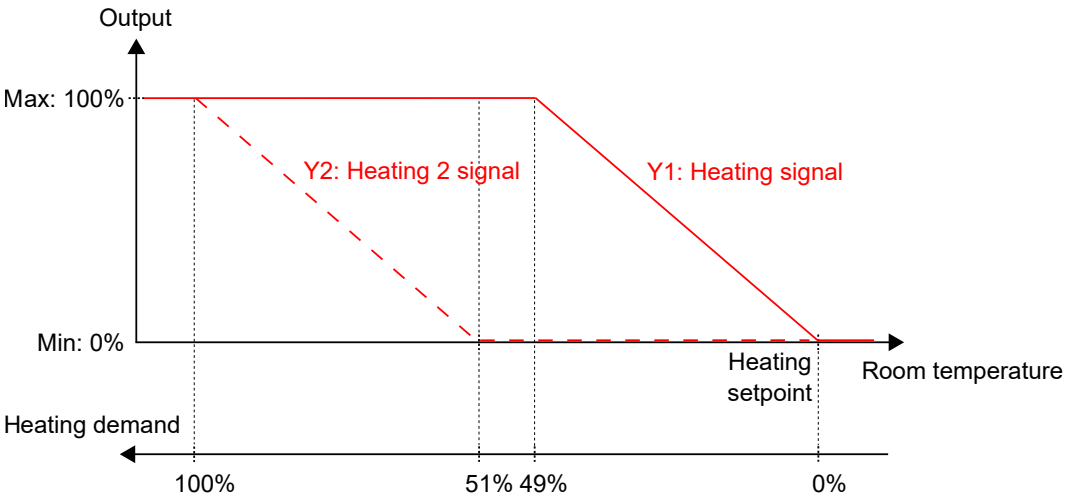


Figure 3-3 Control behaviour for the Heating + Heating controller mode.

3.1.3 Heating + Cooling

This controller mode is suitable for room HVAC systems that use a radiator or fan coil as heating device, and a fan coil or chilled beam as 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, Y1, that is configured on the controller outputs by using the values listed in *Table 3-3*.

When in cooling mode, the controller outputs a cooling signal, Y2, that is configured on the controller outputs by using the values listed in *Table 3-3*.

Maximum and minimum limits for the output signals can be set, see section *3.2*.

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

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital
Y2	Cooling	Analog
	Cooling valve, increase Cooling valve, decrease[2]	Digital Digital
	Cooling valve, thermal (PWM)	Digital
Y1 + Y2	6-way valve	Analog

1. Only available for 3–point models.
2. Only available for 3–point models.

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, *Y1: Heating signal* increases to respond to the heating demand. At 100% heating demand,

Y1: Heating signal reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Y1: Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y2: Cooling signal* increases to respond to the cooling demand. At 100% cooling demand, *Y2: Cooling 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, *Y2: Cooling signal* is at its minimum.

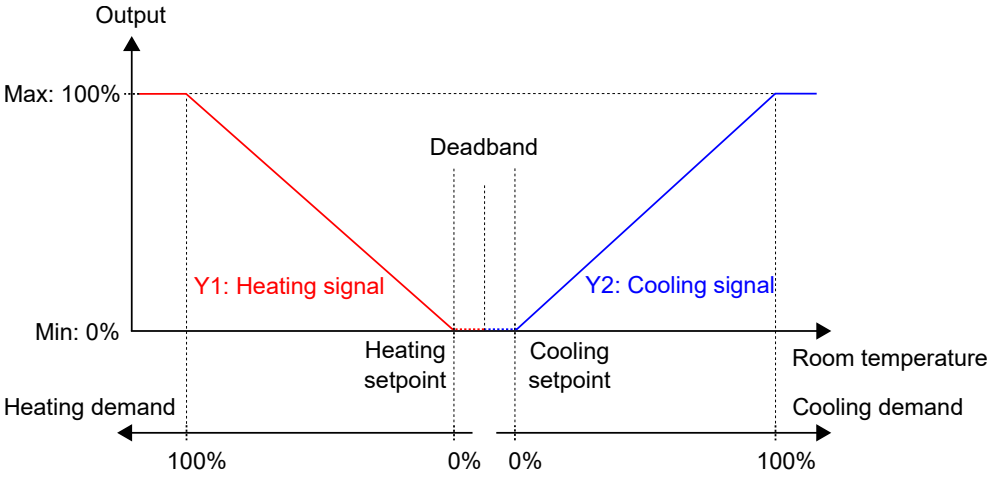


Figure 3-4 Control behaviour for the Heating + Cooling controller mode.

3.1.4 Cooling

This controller mode is suitable for room HVAC systems that use a fan coil or a chilled beam as cooling device.

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

The controller is always in cooling mode and outputs a cooling signal, Y1, that is configured on the controller outputs by using the configuration values listed in *Table 3-4*.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-4 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Cooling	Analog
	Cooling valve, increase Cooling valve, decrease[1]	Digital Digital
	Cooling valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-5 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, *Y1: Cooling signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: Cooling signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: Cooling signal* is at its minimum.

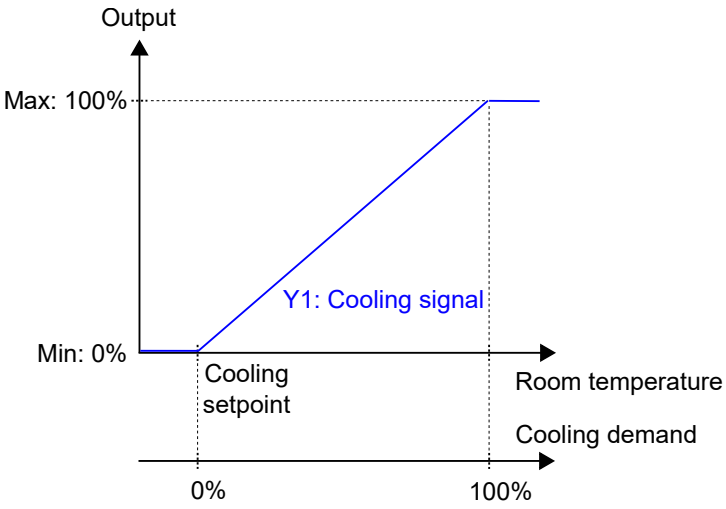


Figure 3-5 Control behaviour for the Cooling controller mode.

3.1.5 Cooling + Cooling

This controller mode is suitable for room HVAC systems that use a fan coil or a chilled beam as cooling device.

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

The controller is always in cooling mode and outputs two cooling signals, Y1 and Y2, in sequence that are configured on the controller outputs by using the configuration values listed in table *Table 3-5*.

The Y1 and Y2 signal sequence order is configurable.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-5 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Cooling	Analog
	Cooling valve, increase Cooling valve, decrease[1]	Digital Digital
	Cooling valve, thermal (PWM)	Digital
Y2	Cooling 2	Analog
	Cooling 2 valve, increase Cooling 2 valve, decrease[2]	Digital Digital
	Cooling 2 valve, thermal (PWM)	Digital

1. Only available for 3–point models.
2. Only available for 3–point models.

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, *Y1: Cooling signal* increases to respond to the cooling demand. At 49% cooling demand, *Y1: Cooling signal* reaches its maximum. When the room temperature rises further and the cooling demand exceeds 51%, *Y2: Cooling 2 signal* increases while *Y1: Cooling signal* stays at its maximum. At 100% cooling demand, *Y2: Cooling 2 signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, both *Y1: Cooling signal* and *Y2: Cooling 2 signal* are at their minimum.

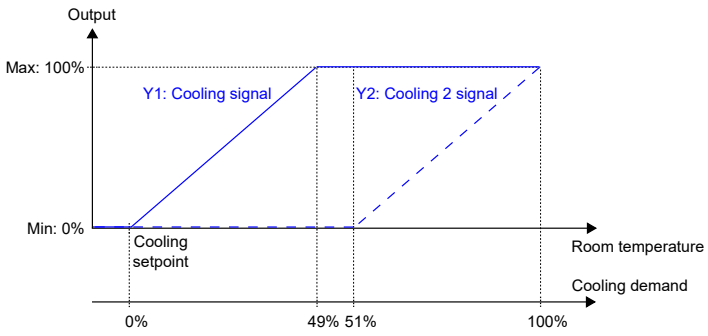


Figure 3-6 Control behaviour for the Cooling + Cooling controller mode.

3.1.6 Heating/Cooling (change-over)

This controller mode is suitable for room HVAC systems that use a 2-pipe fan coil as 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. See section *3.3* for information about the change-over function.

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, see section *3.3*.

When the controller is in heating or cooling mode, the controller outputs a heating or cooling signal, Y1, that is configured on the controller outputs by using the configuration values listed in *Table 3-6*.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-6 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Change-over valve	Analog
	Change-over valve, increase Change-over valve, decrease[1]	Digital Digital
	Change-over valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-7 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, *Y1: Change-over (heating mode) signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Change-over (heating mode) signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, *Y1: Change-over (heating mode) signal* is at its minimum.

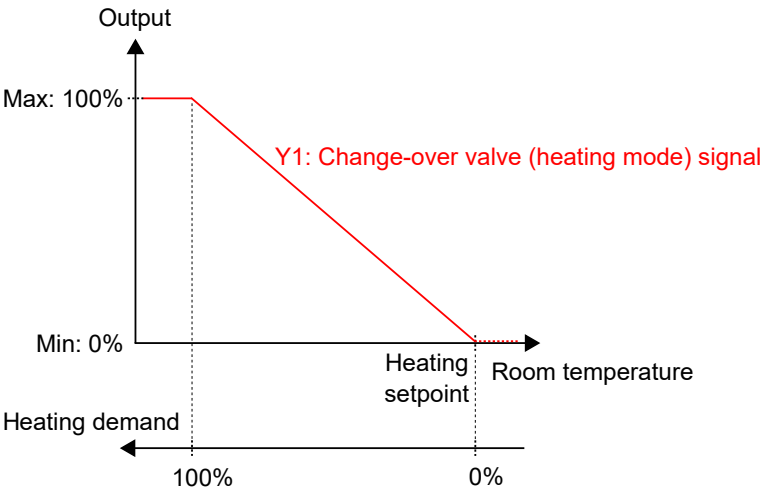


Figure 3-7 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in heating mode.

Figure 3-8 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, *Y1: Change-over (cooling mode) signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: Change-over (cooling mode) signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: Change-over (cooling mode) signal* is at its minimum.

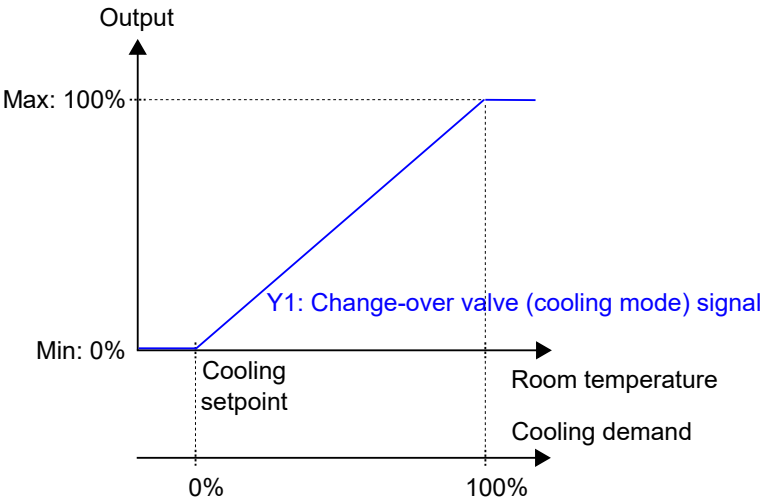


Figure 3-8 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in cooling mode.

3.1.7 Heating + VAV

This controller mode is suitable for room HVAC systems that use a radiator as heating device, and 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 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 regulate based on fresh air demand instead of cooling demand, or based on cooling demand and fresh air demand simultaneously, see

section 3.6. The controller regulates based on fresh air demand by using CO_2 control, see section 3.9. As CO_2 is part of the control loop it is not possible to detect presence with high CO_2 level. The CO_2 level for presence activation (ppm) function is disabled in this control mode.

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 both a heating signal, Y1, and a VAV signal, Y2, that are configured on the controller outputs by using the values listed in *Table 3-7*.

When in cooling mode, the controller outputs a VAV signal, Y2, that is configured on the controller outputs by using the value listed in *Table 3-7*.

Maximum and minimum limits for the heating output signal can be set, see section 3.2. Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section 3.6.

Table 3-7 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital
Y2	VAV	Analog

1. Only available for 3–point models.

Figure 3-9 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 output signal, 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, *Y1: Heating signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Heating signal* reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Y1: Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y2: VAV signal* increases to respond to the cooling demand. At 100% cooling demand, *Y2: VAV signal* reaches its maximum. *Y2: VAV signal* never goes below its set minimum limit.

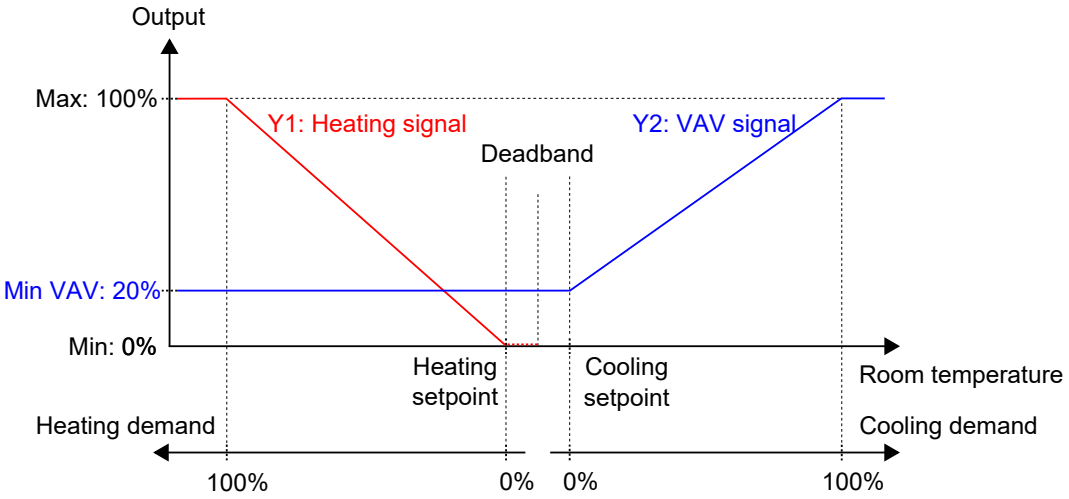


Figure 3-9 Control behaviour for the Heating + VAV controller mode when the controller regulates based on heating and cooling demand.

3.1.8 Heating + VAV and forced ventilation

This controller mode is suitable for room HVAC systems that use a radiator as heating device, and 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.

This controller mode works like *3.1.7 Heating + VAV* but with forced ventilation on by default. When the ventilation is forced, the cooling output is set to full cooling (full supply air volume), regardless of what the controller output signal is. For VAV control, several basic flows exist for supply air depending on the current running mode.

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 regulate based on fresh air demand instead of cooling demand, or based on cooling demand and fresh air demand simultaneously, see section *3.6*. The controller regulates based on fresh air demand by using CO_2 control, see section *3.9*.

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 both a heating signal, Y1, and a VAV signal, Y2, that are configured on the controller outputs by using the values listed in *Table 3-7*.

When in cooling mode, the controller outputs a VAV signal, Y2, that is configured on the controller outputs by using the value listed in *Table 3-7*.

Maximum and minimum limits for the heating output signal can be set, see section *3.2*. Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section *3.6*.

Table 3-8 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital
Y2	VAV	Analog

1. Only available for 3–point models.

Figure 3-9 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 output signal, 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, *Y1: Heating signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Heating signal* reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Y1: Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y2: VAV signal* increases to respond to the cooling demand. At 100% cooling demand, *Y2: VAV signal* reaches its maximum. *Y2: VAV signal* never goes below its set minimum limit.

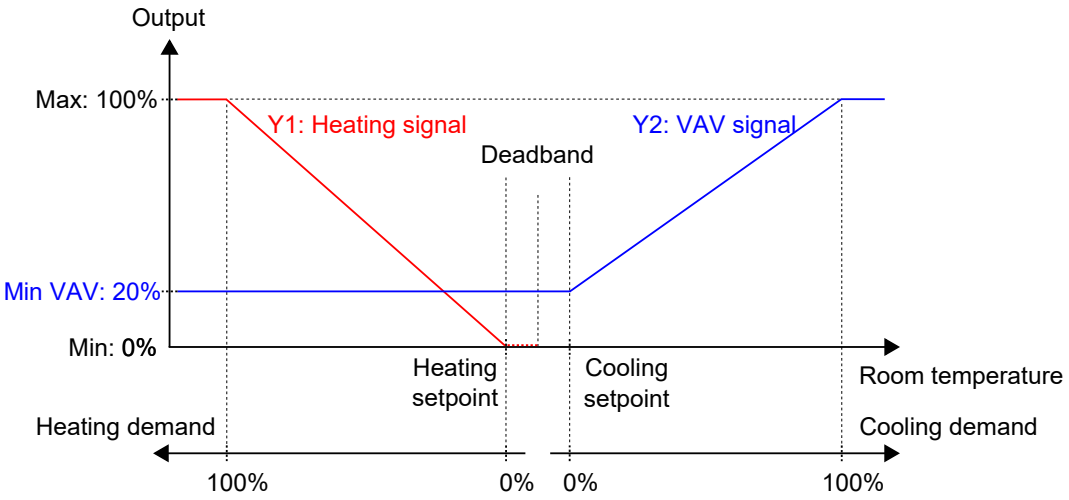


Figure 3-10 Control behaviour for the Heating + VAV controller mode when the controller regulates based on heating and cooling demand.

3.1.9 Heating + Cooling + VAV

This controller mode is suitable for room HVAC systems that use a radiator as heating device and a chilled beam as 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 cooling demand and fresh air demand simultaneously, see section *3.6*. The controller regulates based on fresh air demand by using CO_2 control, see section *3.9*.

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 both a heating signal, Y1, and a VAV signal, Y3, that are configured on the controller outputs by using the values listed in *Table 3-9*.

When in cooling mode, the controller outputs a cooling signal, Y2, and a VAV signal, Y3, in sequence that are configured on the controller outputs by using the configuration values listed in *Table 3-9*.

The Y2 and Y3 signal sequence order is configurable.

Maximum and minimum limits for the heating and cooling output signals can be set, see section *3.2*. Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section *3.6*.

Table 3-9 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Heating	Analog
	Heating valve, increase Heating valve, decrease[1]	Digital Digital
	Heating valve, thermal (PWM)	Digital
Y2	Cooling	Analog
	Cooling valve, increase Cooling valve, decrease[2]	Digital Digital
	Cooling valve, thermal (PWM)	Digital

Table 3-9 Controller output configuration values and controller output types. (continued)

Output signal	Controller output configuration value	Controller output type
Y1 + Y2	6-way valve	Analog
Y3	VAV	Analog

1. Only available for 3–point models.
2. Only available for 3–point models.

Figure 3-11 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, *Y1: Heating signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Heating signal* reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Y1: Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y2: Cooling signal* increases to respond to the cooling demand. At 49% cooling demand, *Y2: Cooling signal* reaches its maximum. When the room temperature rises further and the cooling demand exceeds 51%, *Y3: VAV signal* increases while *Y2: Cooling signal* stays at its maximum. At 100% cooling demand, *Y3: 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 *Y2: Cooling signal* and *Y3: VAV signal* are at their minimum.

Y3: VAV signal never goes below its set minimum limit.

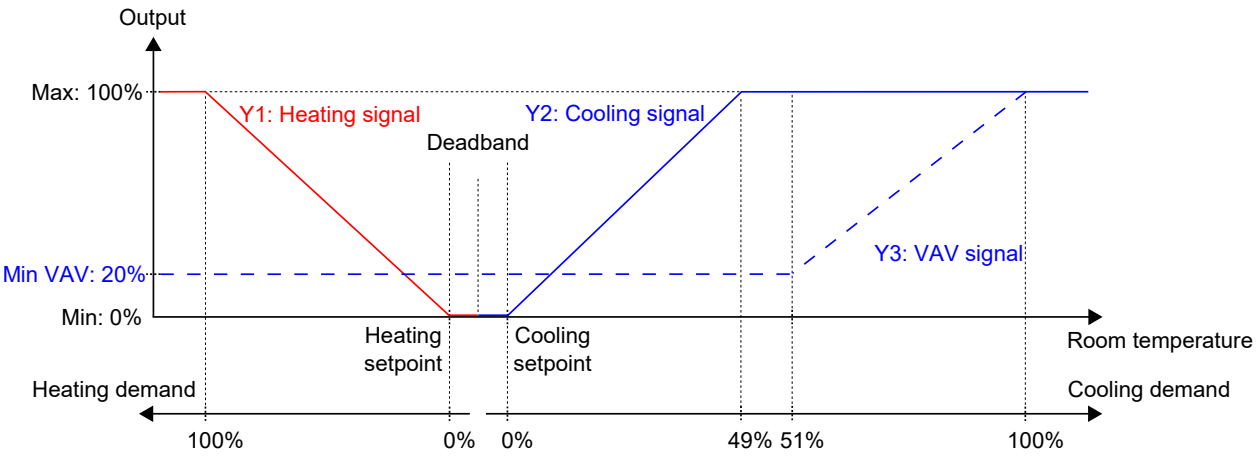


Figure 3-11 Control behaviour for the Heating + Cooling + VAV controller mode when the controller regulates based on heating and cooling demand.

3.1.10 Heating + Heating/Cooling (change-over)

This controller mode is suitable for room HVAC systems that use a 2-pipe fan coil as heating and cooling device, and where an additional heating device, typically an electrical heating battery, is used to provide extra heating during cold seasons.

The controller is set to operate in either Heating + Heating mode or Heating + Cooling mode by using the change-over function. 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. See section *3.3* for information about the change-over function.

The controller operates in Heating + Heating mode when the controller change-over state is *heating*, and in Heating + Cooling mode when the controller change-over state is *cooling*. See section *3.3* for information about the controller change-over state.

The Heating + Heating mode is typically used during cold seasons, such as winter. The Heating + Cooling mode is typically used during warm seasons, such as summer.

Heating + Heating mode

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 two heating signals, Y1 and Y2, in sequence that are configured on the controller outputs by using the configuration values listed in table *Table 3-10*.

The Y1 output signal is associated with the 2-pipe fan coil and increases first to respond to the initial heating demand. The Y2 output signal is associated with the additional heating device and responds to any further heating demand that the 2-pipe fan coil cannot meet.

Maximum and minimum limits for the output signals can be set, see section *3.2*.

Table 3-10 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Change-over valve	Analog
	Change-over valve, increase Change-over valve, decrease[1]	Digital Digital
	Change-over valve, thermal (PWM)	Digital
Y2	Heating	Analog
	Heating valve, increase Heating valve, decrease[2]	Digital Digital
	Heating valve, thermal (PWM)	Digital

1. Only available for 3–point models.
2. Only available for 3–point models.

Figure 3-12 illustrates the control behaviour for this 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, *Y1: Change-over (heating mode) signal* increases to respond to the heating demand. At 49% heating demand, *Y1: Change-over (heating mode) signal* reaches its maximum. When the room temperature falls further and the heating demand exceeds 51%, *Y2: Heating signal* increases while *Y1: Change-over (heating mode) signal* stays at its maximum. At 100% heating demand, *Y2: Heating signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, both *Y1: Change-over (heating mode) signal* and *Y2: Heating signal* are at their minimum.

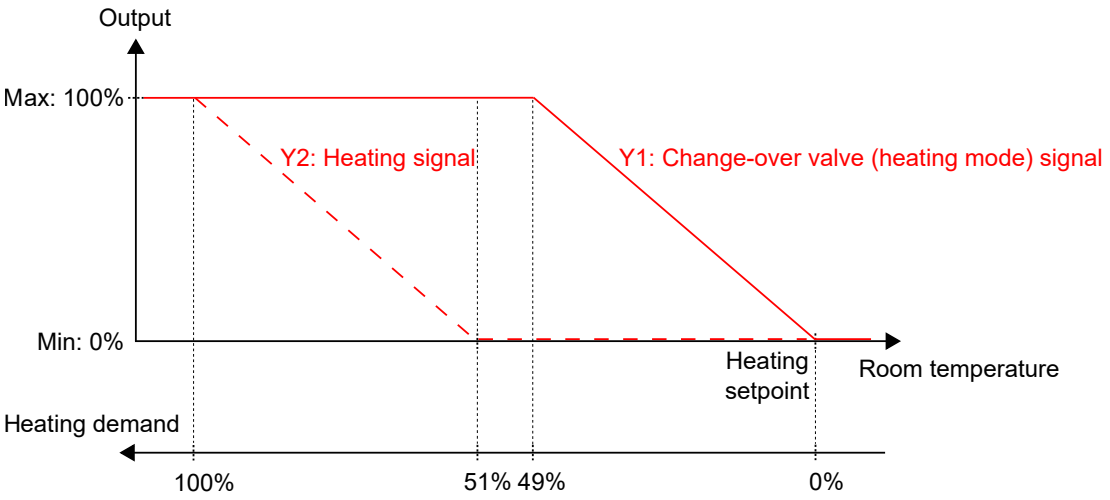


Figure 3-12 Control behaviour for the Heating + Heating/Cooling (change-over) controller mode when the controller is in Heating + Heating mode.

Heating + Cooling mode

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 cooling mode, the controller outputs a cooling signal, Y1, that is configured on the controller outputs by using the values listed in *Table 3-11*. The Y1 output signal is associated with the 2-pipe fan coil.

When in heating mode, the controller outputs a heating signal, Y2, that is configured on the controller outputs by using the values listed in *Table 3-11*. The Y2 output signal is associated with the additional heating device.

Maximum and minimum limits for the output signals can be set, see section *3.2*.

Table 3-11 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Change-over valve	Analog
	Change-over valve, increase Change-over valve, decrease[1]	Digital Digital
	Change-over valve, thermal (PWM)	Digital
Y2	Heating	Analog
	Heating valve, increase Heating valve, decrease[2]	Digital Digital
	Heating valve, thermal (PWM)	Digital

1. Only available for 3–point models.
2. Only available for 3–point models.

Figure 3-13 illustrates the control behaviour for this 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, *Y2: Heating signal* increases to respond to the heating demand. At 100% heating demand, *Y2: Heating signal* reaches its maximum. When the room temperature is in the range between the heating setpoint and the deadband centre, and no heating demand exists, *Y2: Heating signal* is at its minimum.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y1: Change-over (cooling mode) signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: Change-over (cooling mode) 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, *Y1: Change-over (cooling mode) signal* is at its minimum.

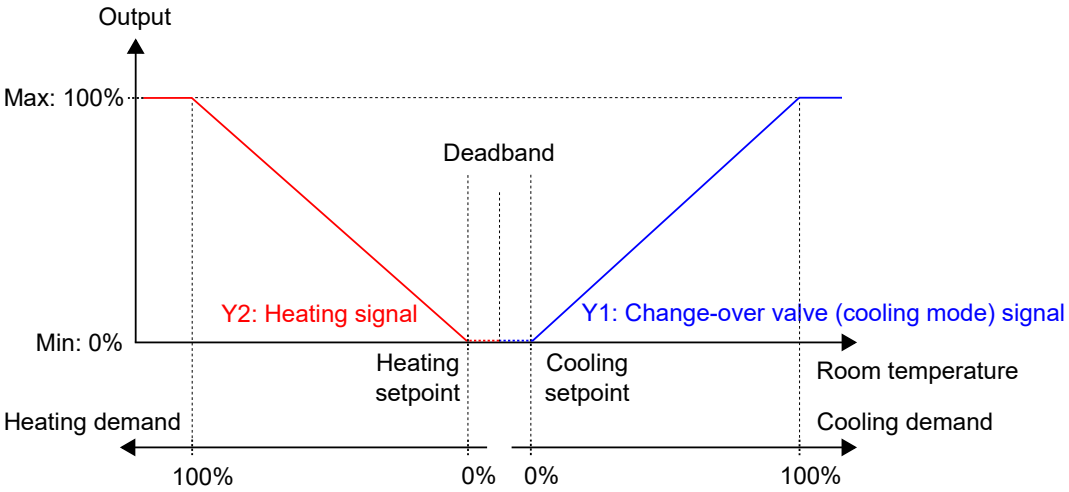


Figure 3-13 Control behaviour for the Heating + Heating/Cooling (change-over) controller mode when the controller is in Heating + Cooling mode.

3.1.11 Heating/Cooling (change-over) + VAV

This controller mode is suitable for room HVAC systems that use a 2-pipe fan coil as 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. See section *3.3* for information about the change-over function. But this controller mode also 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 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, see section *3.3*.

When the controller is in heating or cooling mode, the controller outputs a heating or cooling signal, Y1, that is configured on the controller outputs by using the configuration values listed in *Table 3-6*.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-12 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Change-over valve	Analog
	Change-over valve, increase Change-over valve, decrease[1]	Digital Digital
	Change-over valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-7 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, *Y1: Change-over (heating mode) signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Change-over (heating mode) signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, *Y1: Change-over (heating mode) signal* is at its minimum.

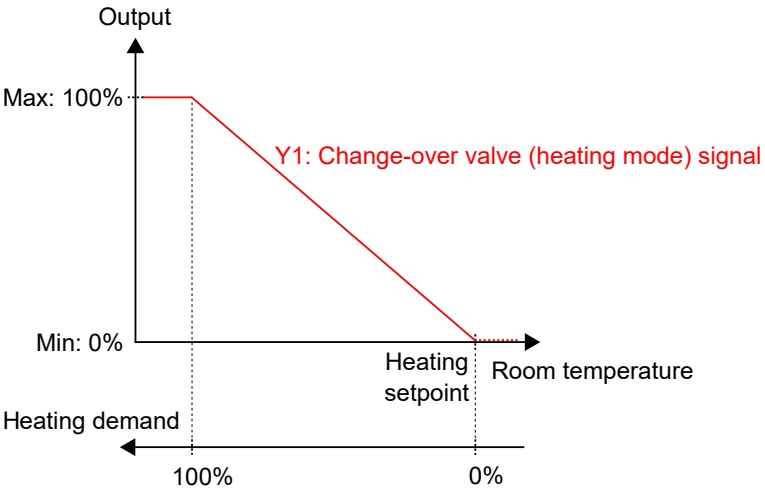


Figure 3-14 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in heating mode.

Figure 3-8 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, *Y1: Change-over (cooling mode) signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: Change-over (cooling mode) signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: Change-over (cooling mode) signal* is at its minimum.

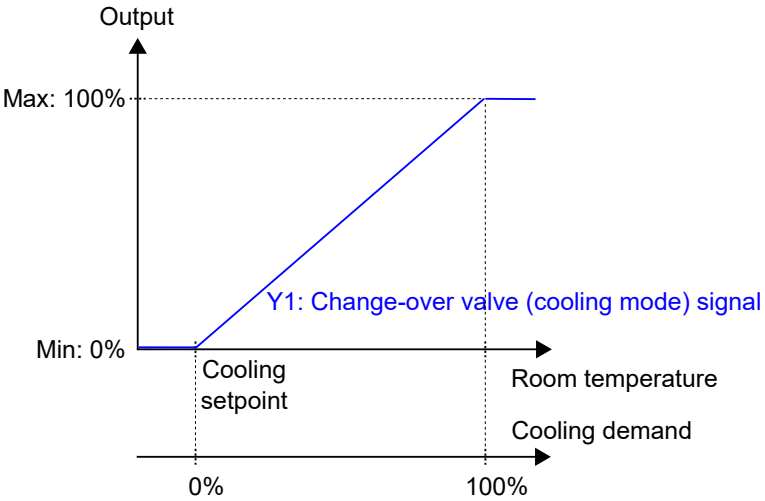


Figure 3-15 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in cooling mode.

VAV

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 *3.6*. The controller regulates based on fresh air demand by using CO_2 control, see section *3.9*.

The controller is always in cooling mode and outputs a VAV signal, Y1, that is configured on the controller outputs by using the configuration value listed in *Table 3-13*.

Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section *3.6*.

Table 3-13 Controller output configuration value and controller output type.

Output signal	Controller output configuration value	Controller output type
Y1	VAV	Analog

Figure 3-16 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, *Y1: VAV signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: VAV signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: VAV signal* is at its minimum.

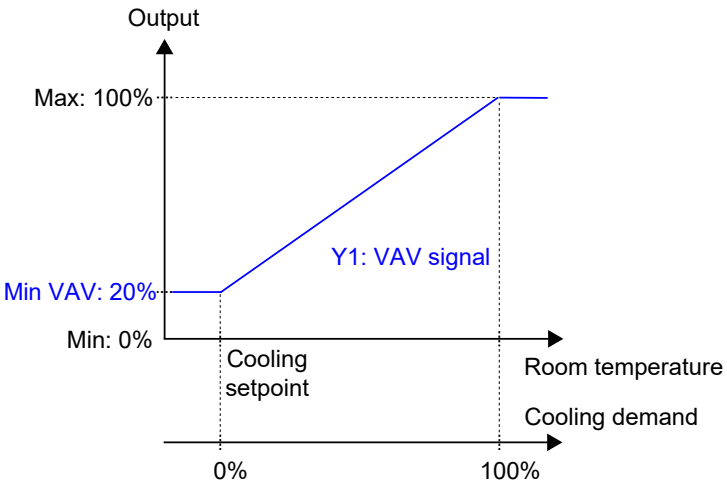


Figure 3-16 Control behaviour for the VAV controller mode when the controller regulates based on cooling demand.

3.1.12 VAV

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 *3.6*. The controller regulates based on fresh air demand by using CO_2 control, see section *3.9*.

The controller is always in cooling mode and outputs a VAV signal, Y1, that is configured on the controller outputs by using the configuration value listed in *Table 3-13*.

Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section *3.6*.

Table 3-14 Controller output configuration value and controller output type.

Output signal	Controller output configuration value	Controller output type
Y1	VAV	Analog

Figure 3-16 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, *Y1: VAV signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: VAV signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: VAV signal* is at its minimum.

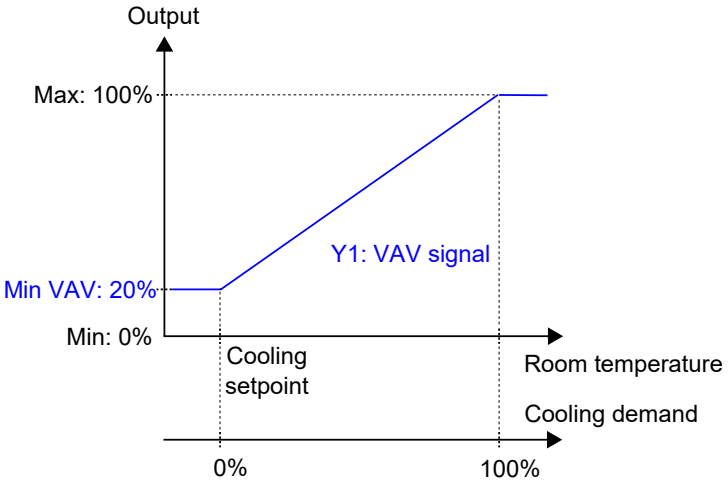


Figure 3-17 Control behaviour for the VAV controller mode when the controller regulates based on cooling demand.

3.1.13 VAV + VAV

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 *3.6*. The controller regulates based on fresh air demand by using CO_2 control, see section *3.9*.

The controller is always in cooling mode and outputs two VAV signals, Y1 and Y2, that is configured on the controller outputs by using the configuration values listed in *Table 3-15*.

Maximum and minimum limits for the VAV output signals are set via the VAV control function, see section *3.6*.

Table 3-15 Controller output configuration value and controller output type.

Output signal	Controller output configuration value	Controller output type
Y1	VAV	Analog
Y2	VAV 2	Analog

Figure 3-18 illustrates the control behaviour when the controller regulates based on cooling demand, and when minimum limits are set for the VAV output signals.

The cooling demand increases as the room temperature rises. When the room temperature rises above the cooling setpoint, *Y1: VAV signal* increases to respond to the cooling demand. At 49% cooling demand, *Y1: VAV signal* reaches its maximum. When the room temperature rises further and the cooling demand exceeds 51%, *Y2: VAV 2 signal* increases while *Y1: VAV signal* stays at its maximum. At 100% cooling demand, *Y2: VAV 2 signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, both *Y1: VAV signal* and *Y2: VAV 2 signal* are at their minimum.

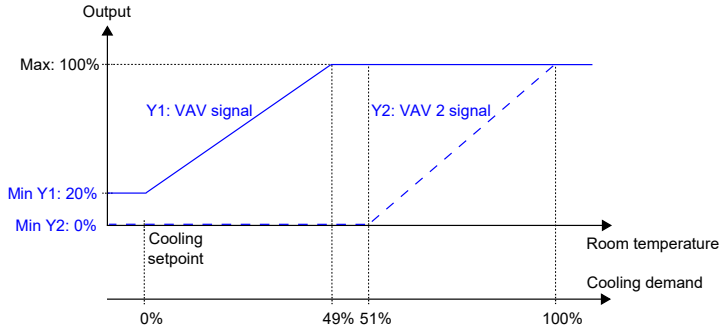


Figure 3-18 Control behaviour for the VAV + VAV controller mode when the controller regulates based on cooling demand.

3.1.14 Change-over with VAV function

This controller mode is suitable for room HVAC systems that use a 2-pipe fan coil as 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. See section *3.3* for information about the change-over function.

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, see section *3.3*.

When the controller is in heating or cooling mode, the controller outputs a heating or cooling signal, Y1, that is configured on the controller outputs by using the configuration values listed in *Table 3-6*.

Maximum and minimum limits for the output signal can be set, see section *3.2*.

Table 3-16 Controller output configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Change-over valve	Analog
	Change-over valve, increase Change-over valve, decrease[1]	Digital Digital
	Change-over valve, thermal (PWM)	Digital

1. Only available for 3–point models.

Figure 3-7 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, *Y1: Change-over (heating mode) signal* increases to respond to the heating demand. At 100% heating demand, *Y1: Change-over (heating mode) signal* reaches its maximum.

When the room temperature is higher than the heating setpoint and no heating demand exists, *Y1: Change-over (heating mode) signal* is at its minimum.

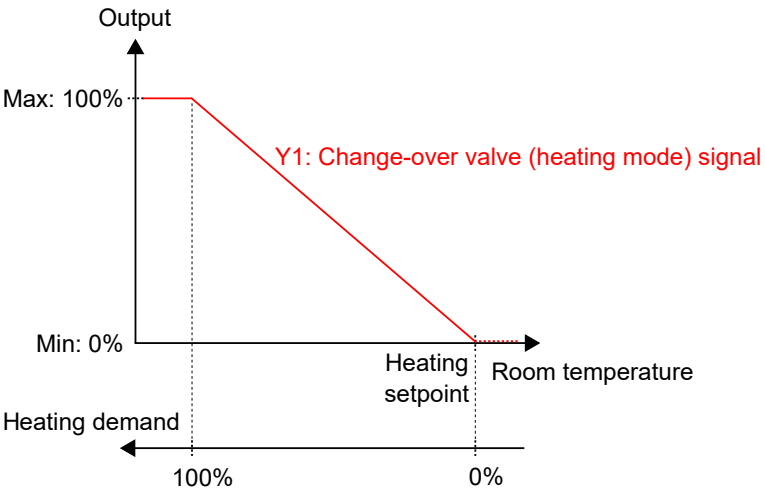


Figure 3-19 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in heating mode.

Figure 3-8 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, *Y1: Change-over (cooling mode) signal* increases to respond to the cooling demand. At 100% cooling demand, *Y1: Change-over (cooling mode) signal* reaches its maximum.

When the room temperature is lower than the cooling setpoint and no cooling demand exists, *Y1: Change-over (cooling mode) signal* is at its minimum.

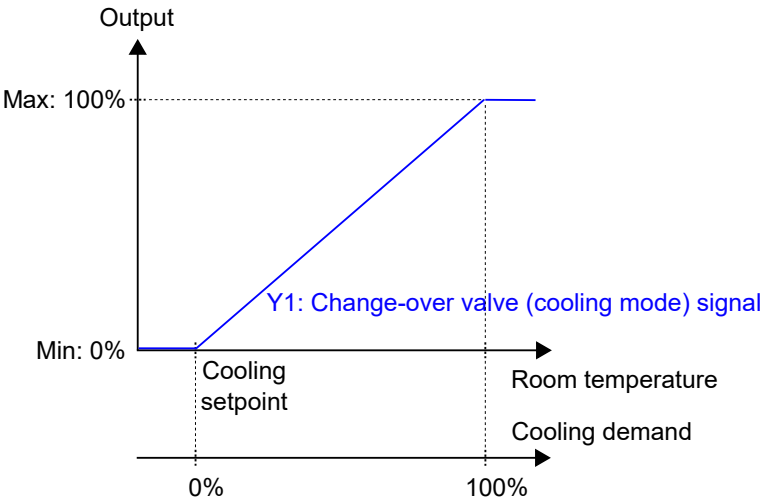


Figure 3-20 Control behaviour for the Heating/Cooling (change-over) controller mode when the controller is in cooling mode.

The VAV function is placed on UO3 and is at a fixed position depending on the controller state. Min position VAV see chapter*3.6 VAV control*.

3.2 Minimum limit for heating output

Minimum limits for the heating output signal can be set. *Figure 3-21* shows the configuration settings in Application tool.

Maximum and minimum limits for the VAV output signal are set via the VAV control function, see section *3.6*.

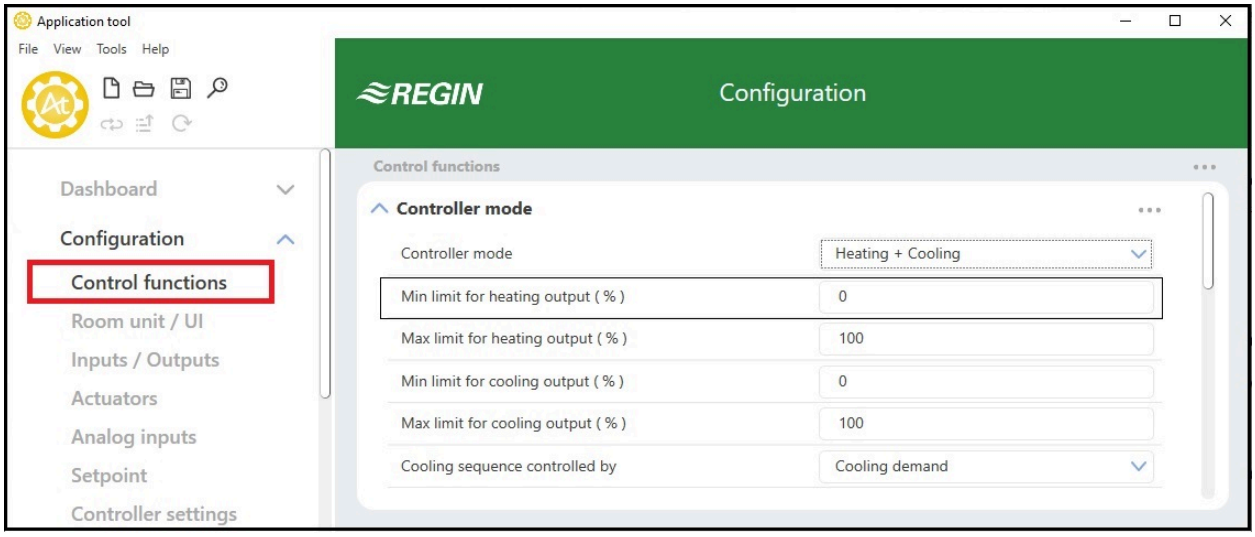


Figure 3-21 Configuration settings for minimum heating output limit in Application tool.

The heating output limits are active when the controller is in heating mode, and inactive when the controller is not in heating mode. When the controller is in heating mode or not is defined by the used controller mode, see section *3.1*.

Figure 3-22 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.

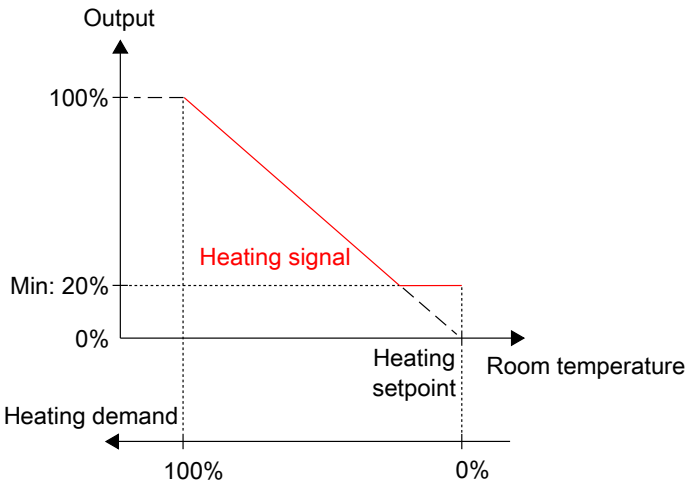


Figure 3-22 Control behaviour when maximum and minimum limits are set for the heating output.

3.3 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 *3.3.1*. The controller change-over state can also be set manually via the Manual / Auto settings, or via communication.

The change-over function is enabled and the configuration settings for change-over detection are shown in Application tool when one of the following controller modes is selected:

- ✓ Heating/Cooling (change-over)
- ✓ Heating + Heating/Cooling (change-over)

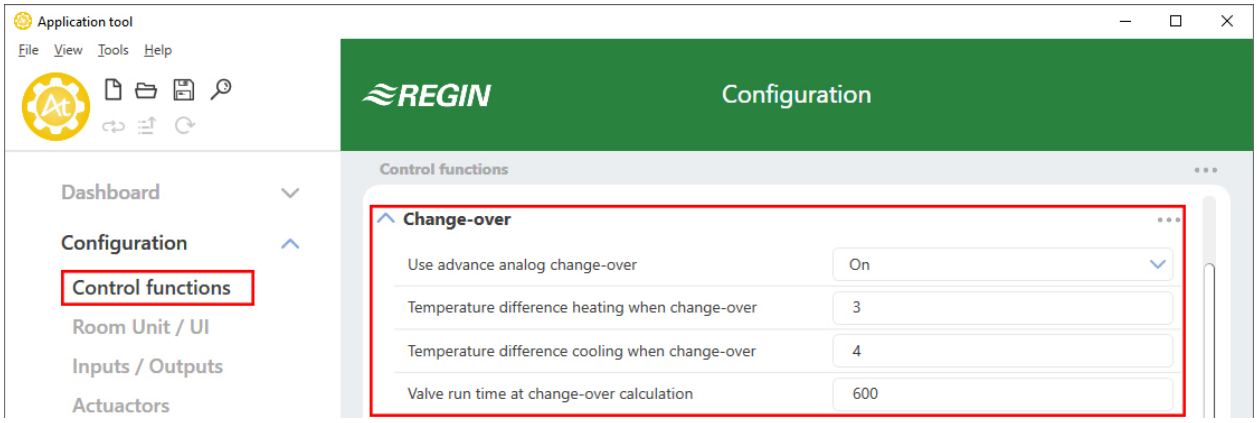


Figure 3-23 Change-over detection configuration settings in Application tool.

3.3.1 Change-over detection

Change-over detection is performed either by using a PT1000 sensor that is connected to an analog 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 setting) higher than the room temperature. The controller shifts the change-over state to *cooling* when the pipe medium temperature is 4°C (default setting) 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* pane in Application tool.

Change-over detection is configured on the controller inputs by using the values listed in *Table 3-17*.

Table 3-17 Change-over detection configuration values and controller input types.

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

The configuration settings for change-over detection are described in *Table 3-18*.

Table 3-18 Change-over detection configuration settings.

Configuration setting	Description
Use advance analog change-over	**Simple**: In simple mode, the change-over state is set to cooling when the change-over temperature goes below the low limit. It is set to heating when the change-over temperature exceeds the high limit. **Advanced**: In advanced mode, the change-over function will measure the difference between the room and media temperature. As long as the heat valve is more than 20 % open, or every time a valve exercise is performed, the difference between the media and room temperature will be calculated. If the temperature difference is greater than the configured value (differs for Heating and Cooling mode), the control mode will change. The factory settings for the difference between Heating and Cooling change-over are: ✓ Change from Heating to Cooling = 4K ✓ Change from Cooling to Heating = 3K This setting may be changed using parameters number 9 and 10.
Temperature difference heating when change-over(°C)	The controller shifts the change-over state to *heating* when the pipe medium temperature is this amount of degrees higher than the room temperature.
Temperature difference cooling when change-over(°C)	The controller shifts the change-over state to *cooling* when the pipe medium temperature is this amount of degrees lower than the room temperature.
Valve run time at change-over calculation (sec)	The period of time (in seconds) that the valve is open before the pipe medium temperature is measured and compared to the room temperature.

3.4 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
- ✓ Bypass

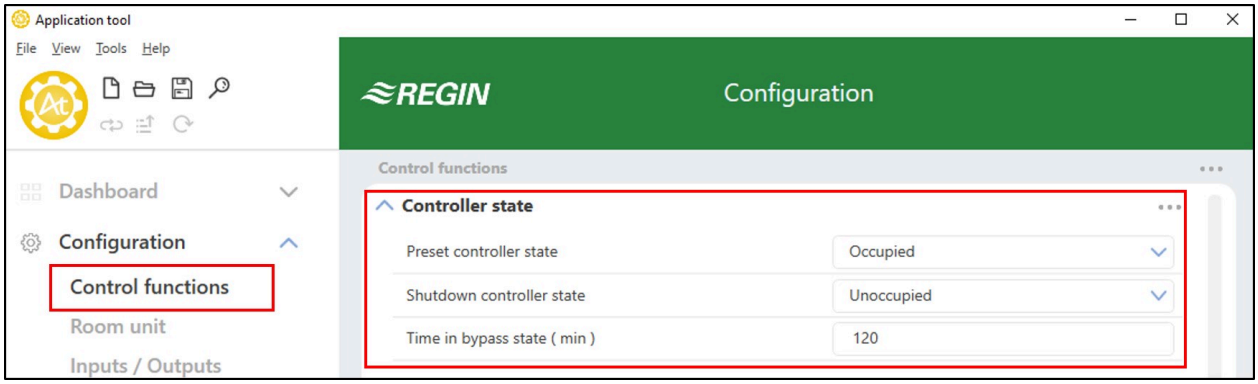


Figure 3-24 Controller state configuration settings in Application tool.

The different controller states make use of various setpoint and deadband settings to regulate the heating and cooling distribution, as described in section *3.4.1*.

The controller state configuration settings are described in section *3.4.2*, and controller state changes are described in section *3.4.3*.

An overview of the controller states is provided in *Table 3-19*.

Table 3-19 Controller state overview.

Controller state	Description	Priority	Indications in controllers with display	LED indication in controllers without display
Off	This state is typically used for when the room is not in use for an extended period of time, for example, 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	✓ OFF indication is shown. ✓ HEAT indication is shown when the demand is greater than zero.	✓ Off
Unoccupied	This state is typically used for when the room is not in use for an extended period of time, for example, during holidays or long weekends.	Energy saving	✓ OFF indication is shown. ✓ HEAT or COOL indication is shown when the demand is greater than zero. ✓ The room temperature, setpoint, setpoint adjustment, or CO_2 level is shown according to the current controller configuration.	✓ Off
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	✓ STANDBY indication is shown. ✓ HEAT or COOL indication is shown when the demand is greater than zero. ✓ The room temperature, setpoint, setpoint adjustment, or CO_2 level is shown according to the current controller configuration.	✓ Blinking
Occupied	This state is typically used for when the room is in use.	Comfort	✓ Occupancy indication is shown. ✓ HEAT or COOL indication is shown when the demand is greater than zero. ✓ The room temperature, setpoint, setpoint adjustment, or CO_2 level is shown according to the current controller configuration, see section.	✓ Solid
Bypass	This state is typically used for when the room is in use, and when a temporary maximum flow of fresh air is needed. For example, 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 high a CO_2 level. The increase in airflow is achieved by using the forced ventilation function, see section *3.7*.	Comfort and improved air quality	✓ Occupancy indication is shown. ✓ HEAT or COOL indication is shown when the demand is greater than zero. ✓ Forced ventilation indication is shown when forced ventilation is active. ✓ The room temperature, setpoint, setpoint adjustment, or CO_2 level is shown according to the current controller configuration.	✓ Blinking slowly

3.4.1 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 3-25 illustrates the control behaviour when no maximum or minimum limits are set for the output signal.

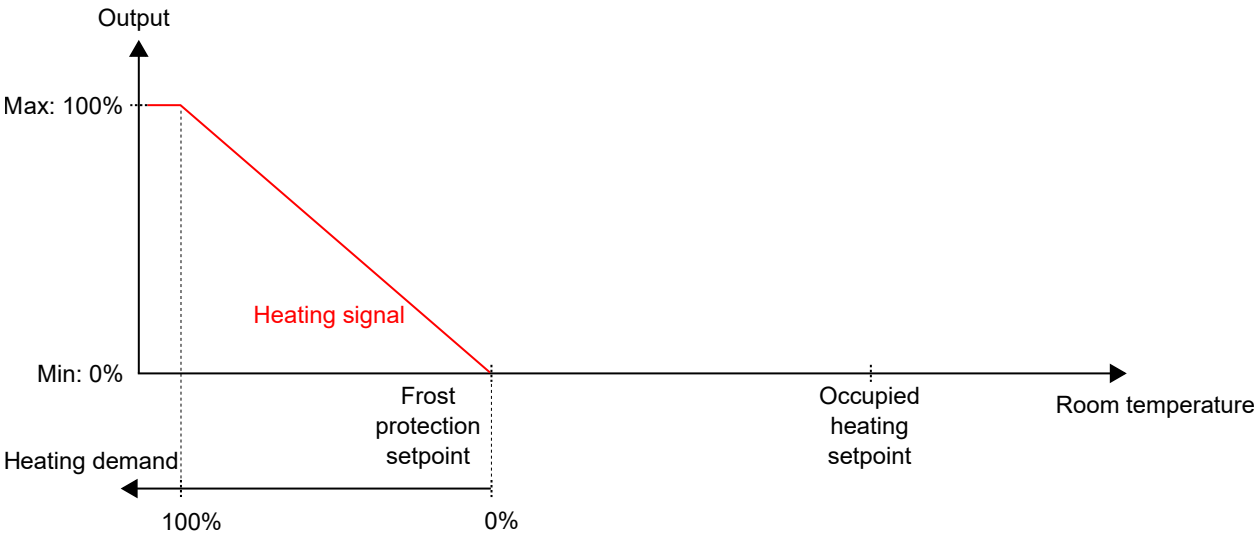


Figure 3-25 Control behaviour for the off controller state.

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 3-26 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

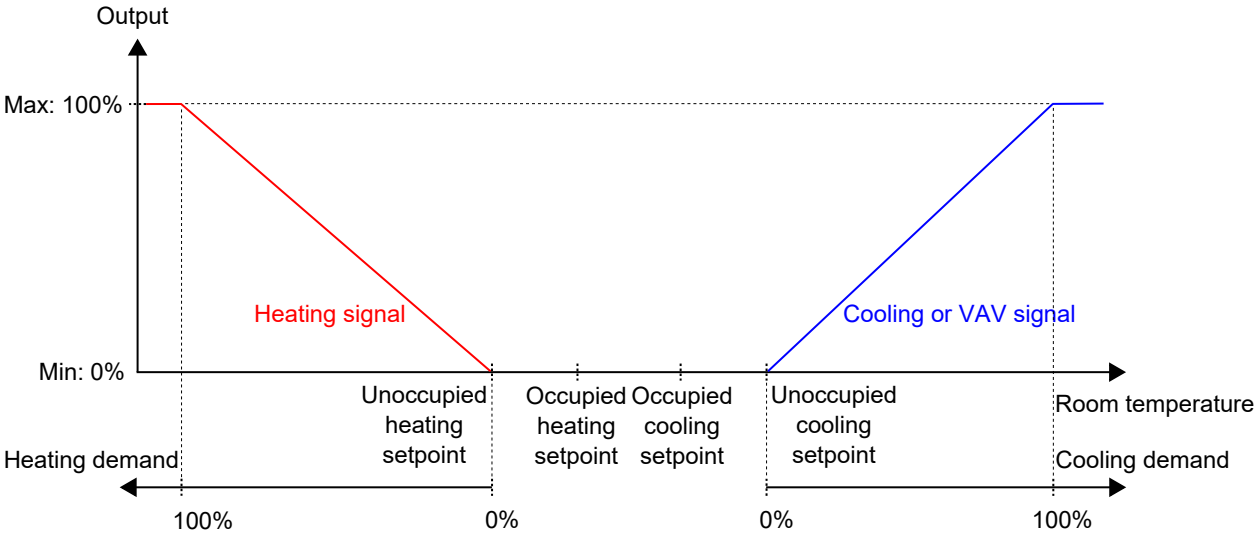


Figure 3-26 Control behaviour for the unoccupied controller state.

Standby

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

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

Figure 3-27 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

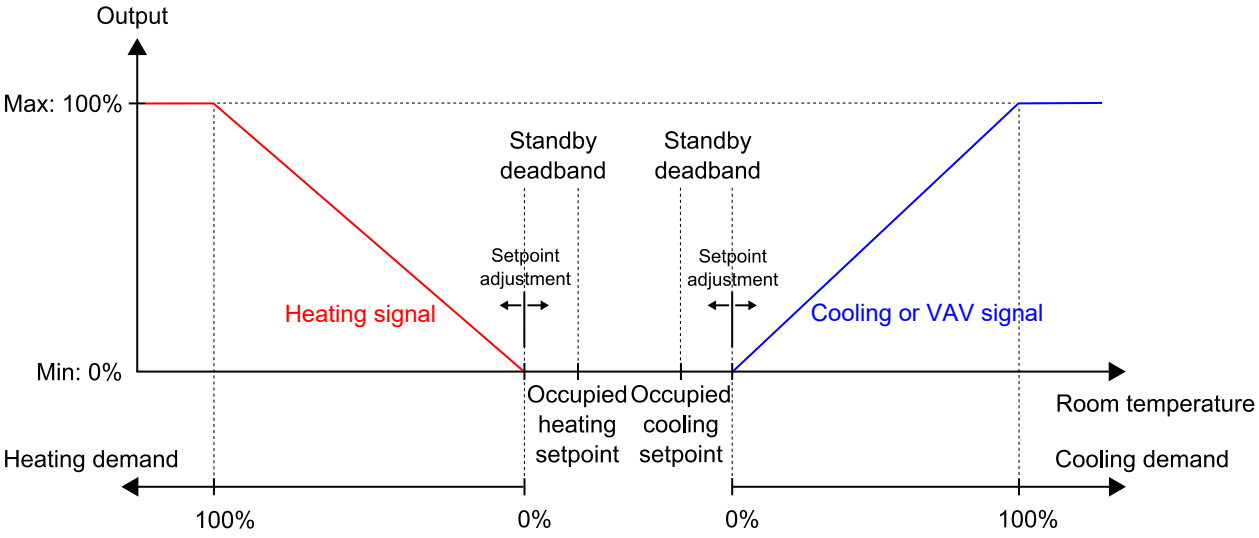


Figure 3-27 Control behaviour for the standby controller state.

Occupied and Bypass

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 bypass state. See section *3.7* for information about the forced ventilation function.

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

Figure 3-28 illustrates the control behaviour when no maximum or minimum limits are set for the output signals.

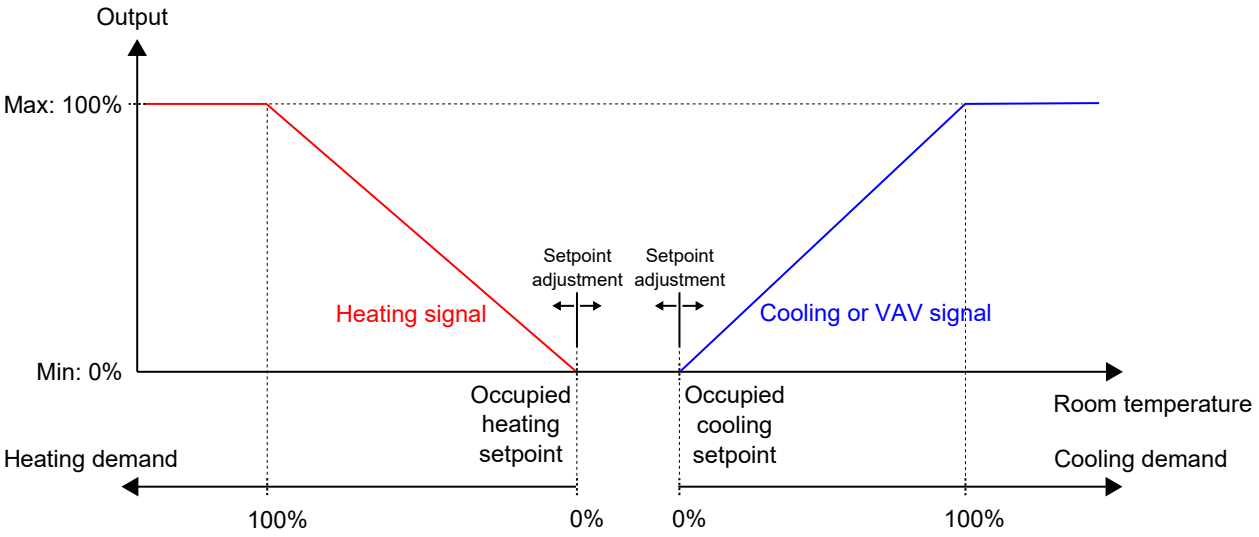


Figure 3-28 Control behaviour for the occupied and bypass controller state.

3.4.2 Configuration settings

The controller state configuration settings are described in *Table 3-20*.

Table 3-20 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 setting)
Shutdown controller state	One of the following controller states is configured as the shutdown controller state: ✓ **Off** ✓ **Unoccupied** (default setting) ✓ **Standby** ✓ **Occupied**
Time in bypass state (min)	The period of time (in minutes) that the controller is in bypass state before the controller changes state to the configured preset controller state. If time is set to 0, the Bypass never switches back automatically. It will need an activating trigger to leave Bypass state, see section *3.4.3*

3.4.3 State changes

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

- ✓ The occupancy (on/off) button on the controller is pressed shorter than 5 seconds (short press).
- ✓ The occupancy (on/off) button on the controller is pressed for more than 5 seconds (long press).
- ✓ Presence is detected:
  - ✓ Via a presence detector, for example, a motion detector, which is connected to the controller.
  - ✓ Due to a high CO_2 level that is detected via a CO_2 sensor, which is connected to the controller.

  See section *3.8* for information about the presence detection function and presence detection configuration settings.
- ✓ The bypass state timeout expires.
- ✓ Presence is not detected anymore.
- ✓ A schedule (occupied or unoccupied) is activated or deactivated.
- ✓ A central command is issued via communication, for example, from a SCADA system.

The following sections provide flow charts that describe how the different events trigger controller state changes.

Occupancy (on/off) button on controller

Figure 3-29 describes controller state changes for when the occupancy (on/off) button on the controller is used.

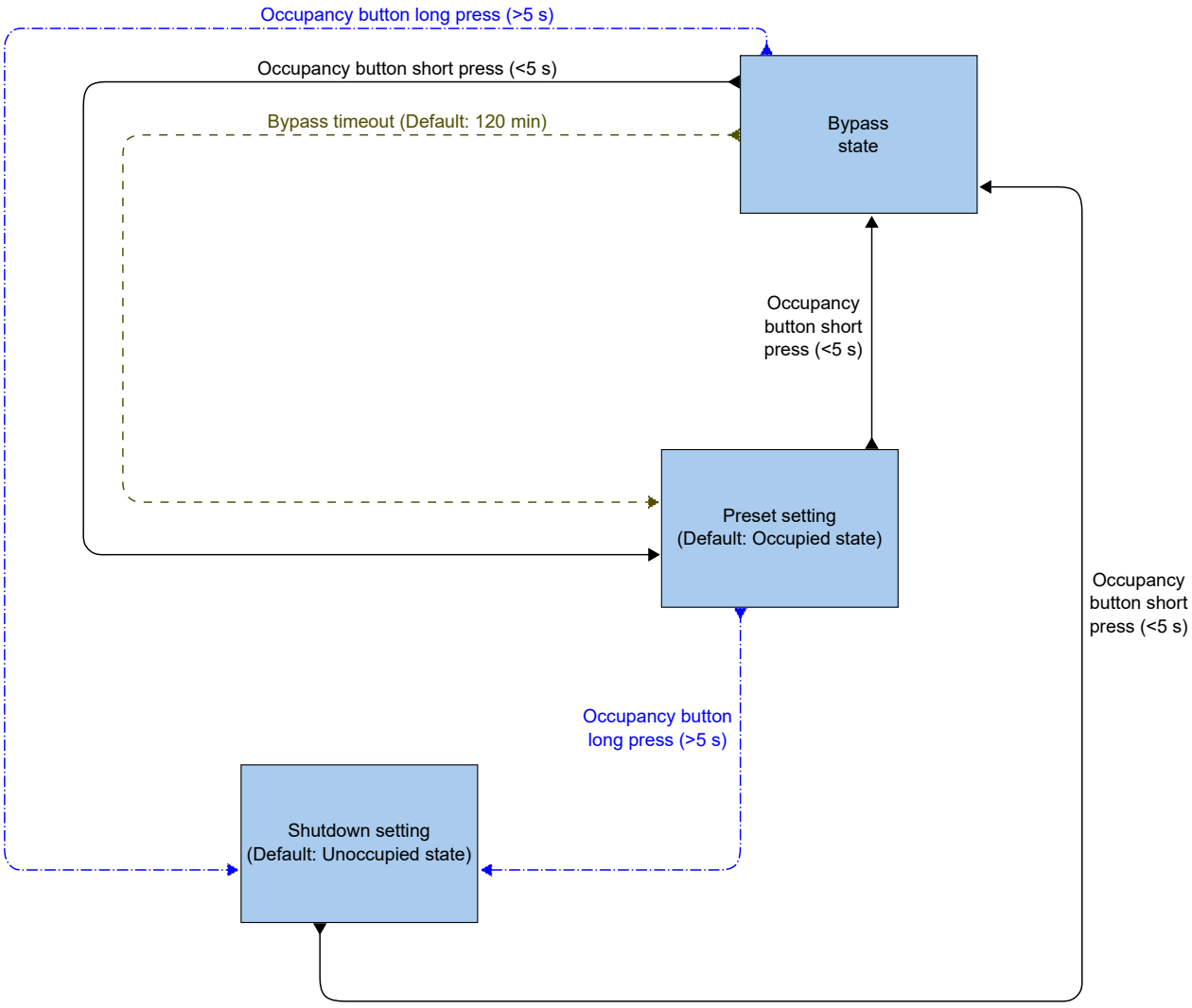


Figure 3-29 Flow chart describing controller state changes for when the occupancy (on/off) button on the controller is used.

Presence detection and occupancy (on/off) button on controller

Figure 3-30 describes controller state changes for when presence detection and the occupancy (on/off) button on the controller are used.

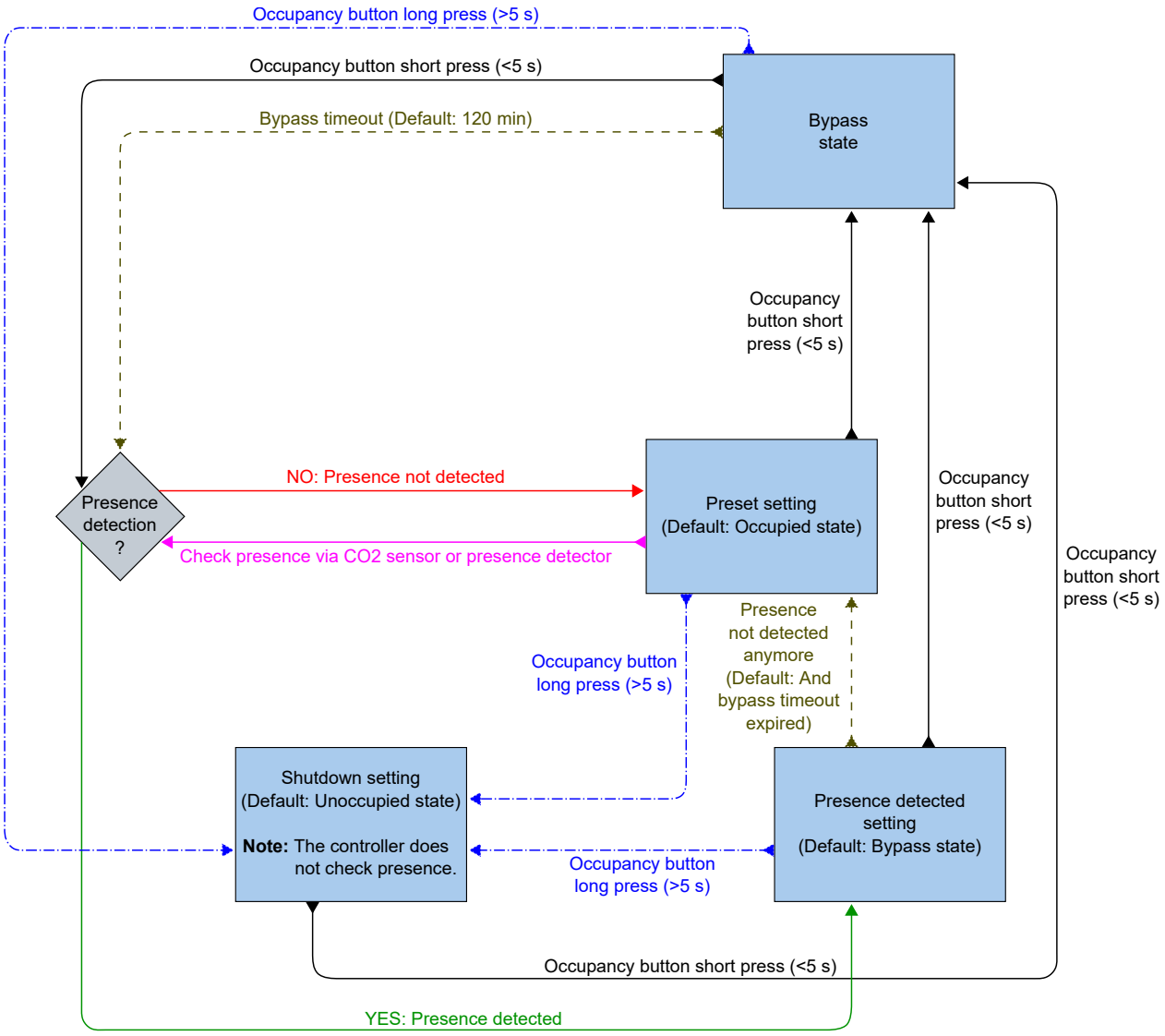


Figure 3-30 Flow chart describing controller state changes for when presence detection and the occupancy (on/off) button on the controller is used.

3.5 Fan control

The fan control function enables the controller to regulate the fan speed for EC fans or 3-speed fans.

A fan is controlled in auto or manual mode. In auto mode, the fan speed is determined by the current heating or cooling demand. In manual mode, one of the following speeds is used:

- ✓ Off
- ✓ Low speed: Fan speed 1
- ✓ Medium speed: Fan speed 2
- ✓ High speed: Fan speed 3

The operative fan mode that is currently in use, that is, auto or manual (off, low speed, medium speed, or high speed), is selected by the end user via the controller, or set via communication. When the controller is in the state specified by the *Shutdown controller state* setting, see section *3.4.2*, the operative fan mode is always auto.

In addition, fan control provides the following optional functions:

- ✓ Fan boost, see section *3.5.3*.
- ✓ Fan kick-start, see section *3.5.4*.
- ✓ Mould protection, see section *3.5.5*.

3.5.1 EC fan control

The EC fan control function is enabled and the EC fan control configuration settings are shown in Application tool when the configuration value listed in *Table 3-21 EC fan control configuration value and controller input type*. is configured on a controller output.

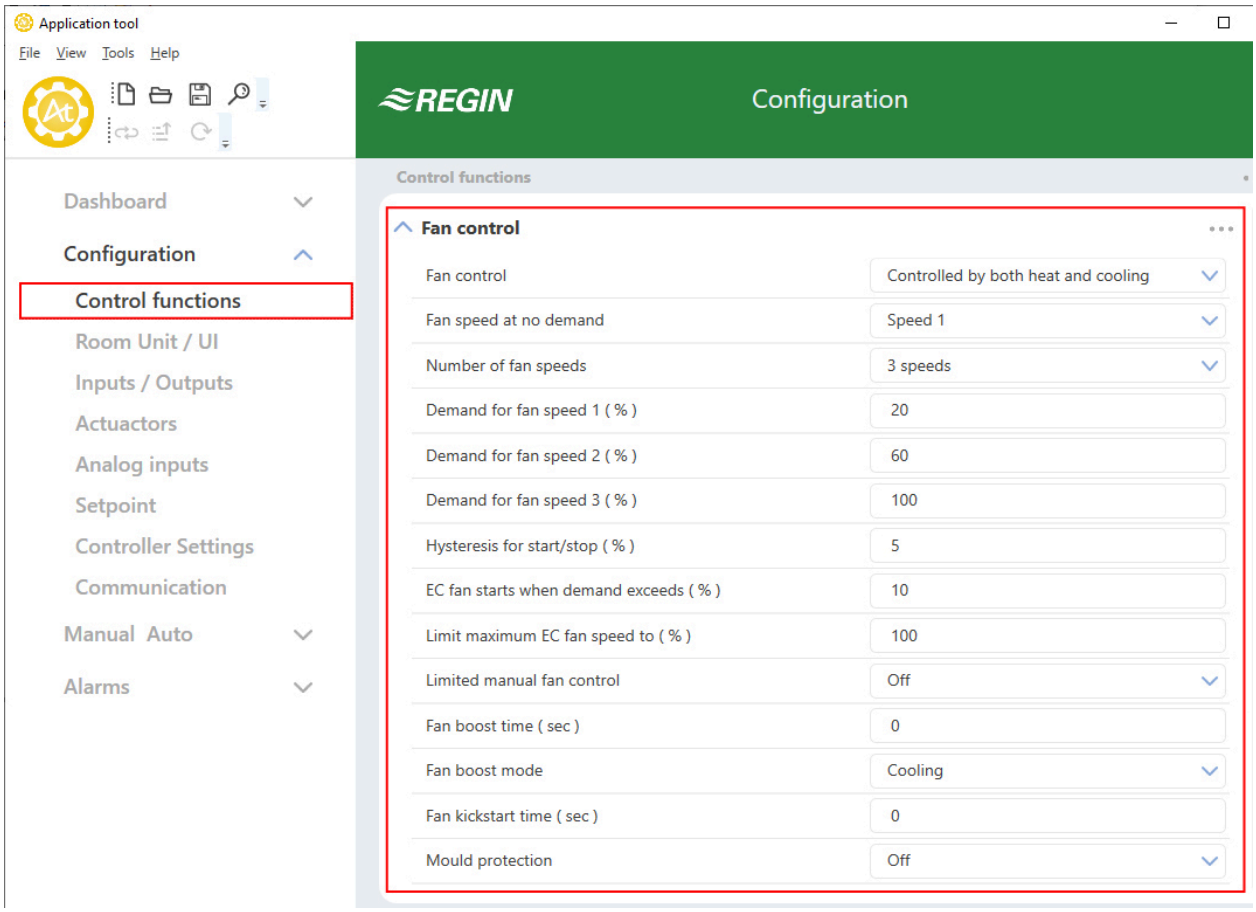


Figure 3-31 EC fan control configuration settings in Application tool.

The controller outputs a fan speed signal, Y1, that is configured on a controller output by using the value in *Table 3-21 EC fan control configuration value and controller input type.*.

In auto mode, the Y1 signal corresponds to the current heating or cooling demand, as illustrated in *Figure 3-32*.

In manual mode, the Y1 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 3-33*. 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 3-21 EC fan control configuration value and controller input type.

Output signal	Controller output configuration value	Controller output type
Y1	EC fan	Analog

The EC fan control configuration settings are described in *Table 3-22 EC fan control configuration settings.*.

Table 3-22 EC fan control configuration settings.

Configuration setting	Fan mode applicability	Description
Fan control	Auto	**Disabled:** Fan control in auto mode is disabled (default setting). **At cooling demand:** Fan control in auto mode is active at cooling demand. **At heating demand:** Fan control in auto mode is active at heating demand. **At heating and cooling demand:** Fan control in auto mode is active both at heating and cooling demand.
Number of fan speeds	Auto and manual	**None:** Fan control in auto and manual mode is disabled. **1 speed:** Only the fan speed 1 signal is used. In auto mode, this means that the controller outputs the fan speed 1 signal instead of the fan speed 2 and 3 signals. **2 speeds:** Only the fan speed 1 and 2 signals are used. In auto mode, this means that the controller outputs the fan speed 2 signal instead of the fan speed 3 signal. **3 speeds:** All 3 fan speed signals are used (default setting).
EC fan starts when demand exceeds (%)	Auto	The fan starts when this heating or cooling demand is exceeded.
Limit maximum EC fan speed to (%)	Auto and manual	In auto mode, the maximum fan speed is set by this value. In manual mode, the maximum fan speed is set by this value, and each fan speed is defined as: ✓ Fan speed 1 = 0.33 * this value ✓ Fan speed 2 = 0 67 * this value ✓ Fan speed 3 = 1 * this value

Figure 3-32 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.

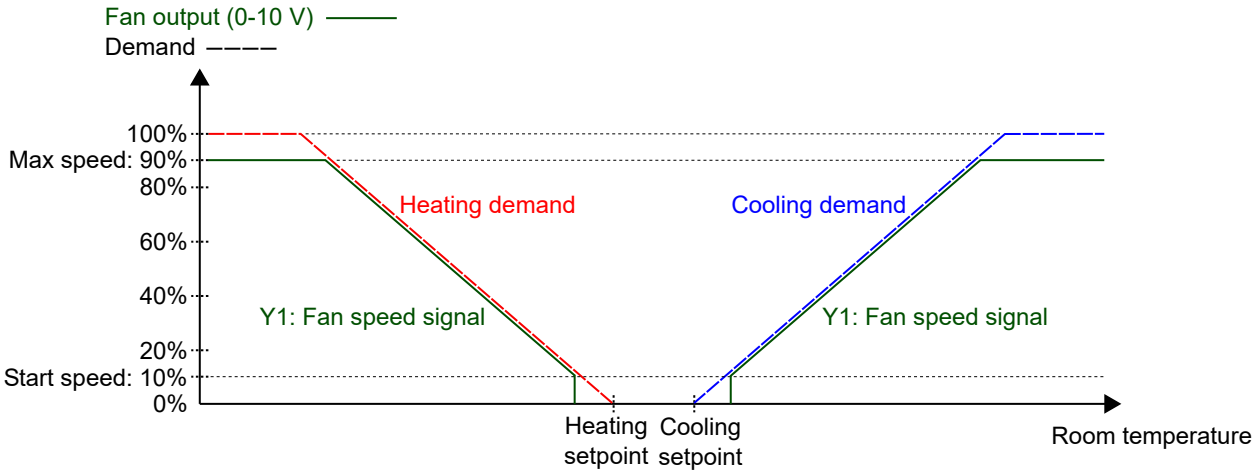


Figure 3-32 EC fan control behaviour in auto mode.

Figure 3-33 illustrates the EC fan control behaviour in manual mode when a 90% maximum limit is set for the fan speed output signal.

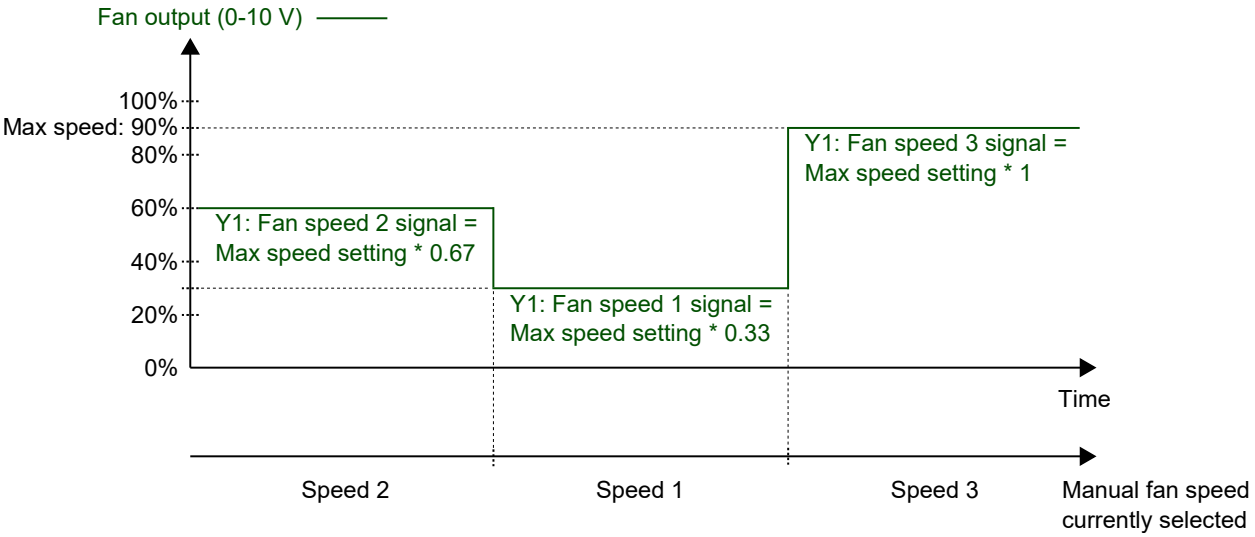


Figure 3-33 EC fan control behaviour in manual mode (fan speed 1, 2, or 3).

3.5.2 3-speed fan control

The 3-speed fan control function is enabled and the 3-speed fan control configuration settings are shown in Application tool when any of the configuration values listed in *Table 3-23* are configured on a controller output.

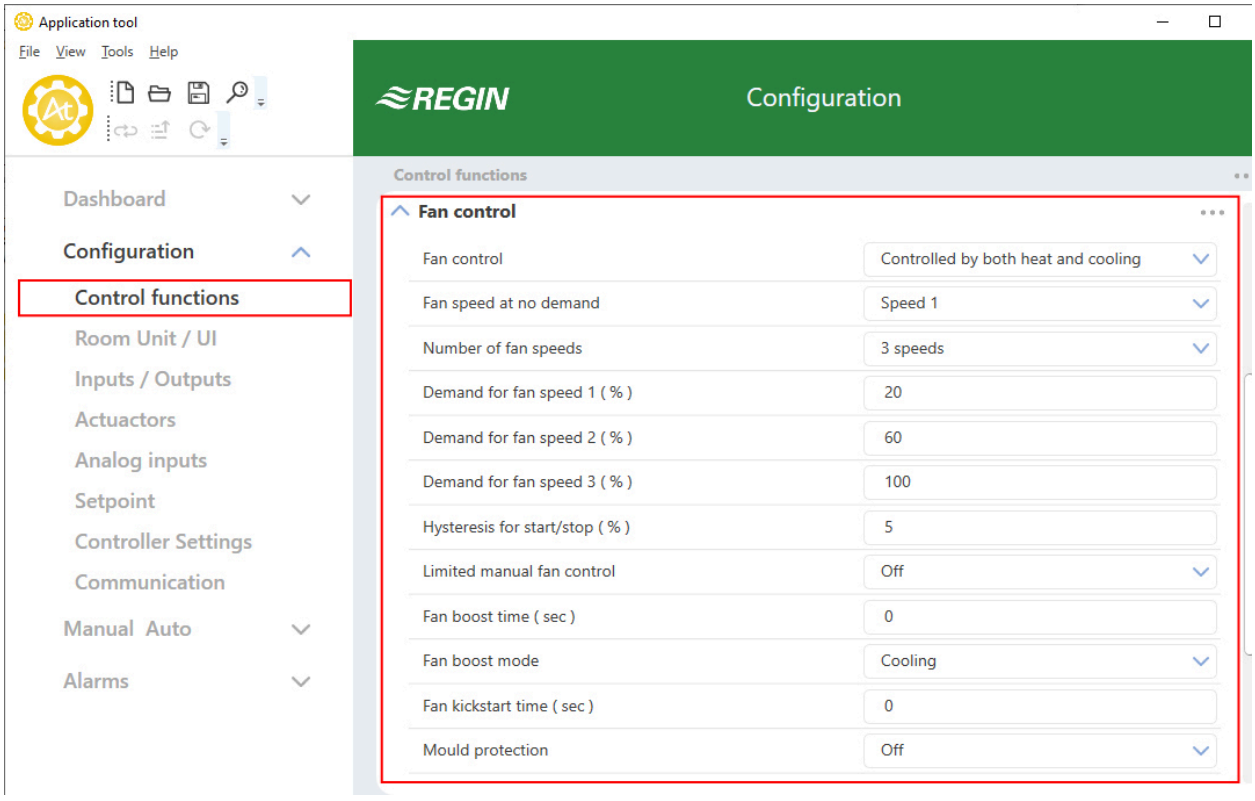


Figure 3-34 3-speed fan control configuration settings in Application tool.

The controller outputs 3 fan speed signals, Y1, Y2, and Y3, that are configured on the controller outputs by using the values listed in *Table 3-23*.

In auto mode, the Y1, Y2, or Y3 signal is active when the current heating or cooling demand is higher than the corresponding *Demand for fan speed [nr] (%)* configuration setting, as illustrated in *Figure 3-35*.

In manual mode, the Y1, Y2, and Y3 signals are independent of the current heating or cooling demand. Instead, each fan speed signal is active when the corresponding fan speed is selected in the controller or set via communication, as illustrated in *Figure 3-36*.

Table 3-23 3-speed fan control configuration values and controller output types.

Output signal	Controller output configuration value	Controller output type
Y1	Fan speed 1	Digital
Y2	Fan speed 2	Digital
Y3	Fan speed 3	Digital

Table 3-24 3-speed fan control configuration settings.

Configuration setting	Fan mode applicability	Description
Fan control	Auto	**Disabled:** Fan control in auto mode is disabled (default setting). **At cooling demand:** Fan control in auto mode is active at cooling demand. **At heating demand:** Fan control in auto mode is active at heating demand. **At heating and cooling demand:** Fan control in auto mode is active at both heating and cooling demand.
Number of fan speeds	Auto and manual	**None:** Fan control in auto and manual mode is disabled. **1 speed:** Only the fan speed 1 signal is used. In auto mode, this means that the controller outputs the fan speed 1 signal instead of the fan speed 2 and 3 signals. **2 speeds:** Only the fan speed 1 and 2 signals are used. In auto mode, this means that the controller outputs the fan speed 2 signal instead of the fan speed 3 signal. **3 speeds:** All 3 fan speed signals are used (default setting).
Demand for fan speed 1 (%)	Auto	The fan speed 1 signal is active when the current heating or cooling demand is higher than this value and lower than the value set by the *Demand for fan speed 2 (%)* setting.
Demand for fan speed 2 (%)	Auto	The fan speed 2 signal is active when the current heating or cooling demand is higher than this value and lower than the value set by the *Demand for fan speed 3 (%)* setting.
Demand for fan speed 3 (%)	Auto	The fan speed 3 signal is active when the current heating or cooling demand is higher than this value.
Hysteresis for fan speed decrease (%)	Auto	Specifies the hysteresis for when a decrease in fan speed occurs. For example, if the *Demand for fan speed 2 (%)* setting is 60% and this setting is 5%, the fan speed 2 signal is deactivated when the heating or cooling demand decrease below 60-5 = 55%. At the same time, the fan speed 1 signal is activated.
Fan speed at no demand	Auto	**Stop:** The fan speed 1 signal is inactive when the heating or cooling demand is lower than the value specified by the *Demand for fan speed 1 (%)* setting (default setting). **Fan speed 1:** The fan speed 1 signal is active also when the heating or cooling demand is lower than the value specified by the *Demand for fan speed 1 (%)* setting.

Figure 3-35 illustrates the 3-speed fan control behaviour in auto mode when no hysteresis for fan speed decrease is applied, the fan speed 1, 2, and 3 signals are configured on digital outputs 3, 4, and 5, and the *Demand for fan speed [nr] (%)* settings are set to 20, 60, and 100, respectively.

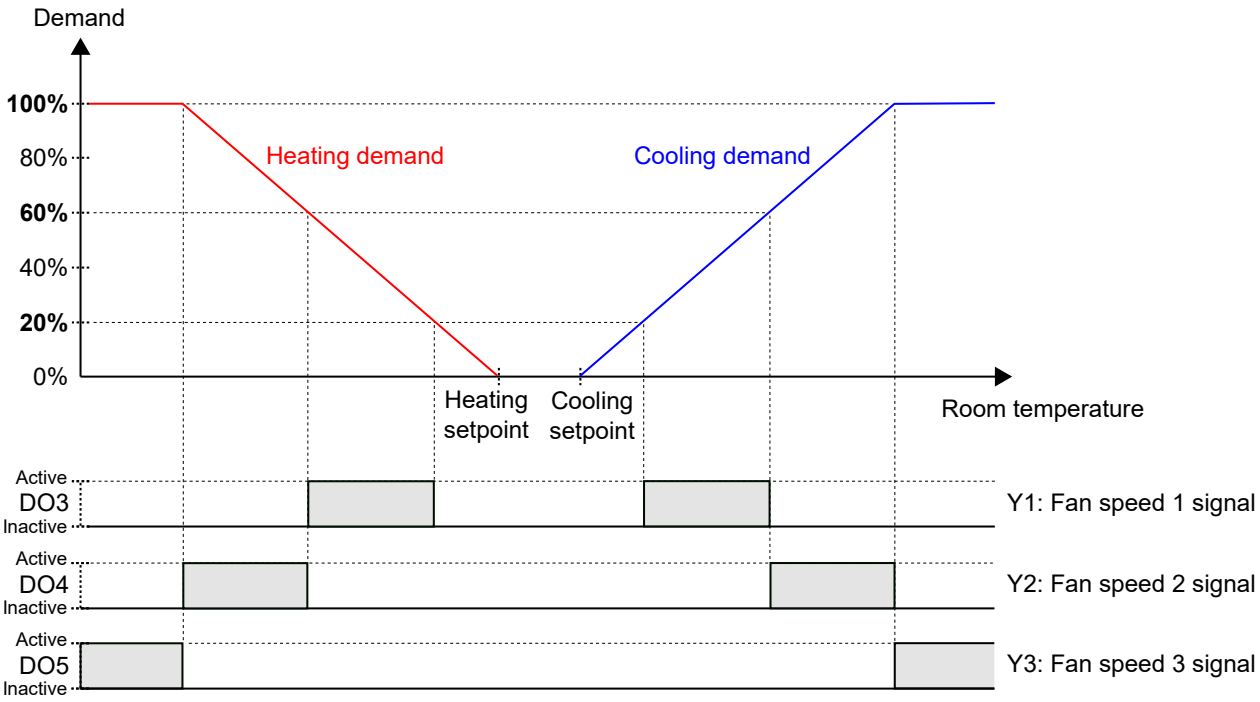


Figure 3-35 3-speed fan control behaviour in auto mode.

Figure 3-36 illustrates the 3-speed fan control behaviour in manual mode when the fan speed 1, 2, and 3 signals are configured on digital outputs 3, 4, and 5.

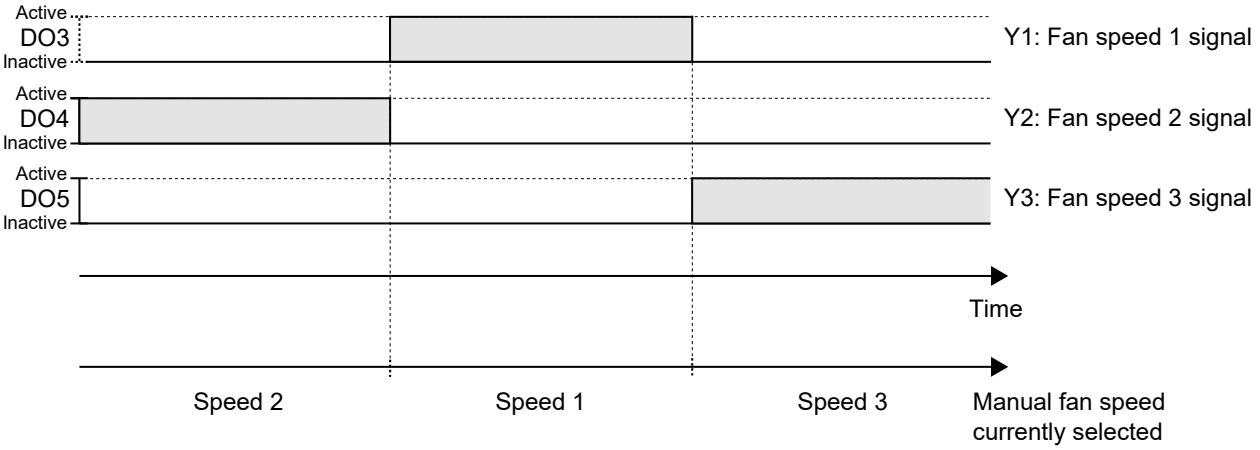


Figure 3-36 3-speed fan control behaviour in manual mode (fan speed 1, 2, or 3).

3.5.3 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 occupancy (on/off) button in the controller is pressed, or 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* pane in Application tool.

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, see section *3.8*, or when the controller changes to bypass state, see section *3.4*. The fan boost time is independent of the *Time in bypass state* configuration setting.

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 3-25*.

Table 3-25 Fan boost configuration settings.

Configuration setting	Description
Fan boost mode	**At cooling demand:** Fan boost is active at cooling demand. **At heating demand:** Fan boost is active at heating demand. **At heating and cooling demand:** Fan boost is active at both heating and cooling demand (default setting).
Fan boost time (sec)	The period of time (in seconds) that the fan boost function is active.

Figure 3-37 illustrates how the fan boost function can be used to provide a perceived cooling effect until the cooling distribution from the cooling valve establishes.

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.

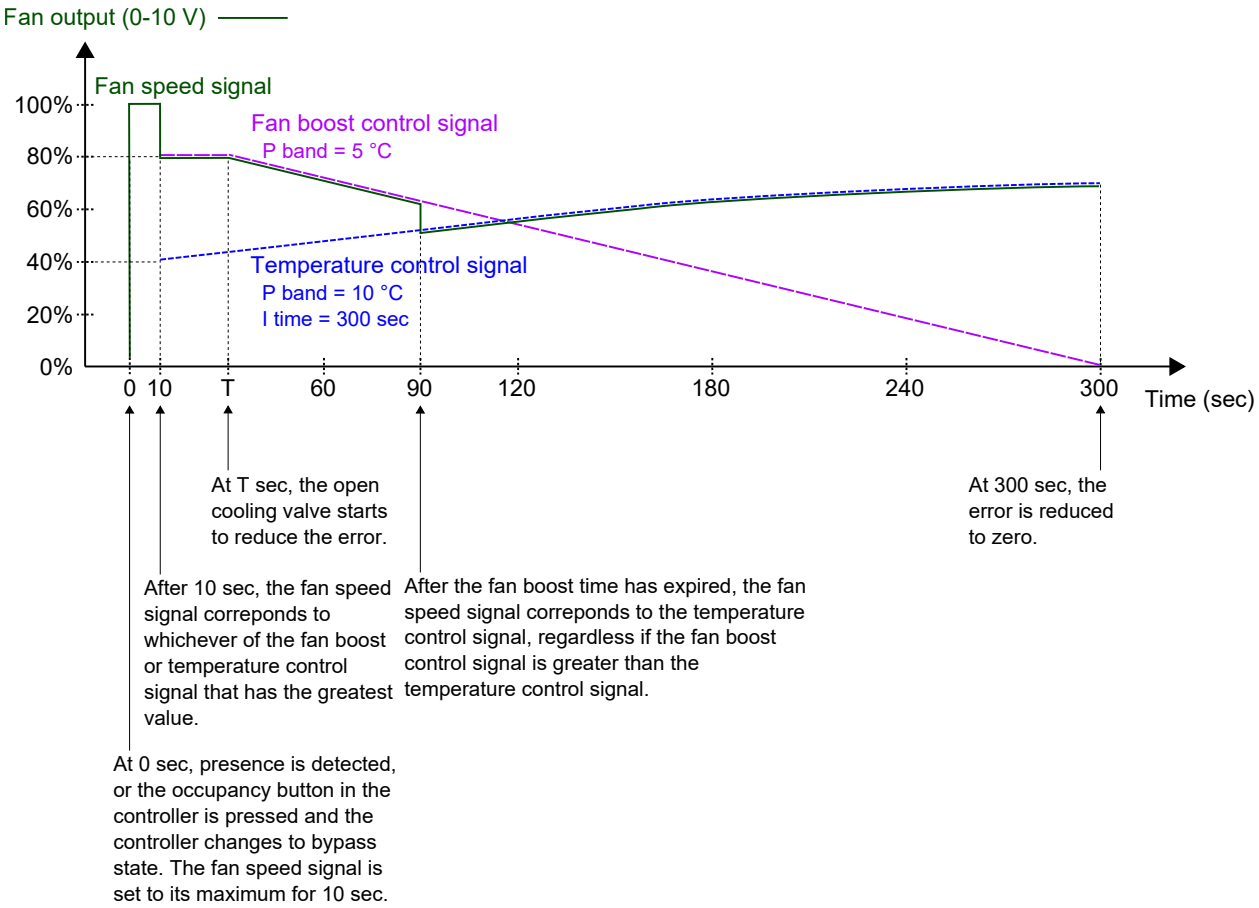


Figure 3-37 An example of fan boost control behaviour for an EC fan in auto mode, which provides a perceived cooling effect until the cooling distribution from the cooling valve establishes. The P-band for the fan boost controller has a lower value (higher gain) than the P-band for the temperature controller.

3.5.4 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 cause 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, auto or manual mode.

The fan kick-start configuration settings are described in *Table 3-26*.

Table 3-26 Fan kick-start configuration settings.

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

3.5.5 Mould protection

Mould protection is a control function that can be used to ensure that the EC or 3-speed fan will always run at least at Speed 1.

When set the fan is completely independent from state, 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/grow.

The mould protection function is enabled by setting *Mould protection* to O*n*.

3.6 VAV control

The variable air volume (VAV) control function is used to manage the behaviour for a damper that is controlled by the analog 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 *3.9*.

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 for VAV output at heating demand* configuration setting is greater than zero.

The VAV control function is enabled and the VAV control configuration settings in Application tool are shown when one of the following controller modes is selected:

- ✓ Heating + VAV
- ✓ Cooling + VAV
- ✓ VAV
- ✓ Heating + Cooling + VAV
- ✓ VAV + VAV

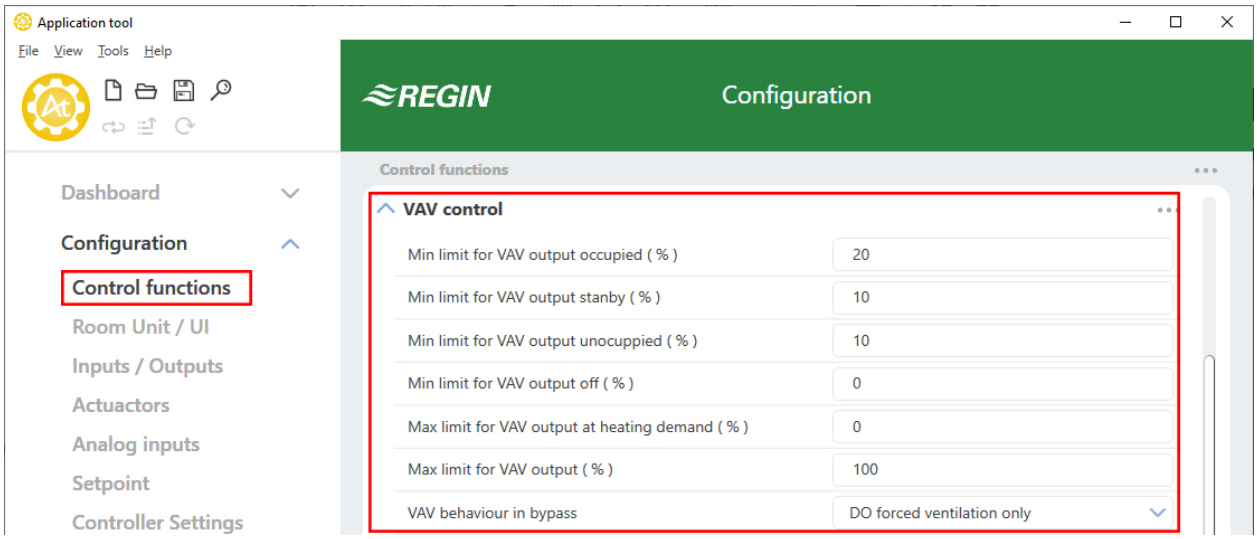


Figure 3-38 VAV control configuration settings in Application tool.

The VAV control configuration settings are described in *Table 3-27*.

Table 3-27 VAV control configuration settings.

Configuration setting	Description
Min limit for VAV output, occupied (%)	Specifies the minimum limit for the VAV output signal when the controller is in the occupied controller state.
Min limit for VAV output, standby (%)	Specifies the minimum limit for the VAV output signal when the controller is in the standby controller state.
Min limit for VAV output, unoccupied (%)	Specifies the minimum limit for the VAV output signal when the controller is in the unoccupied controller state.
Min limit for VAV output, off (%)	Specifies the minimum limit for the VAV output signal when the controller is in the off controller state.
Max limit for VAV output at heating demand (%)	This setting is only applicable for the following controller modes: ✓ Heating + VAV ✓ Heating + Cooling + VAV When this value is greater than zero, the VAV output signal follows the heating output signal to a maximum that is specified by this value.
Max limit for VAV output (%)	Specifies the maximum limit for the VAV output signal.
VAV behaviour in bypass	✓ **DO forced ventilation only** Digital output Forced Ventilation sets to active. ✓ **VAV fully open** Analog Output VAV sets to fully open, 10V.

Figure 3-39 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.

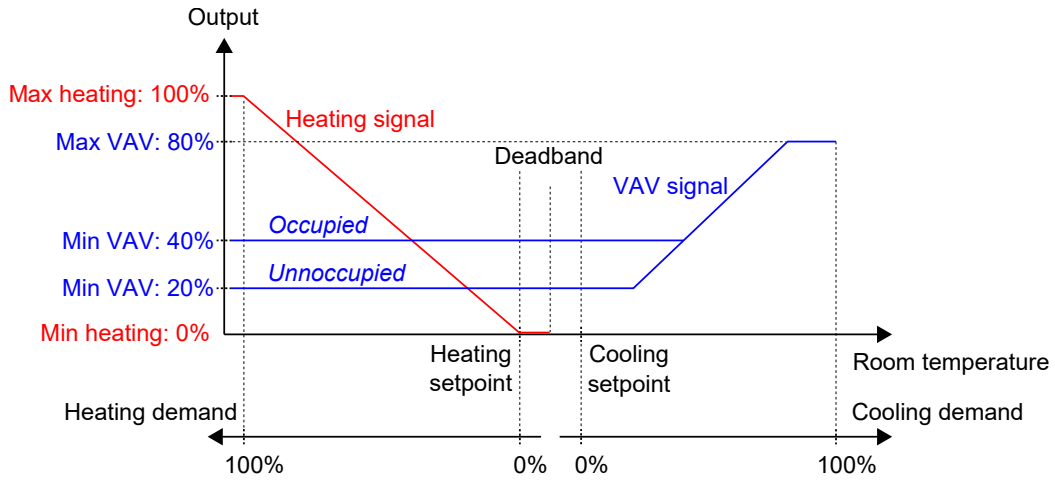


Figure 3-39 VAV control behaviour based on cooling demand when a maximum limit is set, and minimum limits for the occupied and unoccupied controller states are set.

Figure 3-40 illustrates the control behaviour for the Heating + VAV controller mode when the *Max 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%).

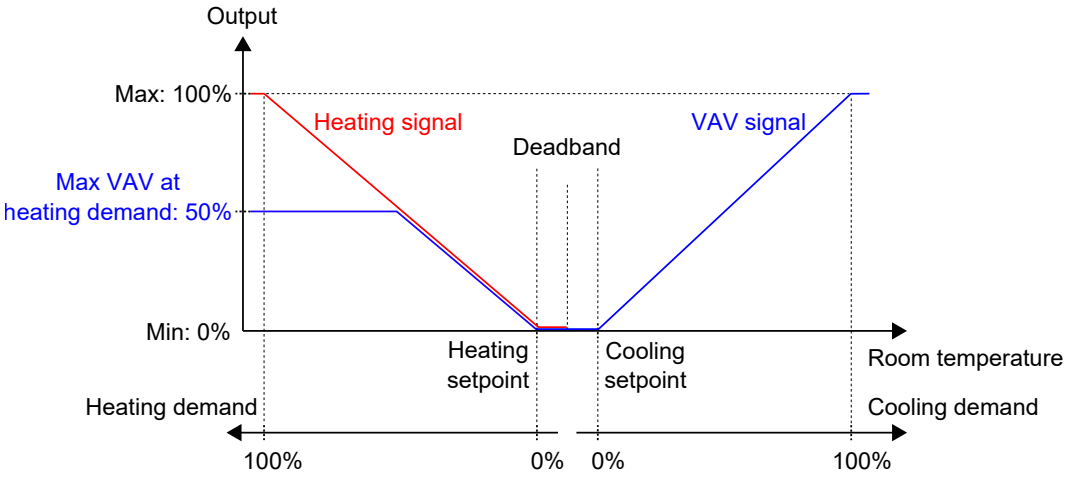


Figure 3-40 Control behaviour for the Heating + VAV controller mode when the maximum VAV output on heating demand setting is applied.

3.7 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 bypass state and the conditions specified by the *Forced ventilation* setting. See section *3.4* for information about bypass state.

When the forced ventilation function is active, a digital controller output that is configured with the **Forced ventilation** value is active, and the analog VAV output signal is set to its maximum for the controller modes that include a VAV sequence. Optionally, for the Heating + Cooling + VAV controller mode, 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 are shown in *Figure 3-41*.

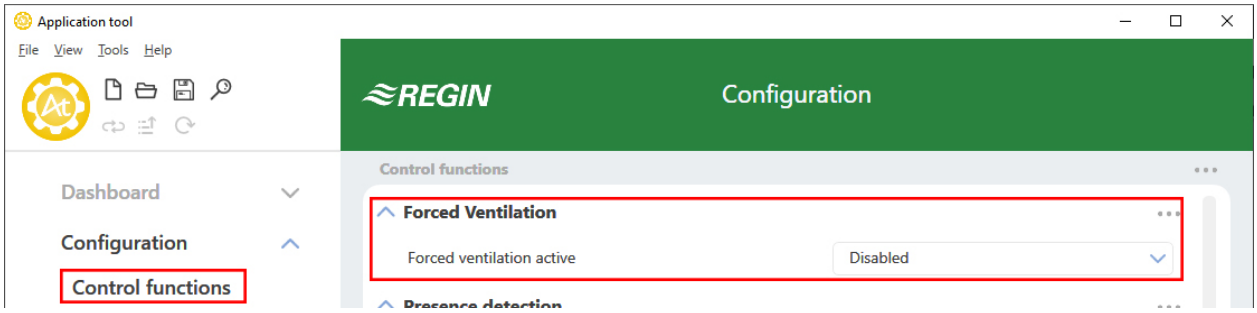


Figure 3-41 Forced ventilation configuration settings in Application tool.

The forced ventilation configuration settings are described in *Table 3-28*.

Table 3-28 Forced ventilation configuration settings.

Configuration setting	Description
Forced ventilation active	This setting is used to select if forced ventilation should be activated when the controller is in heating or cooling mode, or in both modes. 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 setting). **On 100% heat or cool output:** Forced ventilation is activated when the heating or cooling output signal is at its maximum and the controller is in bypass state. **On 100% cool output:** Forced ventilation is activated when the cooling output signal is at its maximum and the controller is in bypass state.

Figure 3-42 illustrates digital output signal behaviour for the Heating + VAV controller mode when no maximum or minimum limits are set for the output signals, the controller is in bypass state, and the following configuration setting are applied:

✓ *Forced ventilation active*: **On 100% heat or cool output**

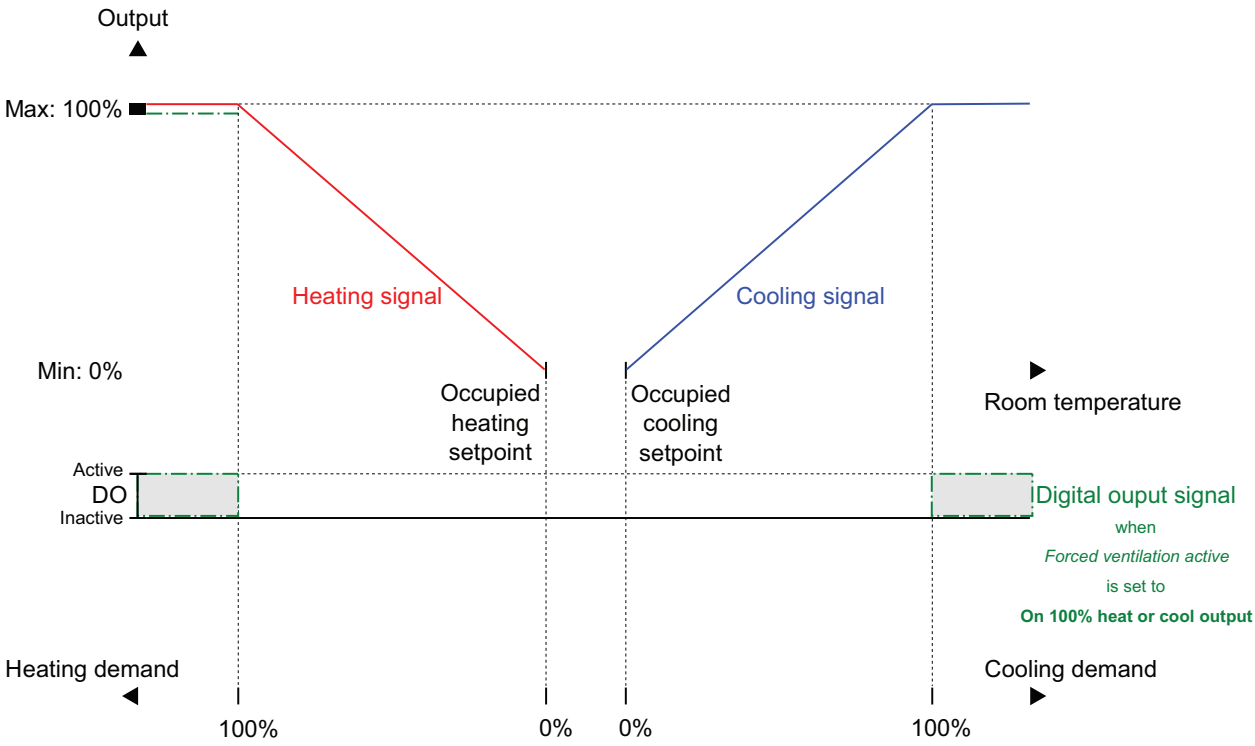


Figure 3-42 Example of forced ventilation control behaviour for the Heating + VAV controller mode when the controller is in bypass state.

3.8 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. See section *3.4* for information about controller states, and controller state changes when using presence detection.

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 analog controller input. Regin's RCC-C3DOCS/RCC-C3HCS controllers have a built-in CO_2 sensor. When the RCC-C3DOCS/RCC-C3HCS units are used, the controller recognizes the built-in CO_2 sensor automatically, and no configuration is needed.

The controller checks for presence continuously when the controller is in the state specified by the *Preset controller state* setting, see section *Presence detection and occupancy (on/off) button on controller*.

The presence detection function is enabled and the presence detection configuration settings are shown in Application tool when any of the configuration values listed in *Table 3-29* are configured on a controller input.

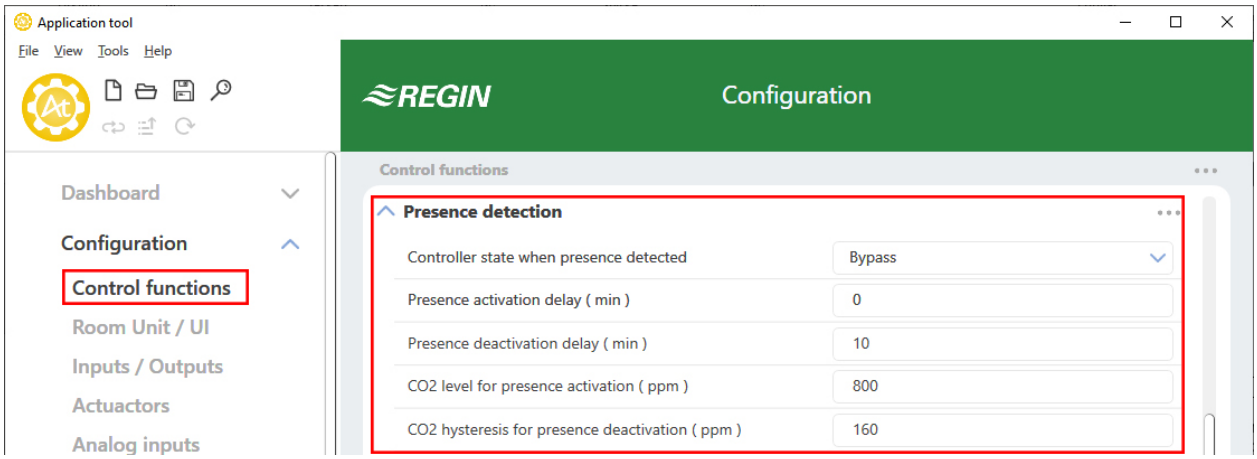


Figure 3-43 Presence detection configuration settings in Application tool.

Table 3-29 Presence detection configuration values and controller input types.

Controller input configuration value	Controller input type
CO2 sensor	Analog
Presence detector	Digital

The presence detection configuration settings are described in *Table 3-30*.

Table 3-30 Presence detection configuration settings.

Configuration setting	Description
Controller state when presence detected	One of the following controller states is configured as active when presence is detected: ✓ **Occupied** ✓ **Bypass** (default setting)
Presence activation delay (min)	The controller checks for presence continuously when the controller is in the state specified by the *Preset controller state* setting. When presence is detected, a timer starts and the controller waits this delay time (in minutes) before changing to the state specified by the *Controller state when presence detected* 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.
Presence deactivation delay (min)	The controller checks for presence continuously when the controller is in the presence detected controller state. 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 *Preset controller 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.
CO2 level for presence activation (ppm)	Presence is detected via the CO_2 sensor when the measured CO_2 level exceeds this value.
CO2 hysteresis for presence deactivation (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.

3.9 CO_2 control

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 can be used together with the controller modes that include a VAV sequence:

- ✓ Heating + VAV
- ✓ Cooling + VAV
- ✓ VAV
- ✓ Heating + Cooling + VAV
- ✓ VAV + VAV

CO_2 control is managed via the VAV control function, by applying the *VAV control* configuration setting, see section *3.6*.

The CO_2 sensor is connected to and configured on an analog controller input by using the value listed in *Table 3-31*. Regin's RCC-C3DOCS and RCC-C3HCS controllers have a built-in CO_2 sensor. When the RCC-C3DOCS or RCC-C3HCS unit is used, the controller recognizes the built-in CO_2 sensor automatically, and no configuration is needed.

Table 3-31 CO_2 control configuration value and controller input type.

Configuration value	Controller input type
CO2 sensor	Analog

CO_2 control provides a specific setting, listed in *Table 3-32*, that is only applicable for the controller modes that include a VAV sequence. This setting is located in the *Configuration -> Control functions -> Controller mode* pane in Application tool, and is shown when an applicable controller mode is selected.

Table 3-32 CO_2 control configuration setting.

Configuration setting	Description
VAV sequence controlled by	The VAV output signal is controlled by the Cooling demand or CO_2 level, the highest demand controls the output.

Figure 3-44 illustrates the control behaviour for CO_2 control when a minimum limits 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.

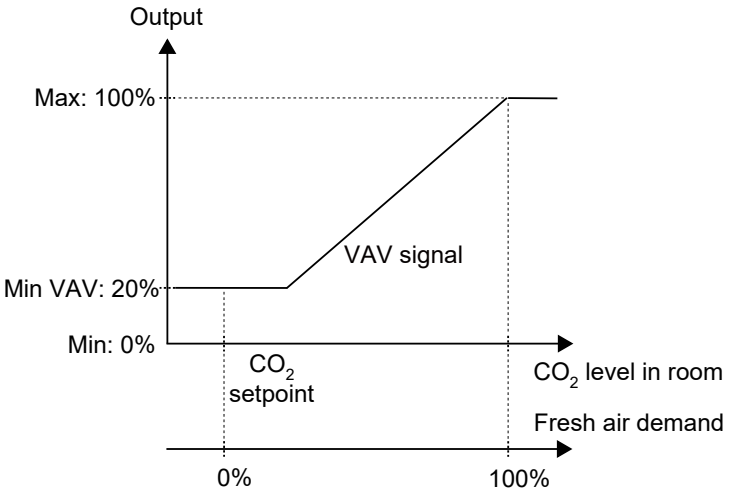


Figure 3-44 CO_2 control behaviour.

3.10 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 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.

At Heat state 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 configurable (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 centre point value when the PI-controller reaches 0% output.

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

Condense At condense (Condense input, CI is high), the cooling control is blocked and the controller is set in neutral position. The heating control will work as normal and will not be blocked.

Heating + Cooling + VAV: For control mode Heating + Cooling + VAV, the valve will act on the cool signal when the PI-controller output has been split in cool state. The picture below shows a simplified view of an AO configured for the 6-way valve with the controller in controller mode Heating + Cooling + VAV. The output acts normal to the PI-controller at heat state and travel from 5 V to 0 V as the PI-controller goes from 0% output to 100% output, but in cool state the output travels from 5 V to 10 V while the PI-controller goes from 0% to 50% output. The 50% to 100% output from the PI-controller then is mapped to a VAV output.

The modes supported by the 6 way valve are:

- ✓ Heating + Cooling
- ✓ Heating + Cooling + VAV
- ✓ Heating + Cooling + VAV and forced ventilation
- ✓ Heating + Cooling + VAV

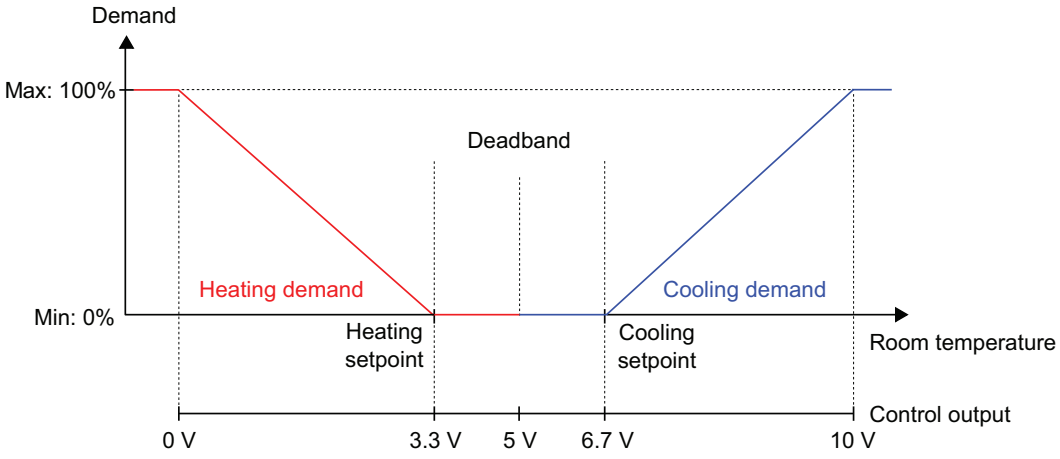


Figure 3-45 Simplified view of an AO configured for the 6-way valve with the controller in controller mode Heating + Cooling + VAV

3.11 Extra zone

The extra zone function is intended to control the underfloor heating in an extra zone, e.g. 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), i.e. it always listens to the main rooms 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 3-33 Extra zone configuration settings*.

The Extra Zone acts as a heating controller and regulates based on it's own heating setpoint and the Extra zone temperature sensor.

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

The extra zone function is enabled in Application tool for use with any of the following controllers:

- ✓ RC-C3
- ✓ RC-C3O
- ✓ RC-C3H
- ✓ RCC-C3DOC
- ✓ RCC-C3DFOC
- ✓ RCC-C3DOCS
- ✓ RCC-C3HCS

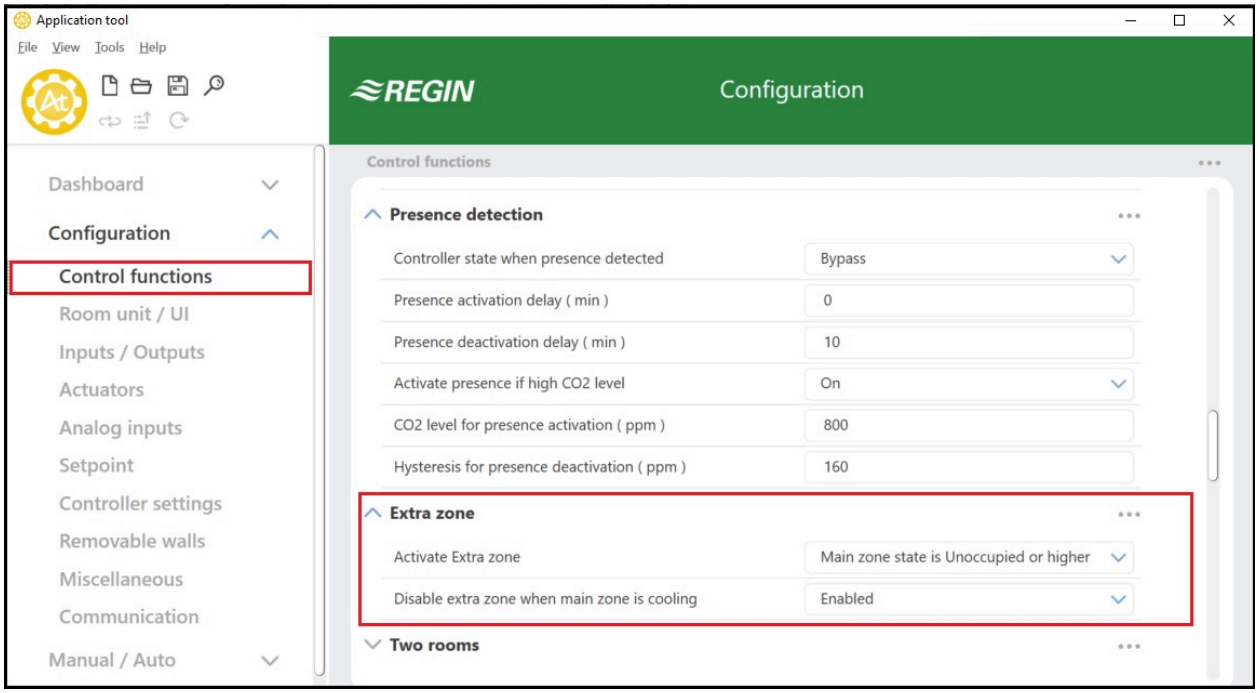


Figure 3-46 Extra zone configuration settings in Application tool.

The extra zone configuration settings are described in *Table 3-33*.

Input signal	Controller input type
Extra zone temperature	Analogue

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

Table 3-33 Extra zone configuration settings.

Configuration setting	Description
Activate Extra zone	One of the following controller states is configured as active when presence is detected: ✓ **Disabled** (default setting) ✓ **Main zone state is Bypass** ✓ **Main zone state is Occupied or higher** ✓ **Main zone state is Standby or higher** ✓ **Main zone state is Unoccupied or high** ✓ **Always**

3.12 Cascade control

The analogue inputs can be configured for use with a supply air temperature limitation sensor. The controller will then automatically switch to cascade control.

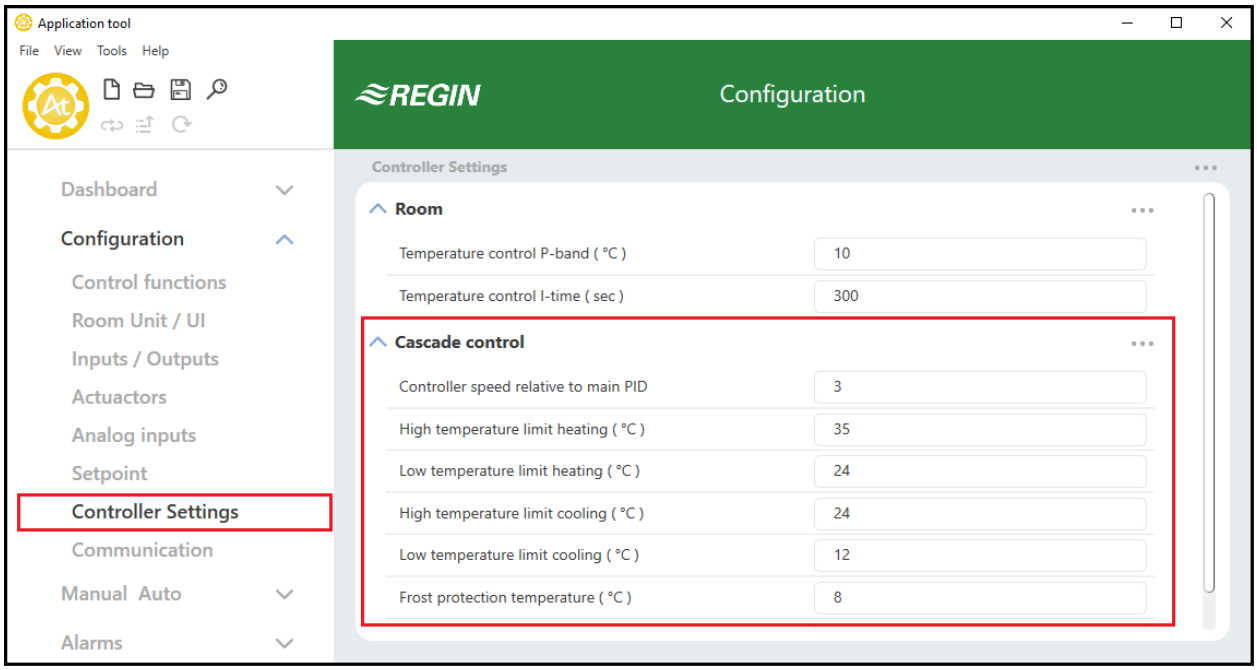


Figure 3-47 Cascade control configuration settings in Application tool.

A room controller will then work together with a supply air temperature controller using cascade control, resulting in a calculated supply air temperature maintaining the room temperature setpoint.

The cascade factor consists of the supply air controller being faster than the room controller. The cascade factor in Regio Midi acts as a divisor which affects both the P-band and I-time.

The cascade control settings are described in *Table 3-34*.

Table 3-34 Cascade control settings.

Configuration setting	Description
Controller speed relative to main PID	The cascade factor
High temperature limit heating (°C)	Highest allowed supply setpoint in heating mode, settable range 10…50 °C
Low temperature limit heating (°C)	Lowest allowed supply setpoint in heating mode, settable range 10…50 °C
High temperature limit cooling (°C)	Highest allowed supply setpoint in cooling mode, settable range 10…50 °C
Low temperature limit cooling (°C)	Lowest allowed supply setpoint in cooling mode, settable range 10…50 °C
Frost protection temperature (°C)	The temperature to activate frost protection control.

Example: If the cascade factor is 3 and the room controller has a P-band of 10 °C and an I-time of 300 s, the supply air controller will receive a P-band of 3 °C and an I-time of 100 s. The supply air controller will therefore be 3 times as fast as the room controller.

4 Models

There are several different Midi room controllers. They can be divided according to type of control in basic models, models for fan control and models for three-point control.

4.1 Model overview and user interface description

Model	Description
RC…	Basic models control analogue actuators, thermal actuators or On/Off actuators with spring return.
RCC…	Basic models with built-in CO_2 sensor. The units control analogue actuators, thermal actuators or On/Off actuators with spring return.
…-C-models	Models with communication. Communication via EXOline, Modbus or BACnet. Note that BACnet communication only is available for models with display.
…D-models	Models with display.
…F-models	Like basic models, models for fan control (…F-models) control analogue, thermal and spring return actuators. With the exception of RC-C3DFOC, they also have a button/fan switch and three digital outputs for control of a three-speed fan (fan coil, etc.). RC-C3DFOC has EC fan control on analogue output UO3.
…H-models	Models with hidden setpoint
…O-models	Models with occupancy button
…T-models	Models for three-point control (…T-models) have four digital outputs for control of two three-point actuators.
…C-models	C at the end. Models with input for external CO_2 sensor.
…3-models	The …3-models have an additional output for control of either an On/Off damper, analogue forced ventilation damper, an analogue EC-fan or an analogue third damper.

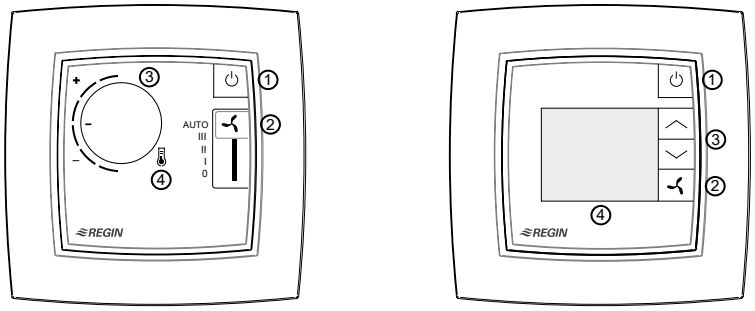
- ✓ **LEDs or display**
  For providing status information.
  Models without display are equipped with LEDs that indicate the current controller state, and if the controller is heating or cooling. For models with display, all types of indications are provided in the display.
- ✓ **Occupancy (on/off) button**
  For putting the room HVAC system in a comfort or energy saving mode, see section *3.4*, or for improving the air quality in the room through a temporary increase in airflow (if forced ventilation is activated, see section *3.7*).
- ✓ **Up/down buttons or knob**
  For performing a setpoint adjustment.
- ✓ **Fan speed button or switch**
  For selecting a fan speed. That is, auto speed or manual (off, low, medium, or high) speed.
- ✓ **Temperature and CO_2 sensor**
  For measuring the temperature or CO_2 level in the room.
  All models are equipped with a built-in temperature sensor, and the RCC-C3DOCS and RCC-C3HCS models include a built-in CO_2 sensor.

Article	Occupancy button / Forced ventilation	3-step fan control	EC fan control	Setpoint knob	Hidden setpoint	Output	Display	Built-in CO_2 sensor	Connection for CO_2 sensor
RC-C3	-	-	X	X	-	0…10 V DC or on/off	-	-	-
RC-C3H	-	-	X	-	X	0…10 V DC or on/off	-	-	-
RC-C3O	X	-	X	X	-	0…10 V DC or on/off	-	-	-

Article	Occupancy button / Forced ventilation	3-step fan control	EC fan control	Setpoint knob	Hidden setpoint	Output	Display	Built-in CO_2 sensor	Connection for CO_2 sensor
RC-C3DOC	X	-	X	-	-	0…10 V DC or on/off	X	-	X
RC-C3DOC-BLACK	X	-	X	-	-	0…10 V DC or on/off	X	-	X
RC-CF	-	X	-	X	-	0…10 V DC or on/off	-	-	-
RC-CFO	X	X	-	X	-	0…10 V DC or on/off	-	-	-
RC-CDFO	X	X	-	-	-	0…10 V DC or on/off	X	-	-
RC-C3DFOC	X	-	X	-	-	0…10 V DC or on/off	X	-	X
RC-CT	-	-	-	X	-	3-point	-	-	-
RC-CTH	-	-	-	-	X	3-point	-	-	-
RC-CTO	X	-	-	X	-	3-point	-	-	-
RC-CDTO	X	-	-	-	-	3-point	X	-	-
RCC-C3DOCS	X	-	X	-	-	0…10 V DC or on/off	X	X	X
RCC-C3DOCS-BLACK	X	-	X	-	-	0…10 V DC or on/off	X	X	X
RCC-C3HCS	-	-	X	-	-	0…10 V DC or on/off	-	X	X

4.2 Model overview and user interface description

The Regio controller user interface is shown in *Figure 4-1*.



Controllers without display Controllers with display

Figure 4-1 Regio controller models without and with display

Table 4-1 describes the buttons, switch, knob, and LEDs that are available on Regio controllers with and without display.

Table 4-1 Button, switch, knob, and LED descriptions for Regio controllers with and without display.

Controllers without display		Controllers with display	
№	**Description**	**№**	**Description**
1	Occupancy (on/off) button with LED that indicates the controller state	1	Occupancy (on/off) button
2	Fan speed switch	2 (*)	Fan speed button
3	Setpoint adjustment knob	3	Up/down buttons for setpoint adjustment
4	LED in temperature icon that indicates if the controller is heating or cooling	4	Display

4.3 Controllers without display

Figure 4-2 shows all the different controller models without display.

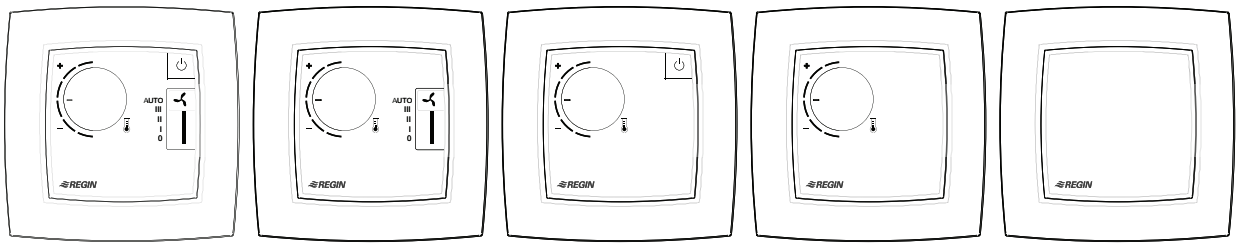


Figure 4-2 Controller models without display.

4.3.1 Selecting a fan speed

A fan speed is selected via the fan speed switch.

When the controller is in the state specified by the *Shutdown controller state* setting the fan speed is always auto, regardless of what is selected via the controller.

4.3.2 Performing a setpoint adjustment

A setpoint adjustment is performed by turning the knob.

4.3.3 Putting the room HVAC system in a comfort/energy saving mode or increasing the airflow

A short press (<5 s) on the occupancy (on/off) button puts the room HVAC system in comfort mode (first in bypass controller state, and then by default in occupied controller state), and increases the airflow temporarily (if forced ventilation is activated).

A long press (>5 s) on the occupancy (on/off) button puts the room HVAC system in energy saving mode (by default in unoccupied controller state).

4.3.4 LED indications

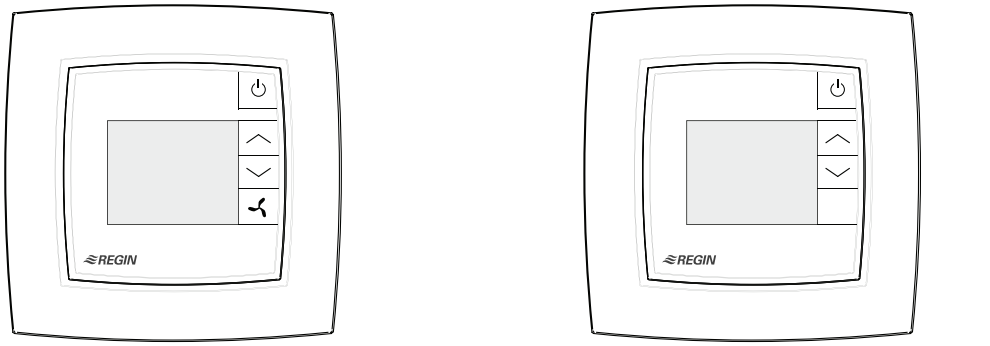
The LEDs indicate the current controller state, and if the controller is heating or cooling. *Table 4-2* describes the LED behaviour.

Table 4-2 LED indication descriptions.

LED location	LED behaviour
In occupancy (on/off) button	**Blinking slowly:** The controller is in bypass state. **Blinking:** The controller is in standby state. **Solid:** The controller is in occupied state. **Off:** The controller is in unoccupied or off state.
In temperature icon in the centre of the controller	**Red solid:** The controller is in heating mode and the demand is greater than zero. **Blue solid:** The controller is in cooling mode and the demand is greater than zero. **Off:** The demand is zero.

4.4 Controllers with display

Figure 4-3 shows all the different controller models with display.



RC-CDFO, RC-C3DFOC RC-C3DOC, RC-CDTO, RCC-C3DOCS

Figure 4-3 Controller models with display.

4.4.1 Selecting a fan speed

This instruction is only applicable for the RC-CDFO and RC-C3DFOC models.

To select a fan speed:

1. Press the fan speed button to enter fan speed selection mode. The fan indication in the display starts to blink.
2. Press the fan speed button to scroll between the auto fan speed selection and the available (as configured in the controller) manual fan speed selections.
3. Press the occupancy (on/off) button to make the selection, or wait 10 seconds for the selection to be made automatically. After the selection has been made, the fan indication stops blinking.

When the controller is in the state specified by the *Shutdown controller state* setting the fan speed is always auto, regardless of what is selected via the controller.

4.4.2 Performing a setpoint adjustment

For controllers with display, a setpoint adjustment can be performed when the controller is in bypass, occupied, or standby state.

To perform a setpoint adjustment:

1. Press the up or down button to enter setpoint adjustment mode. The setpoint adjustment and up/down arrow indications in the display start to blink.

2. Press the up or down button to increase or decrease the setpoint adjustment, respectively. The selected setpoint adjustment value is shown in the display.
3. Press the occupancy (on/off) button to make the selection, or wait 5 seconds for the selection to be made automatically. After the selection has been made, the setpoint adjustment and up/down arrow indications stop blinking.

4.4.3 Putting the room HVAC system in a comfort/energy saving mode or increasing the airflow

A short press (<5 s) on the occupancy (on/off) button puts the room HVAC system in comfort mode (first in bypass controller state, and then by default in occupied controller state), and increases the airflow temporarily (if forced ventilation is activated).

A long press (>5 s) on the occupancy (on/off) button puts the room HVAC system in energy saving mode (by default in unoccupied controller state).

4.4.4 Display indications

The display indications are shown in *Figure 4-4*.

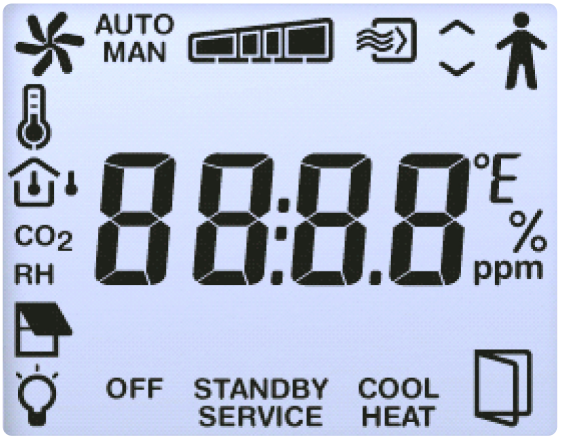


Figure 4-4 Indications in controller display.

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

Table 4-3 Display indication descriptions.

Indication	Description
	Occupancy indication is shown when the controller is in occupied or bypass state.
STANDBY	Controller is in standby state.
OFF	Controller is in unoccupied or off state.
	Room temperature is shown.
CO_2	CO_2 level in room is shown.
	**Solid:** Setpoint or setpoint adjustment is shown according to the current *View mode* setting. **Blinking:** Setpoint adjustment is in progress by using the up and down buttons.

Table 4-3 Display indication descriptions. (continued)

Indication	Description
	Up/down arrows are blinking alternatively when setpoint adjustment is in progress.
	**Turning:** The fan is active. **Blinking:** Fan speed selection is in progress.
AUTO	EC or 3-speed fan control in auto or manual mode. The fan speed is shown in the following ways: When **3 speeds** is configured in the controller as number of used fan speeds, one of these indications is shown:  No fan speed Fan speed 1 Fan speed 2 Fan speed 3 When **2 speeds** is configured in the controller as number of used fan speeds, one of these indications is shown:  No fan speed Fan speed 1 Fan speed 2 When **1 speed** is configured in the controller as number of used fan speeds, one of these indications is shown:  No fan speed Fan speed 1
MAN	
HEAT	Controller is in heating mode and the demand is greater than zero.
COOL	Controller is in cooling mode and the demand is greater than zero.
	Forced ventilation is active.
SERVICE	Controller is in service mode, in which the parameter menu can be accessed.
	Room window is open.
	Lighting is active.
	Sun blind is out.
RH	Relative humidity level in room is shown temporarily.
	Outdoor temperature is shown temporarily.

4.4.5 Parameter menu

It is possible to set different parameter values in a parameter menu. The parameter menu is accessed by simultaneously holding the INCREASE and DECREASE buttons pressed for about 5 seconds and then pressing the INCREASE button twice. The Service indication will be displayed.

The display will initially show the parameter number "1". Use the INCREASE and DECREASE buttons to scroll between parameters.

Press the Occupancy button to select the desired parameter. The parameter number will be replaced by the parameter value. The value can be changed using the INCREASE and DECREASE buttons. If a button is held depressed the value will start scrolling, first slowly and then with increasing speed in 3 – 4 steps with 2 – 3 seconds between steps.

Acknowledge/Regret

To acknowledge and store a set parameter value, press the Occupancy button again, the display then returns to showing the parameter number. To retrieve the original value, i.e. the value before change, press the INCREASE and DECREASE buttons at the same time. The original value is shown on the display.

Return

After a certain time, about 1 minute, or when the INCREASE and DECREASE buttons are pressed at the same time while in the menu, the display returns to the normal view. Exit is shown on the display after the last parameter. The parameter menu is exited by pressing the Occupancy button while in Exit. Pressing on INCREASE goes to the first parameter and pressing on DECREASE goes to the last parameter.

Blocking of buttons

To prevent unauthorised users from accessing important functions, Regio controllers have a built-in function for blocking button access. As seen in the below tables, blocking may take place in different ways. The INCREASE/DECREASE buttons are always blocked/unblocked simultaneously. If the INCREASE/DECREASE buttons are blocked, the parameter menu can still be reached normally. Parameter 108 is used for configuration.

For models without a fan button and configuration options 4-6, the function remains the same as for options 0-3.

Configuration options	Button function
0	No button is active.
1	Only Occupancy button active.
2	Only INCREASE/DECREASE buttons active.
3	Occupancy and INCREASE/DECREASE buttons active.
4	Only fan button active.
5	Occupancy and fan buttons active.
6	INCREASE/DECREASE and fan buttons active.
7	All buttons active.

Configuration options	Occupancy button active	INCREASE/DECREASE buttons active	Fan button active
0			
1	X		
2		X	
3	X	X	
4			X
5	X		X
6		X	X
7	X	X	X

Configuration menu blocking

This function prevents unauthorised access to the configuration menu using the buttons on the front of the device. When the function is active, all buttons will function normally except for the configuration menu no longer being accessible when INCREASE and DECREASE are pressed simultaneously. The function can be activated via the display, Application tool and Modbus. Please note that if the function is activated via the display, re-entering the parameter list via the display will be prevented. The function must then be deactivated using Application tool.

Parameter list

The following parameters can be changed in the parameter menu (FS = Factory setting):

Parameter number	Description	FS
1	Basic heating setpoint	22°C
2	Basic cooling setpoint	24°C
3	Neutral zone at standby, Heating setpoint = Basic sp. heating-3 by default Cooling setpoint = Basic sp.cooling+3 by default	3°C
4	Heating setpoint at Unoccupied	15°C
5	Cooling setpoint at Unoccupied	30°C
6	Frost protection setpoint	8°C
7	P-band for room controller	10°C
8	I-time for room controller	300 s
9	The difference between the temperature in the room and the media temperature for change-over to cooling	3 K
10	The difference between the temperature in the room and the media temperature for change-over to heating	4 K
11	Control mode: 0 =Heating 1 = Heating / Heating 2 = Heating or Cooling via change-over 3 = Heating / Cooling 4 = Heating / Cooling with VAV-control and forced ventilation 5 = Heating / Cooling with VAV-control 6 = Cooling 7 = Cooling / Cooling 8 = Heating / Cooling/VAV (C3-models, except RC-C3DFOC) 9 =Heating / Heating or Cooling via change-over (only available on models with fan control) 10 = Change-over with VAV function 11 = VAV 12 = Heating / Cooling (change-over) + VAV 13 = VAV + VAV	3
12	Time in Bypass mode	120 min
13	Disconnect timer with Occupancy/Unoccupancy	10 min
14	Switch-on delay for Occupancy	0 min
15	State connected sensor on AI1: 0 = Internal sensor 1 = External room sensor 2 = Change-over sensor (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 3-10 = No function 11 = Supply air temperature limitation sensor 12 = Extra zone temperature	0
16	State connected sensor on UI1: (All models except RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 0 = None 1 = Change-over digital 2 = Change-over analogue 3 = External room sensor 4 = Supply air temperature limitation sensor 5 = Extra zone temperature	2
17	State connected sensor on DI1: 0 = Not active 1 = Window contact 2 = No function 3 = Presence detector 4 = Change-over sensor (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 5-6 = No function	3

Parameter number	Description	FS
18	State connected sensor on DI2: 0 = None 1 = Window contact 2 = Condensation sensor 3 = Presence detector 4 = Change-over sensor (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC, RCC-C3HCS) 5 = No function 6 = No function 7 = Run indication / Ext. digital input	2
20	State connected function on UO1: 0 = None 1 = Thermal actuator heat 2 = None 3 = Heating actuator 0...10 V 4 = None 5 = On/off actuator heat 6 = None 7 = 6-way valve 8 = VAV 9 = VAV2	3
21	State connected function on UO2: 0 = None 1 = None 2 = Thermal actuator cool 3 = None 4 = Cooling actuator 0…10 V 5 = None 6 = On/off actuator cool 7 = 6-way valve 8 = VAV 9 = VAV2	4
22	State connected function on UO3: 0 = None 1 = Forced vent. digital 3 = Lighting control 4 = Analogue output 6 = Control of EC fan (RC-C3-models) 7 = Extra zone active signal 8 = VAV2 10 = Heat Extra zone 11 = Thermal actuator heat Extra zone	1
24	Y3 output in manual mode (only if Y3 is configured as an analogue output; not available for RC-C3DFOC)	0 %
28	State output signal range for Y3-actuators: 0=0…10 V 1=2…10 V 2=10…2 V 3=10…0 V	0
29	State output signal range for heating actuators: 0=0…10 V 1=2…10 V 2=10…2 V 3= 10…0 V	0
30	State output signal range for cooling actuators: 0=0…10 V 1=2…10 V 2=10…2 V 3= 10…0 V	0
31	Period time for heating actuators with thermal actuator	60 s
32	Period time for cooling actuators with thermal actuator	60 s
33	Run time for heating actuators with increase/decrease actuators	120 s
34	Run time for cooling actuators with increase/decrease actuators	120 s
35	Neutral zone for increase/decrease actuators	2%
36	Time in hours between exercise of heating actuators	23 h
37	Time in hours between exercise of cooling actuators	23 h
38	Hysteresis for on/off actuators and heating	2 K
39	Hysteresis for on/off actuators and cooling	2 K
40	Minimum limit for the heat output	0 %
41	The fan will never stop 0 = OFF 1 = ON	0

Parameter number	Description	FS
42	Select if setpoint or actual value is to be shown in the display. 0 = Actual value 1 = Heat setpoint 2 = Cool setpoint 3 = Average value of heating and cooling setpoint 4 = Only setpoint offset 5 = CO_2 concentration in the room in ppm (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 6 = Heating setpoint +setpoint offset 7 = cooling setpoint+setpoint offset 8 = Average of heating and cooling setpoint+setpoint offset 9 = The calculated flow in the duct in l/s (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	0
43	Highest permitted setpoint adjustment upwards	3°C
44	Highest permitted setpoint adjustment downwards	3°C
45	Pre-set operating mode: 0 = Off 1 = Unoccupied 2 = Stand-by 3 = Occupied. Forced ventilation is not set in Occupied mode.	3
46	State operating mode by pressing the occupancy button for 5 s: 0 = Off 1 = Unoccupied.	1
47	Select operating mode for central control: 0=Off 1=Unoccupied 2=Stand-by 3=Occupied 5=No central control	5
48	Min flow at cool output when control mode Heating/Cooling with VAV-control is selected Min flow at Y3 output when control mode Heating/Cooling/VAV is selected	20 %
49	Max flow on Y3 output when control mode Heating/Cooling/VAV is selected and in heating mode	0 %
50	Configuration of fan control: 0 = No control 1 = Fan is controlled by heating demand 2 = Fan is controlled by cooling demand 3 = Fan is controlled by both heating and cooling demand	3
51	Start signal in % for fan speed 1 on heating or cooling control	5%
52	Start signal in % for fan speed 2	60%
53	Start signal in % for fan speed 3	100%
54	Hysteresis for start/stop of fans	5%
55	State number of speeds for the fan (1, 2 or 3)	3
56	Temperature compensation on AI1	0°C
57	Temperature compensation on UI1	0°C
58	Temperature compensation on internal room sensor	0°C
59	Filter factor for analogue temperature inputs	0,2
60	State NO/NC digital input 1: 0 = NO (Normally open) 1 = NC (Normally closed)	0
61	State NO/NC digital input2: 0 = NO (Normally open) 1 = NC (Normally closed)	1
62	State NO/NC universal input 1: 0 = NO (Normally open) 1 = NC (Normally closed)	0
63	Manual/Auto Heating output: 0 = Off 1 = Manual 2 = Auto	2
64	Manual/Auto cooling output: 0 = Off 1 = Manual 2 = Auto	2

Parameter number	Description	FS
65	Manual/Auto Y3 forced ventilation output: 0 = Off 1 = Manual 2 = Auto For C3 models (except C3DFOC), manual mode means that Y3 puts out what is stated in parameter 24 if Y3 is configured as an analogue output. When Y3 is configured as a Digital output (including for C3 models) or does not exist, this parameter constitutes the Manual/Auto mode for the forced ventilation.	2
66	Manual/Auto control of change over mode: 0 = Heat control 1 = Cool control 2 = Automatic change over depending on analogue sensor input or digital input	2
67	Heating output in manual mode	0 %
68	Cooling output in manual mode	0 %
69	Controller Modbus address	Factory set
70	Parity bit Modbus communication: 0 = No parity 1 = Odd parity 2 = Even parity 3 = No parity, 1 stop bit	2
71	Modbus time out for character (t1.5), in ms. Should be 1,5 times a character, i.e. at least 2 ms.	3 ms
72	Answer delay in Modbus (t3.5), in ms. Should be 3,5 times a character, i.e. at least 5 ms.	5 ms
73	Selection of heating output function (NO/NC): 0 = NC (Normally closed) 1 = NO (Normally opened)	0
74	Setpoint display at setpoint adjustment.: 0 = The offset is shown in the display 1 = The active setpoint + offset is shown in the display. Heat or Cool is shown depending on whether heat or cool is active when entering the menu 2 = Heat setpoint + offset is shown in the display 3 = Cooling setpoint + offset is shown in the display 4 = Heating occupied setpoint + offset is shown in the display 5 = Cooling occupied setpoint + offset is shown in the display 6 = Average of heating and cooling setpoints + offset is shown in the display	0
75	Sequence order for Y2 and Y3: 0 = Y2 activates before Y3 1 = Y3 activates before Y2	0
76	Forced ventilation, control function: 0 = Not active 1 = Forced ventialtion at 100% output of heat or cool 2 = Forced ventilation at 100% Cool output	0
77	Operating mode at presence detection: 3 = Occupied 4 = Bypass	4
78	EXOline PLA-address	Factory set
79	EXOline ELA-address	Factory set
80	Selection of cooling output functions (NO/NC): 0 = NC 1 = NO	0
81	State the connected sensor at AI2: (Only RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 0 = None 1– 4 = No function 5 = CO_2-sensor 6 = No function 7 = 0…100% (OEM-function) 8 = Flow calculation 9 = 0…10 V 11 = Supply air temperature (0…10 V) 12 = Extra zone temperature (0…10 V)	5

Parameter number	Description	FS
82	Flow at 0 V input in AI2	0 l/s
83	Flow at 10 V input in AI2	100 l/s
84	Minimum runtime when calculating for change over	600 s
86	Alarm limit for high room temperature	40°C
87	Alarm limit for low room temperature	15°C
91	Function to prevent user from setting manual fan speed if fan should not run due to cooling/heating output according to parameter 50. 0 = Not active 1 = Active	0
92	Fan boost function. Activation time: 0 = Not active 1-10 = The function is active for 10 s. 11-600 = Total activation time	0
93	Boost function, configuration: 0 = Heating mode only 1 = Cooling mode only 2 = Both heating and cooling mode	1
94	Fan kickstart. The fan will run 100 % when starting up for the set time. 0 = Not active 1-10 = Active for set time (seconds)	0 seconds
97	Activate presence if CO_2 level is higher (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	800 ppm
98	Deactivate presence if the CO_2 level is lower than the limit minus this hysteresis (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	160 ppm
100	Filter factor for CO_2-input (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	0.2
101	Offset for internal CO_2 sensor reading	0 ppm
104	CO_2-level at 0 V (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	0 ppm
105	CO_2-level at 10 V (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	2000 ppm
108	Button function configuration: 0 = No button is active 1 = Only Occupancy button active 2 = Only INCREASE/DECREASE buttons active 3 = Occupancy and INCREASE/DECREASE buttons active 4 = Only fan button active 5 = Occupancy and fan buttons active 6 = INCREASE/DECREASE and fan buttons active 7 = All buttons active	7
109	Activate parameter menu access via display: 0 = Not active 1 = Active **NOTE:** Activating this function via the display will prevent re-entry! If so, parameter menu access may be activated again using Application tool.	0
110	Activate manual bypass timer setting. When the function is active, the user may step through bypass time in 1 hour increments. 0 = Not active 1 = Active	0
112	Min limit for VAV-damper at CO2-control (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	600 ppm
113	Max limit for VAV-damper at CO2-control (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)	800 ppm
114	This parameter defines the protocol to be used: 0 = EXOline/Modbus 1 = BACnet MS/TP	0
115	BACnet MS/TP MAC address: 0-127 = master address 128-254 = slave address	Factory set (00-99)
116	Low 4 figures of the BACnet device ID. 0-9999	Factory set
117	High 3 figures of the device ID.	Factory set
118	BACnet MS/TP Max master.	127

Parameter number	Description	FS
119	COMbus speed: 0=9600 1 = 19200 2 = 38400 3 = 76800 (only BACnet)	0
120	COMbus reset. When activated (1) it resets the communication to default settings.	0 (deactivated)
121	Min limit for EC fan (%)	10 %
122	Max limit for EC fan (%)	100 %
123	VAV-damper max limitation (%)	100 %
125	Model	Factory set (read only)
126	Version Major	Factory set (read only)
127	Version Minor	Factory set (read only)
128	Version Branch	Factory set (read only)
129	Revision	Factory set (read only)
132	Basic flow, Standby	10 %
133	Basic flow when no presence (Unoccupied)	10 %
134	Basic flow, Off	0 %
144	Period time for VAV-actuators with thermal actuators	60 s
145	Select VAV-actuator function (NO/NC) 0 = NC (normally closed) 1 = NO (normally open)	0
146	Supply air max limitation for cascade control and heating control	35°C
147	Supply air min limitation for cascade control and heating control	24°C
148	Supply air max limitation for cascade control and cooling control	24°C
149	Supply air min limitation for cascade control and cooling control	12°C
150	Cascade factor between room controller and supply air controller	3°C
151	Frost protection temperature for supply air when supply air temperature limitation is active	8°C
152	Activate supply air temperature limitation for: 0 = Heating control 1 = Cooling control 2 = Both heating and cooling control	1
153	Select simple or advanced analog change-over function 0 = Simple 1 = Advanced	1
154	Use valve exercise 0 = Never 1 = Regularly 2 = Regularly and at power-up 3 = Regularly, at power-up and when changing state to Occupied	1
155*	If true all the leds in the controller will be turned off	0
156**	CO_2 PI Control P Band	100
157**	CO_2 PI Control I Time	100
158**	CO_2 Setpoint	600
159*	Room Setpoint for Extra zone	22

Parameter number	Description	FS
160*	Enable options for Extra zone 0 = Disabled 1 = Main zone state is Unoccupied or higher 2 = Main zone state is Standby or higher 3 = Main zone state is Occupied or higher 4 = Main zone state is Bypass 5 = Always on	0
161*	Extra zone PI Control P Band	10
162*	Extra zone PI Control I Time	300
163*	If Enabled it will disable extra zone when main controller is cooling	1
164*	Voltage applied to 6 way valve for fully open at sequence 1	0
165*	Voltage applied to 6 way valve to start open at sequence 1	3,3
166*	Voltage applied to 6 way valve to start open at sequence 2	6,7
167*	Voltage applied to 6 way valve for fully open at sequence 2	10
168*	Voltage applied to 6 way valve for center point, closed both sequences	5
169*	Center point Hysteresis	2
170*	Sequence order 0 = Cool 1st Sequence 1 = Heat 2nd Sequence	1
171*	Conversion factor for temperature sensor (0-10V) on AI2 at 0V	-10
172*	Conversion factor for temperature sensor (0-10V) on AI2 at 10V	50
173*	Display Switch values 0 = Don't switch values 1 = Switch between Temperature and CO_2	0
174*	CO_2 Level High Limit for alarm	1000
175*	Min Flow at VAV 2 when control mode is VAV/VAV	0
176*	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in StanDby state	10
177*	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in Unoccupied state	10
178*	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in Off state	0
179*	Max Flow in VAV 2	100
180*	Bypass behaviour in VAV/VAV mode 0 = DO Forced ventilation 1 = Y1 VAV 2 = Y1 VAV and Y2 VAV 3 = Y1 VAV, Y2 VAV and DO Forced ventilation	0
181*	If active the Fan will always run at least at speed 1, it will override open window and manual	0
182*	Manual value heat output 2	0
183*	Manual value cool output 2	0
184*	Manual value vav output 2	0
185*	Manual/Auto for heat output 2 0 = Off 1 = Manual 2 = Auto	2
186*	Manual/Auto for cool output 2 0 = Off 1 = Manual 2 = Auto	2
187*	Manual/Auto for VAV output 2 0 = Off 1 = Manual 2 = Auto	2

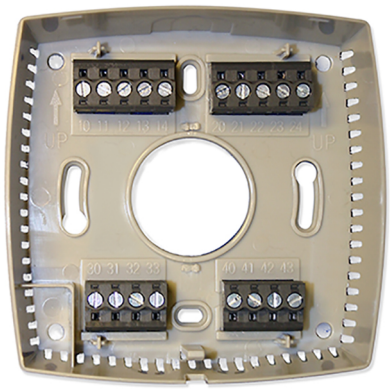
Parameters marked with * are only available in Regio Midi 1.7 or newer versions.
Parameters marked with ** are used only in version 1.7-1-01 and 1.7-1-02.

5 Installation preparations

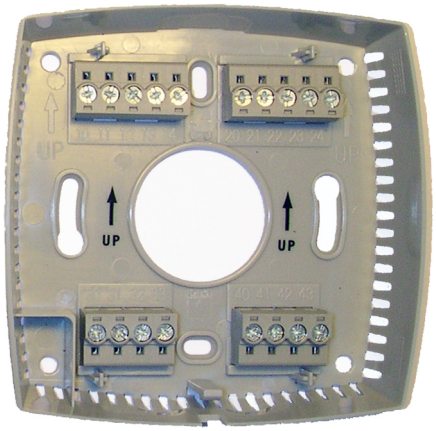
5.1 Different versions of terminals and pins

In the summer of 2008, a new terminal type was introduced in the Regio controllers. The old terminal type is dark grey and intended for 1.3 mm pins. The new terminal type is light grey and intended for 1.1 mm pins. Confusion between a new and old bottom plate may lead to deficient contact. Therefore, it is important to use an old electronics unit together with an old bottom plate and a new electronics unit together with a new bottom plate. From the end of 2017 the bottom plate will be white instead of grey.

The figures below show an example of the difference between the old and current terminal types (the number of terminals depends on the Regio model).



Old terminal type (1.3 mm pins).



Current terminal type (1.1 mm pins).

5.2 Using labels

On the back of the electronics cassette, there is a set of labels which makes it easier to install large numbers of Midi 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.

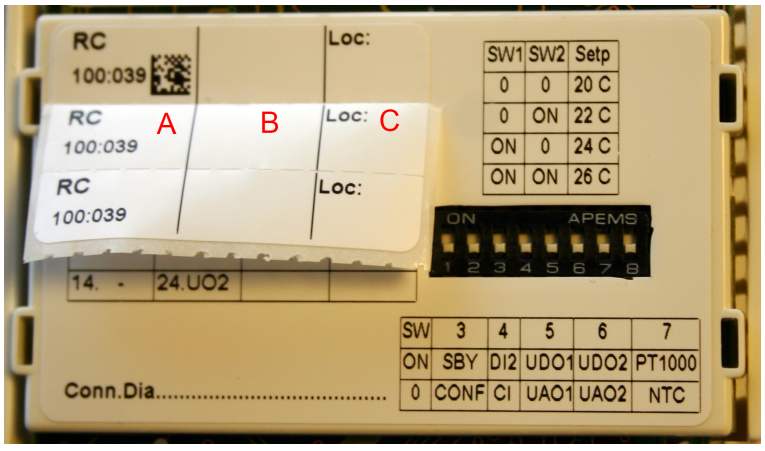


Figure 5-1 Label on the back of the controller. A: model and address. B: Field for new address or reference to connection diagram. C: Field for room number.

The three-piece label can be split and the parts can be fastened to the installation drawing and the bottom plate of the controller. The label carries information on the communication address etc., and has a note area where you can enter a reference number to the connection diagram.

The address on the sticker has a different meaning depending on what communication protocol is used.

Example 1

If the address on the sticker is 191:183 the following addresses are valid for the different communication protocols:

EXOline: PLA=191, ELA=183

Modbus: address=183

BACnet: device ID=191183 (low 4 figures=1183, high 3 figures=19), MS/TP MAC address=83*

Example 2

If the address on the sticker is 10:001 the following addresses are valid for the different communication protocols:

EXOline: PLA=10, ELA=1

Modbus: address=1

BACnet: device ID=10001 (low 4 figures=1, high 3 figures=1), MS/TP MAC address=1*

* *BACnet is only available in models with display*

5.3 Setting of DIP switches (models without display)

Models without display have eight DIP switches (SW1-8) for setting basic functions. They are found on the back of the electronics cassette.

Figure 5-2 DIP switches.

SW1-2

Table 5-1 Setting of basic heating setpoint with DIP switch SW1 and SW2

Basic setpoint (°C)	SW1	SW2
20	OFF	OFF
22 (FS)	OFF	ON
24	ON	OFF
26	ON	ON

SW3

Occupied is the pre-set operating mode, SW3: OFF (FS). If you want the pre-set operating mode to be Stand-by, set SW3 in mode ON.

SW4-8

Follow the tables in the chapter 6 *Installation* for setting SW4-8.

6 Installation

6.1 Mounting

Place the controller in a location that has a temperature representative for the room. A suitable location is approx. 1.6 m above floor level in a place with unobstructed air circulation. Remove the frame by pressing the locking tab in the lower edge of the cover with a screwdriver. See figure 5.

Next, gently lift the electronics cassette out, see figure 6. Be careful not to damage the electronics.

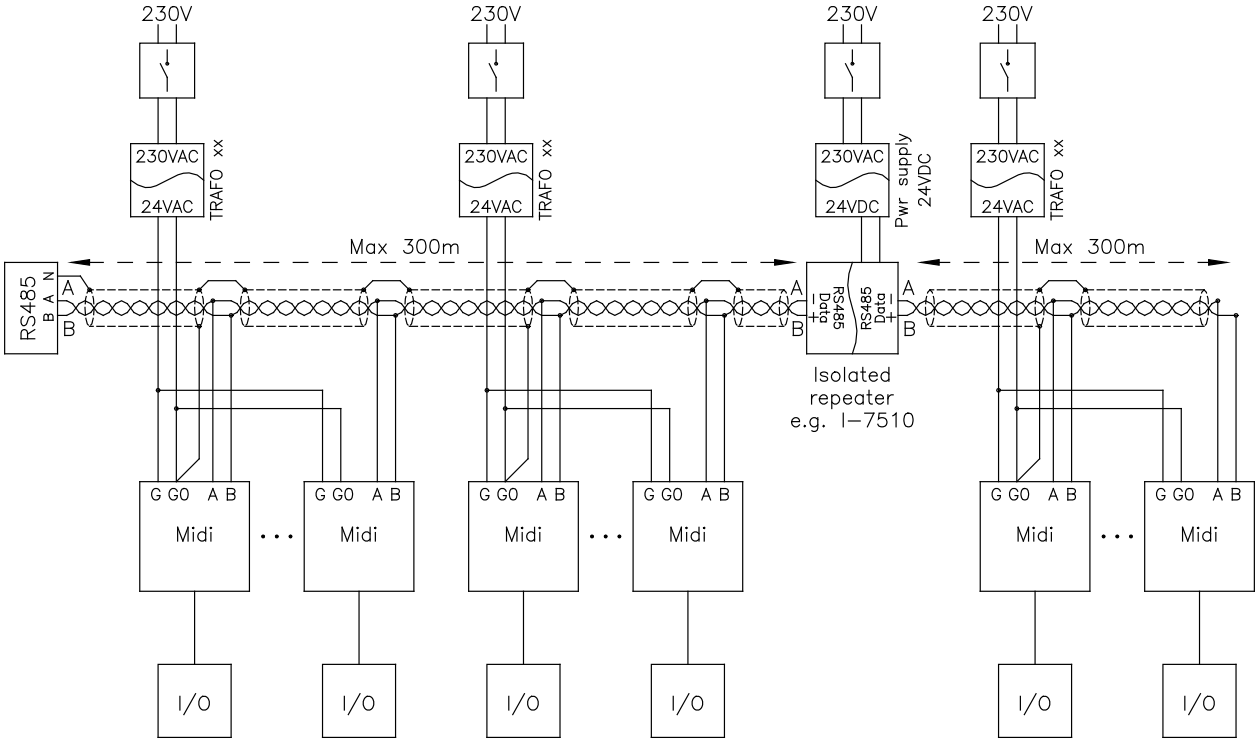
The bottom plate with terminals has several fixing hole combinations. Select suitable holes and screw the bottom plate onto the wall or connection box, so that the arrows on the bottom plate point upwards. Do not tighten the screws too hard!

With surface-mounted cabling, break out suitable holes from the marks in the plastic.

6.2 Wiring

All units that share the same transformer and communication loop must use the same transformer-pole for G (terminal 10) and G0 (terminal 11). On the communication loop the A-terminal (terminal 42) should only be connected to another A-terminal and the B-terminal (terminal 43) 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) Midi 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 below.



The figure below shows the location of the terminals. The connection diagrams and tables on the following pages show the wiring for basic models, the model for CO_2 control, the model with built in CO_2 sensor, models for fan control and models for three-point control.

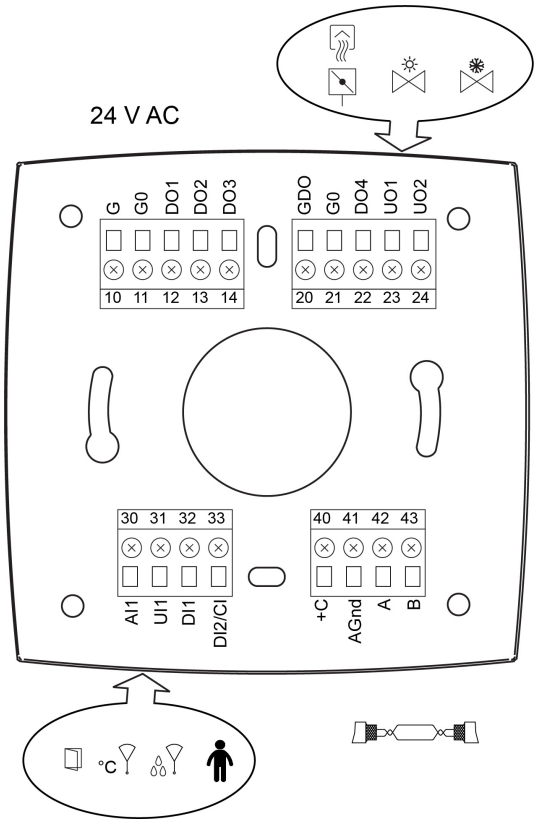
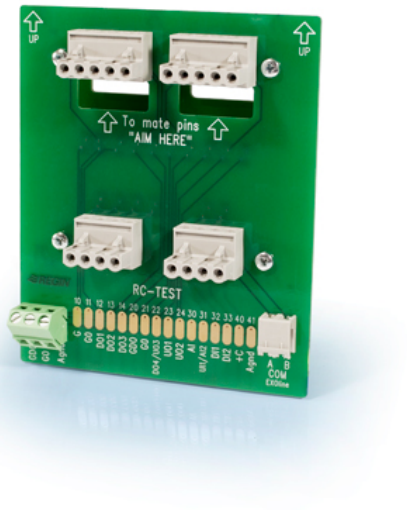


Figure 6-1 Example of bottom plate with terminals.

6.3 Measurement and testing during installation



In order to make measurements and test the inputs/outputs of a Regio room controller during installation, Regin's RC-TEST service adapter may be used.

Simply align the pins at the bottom of the RC-TEST with the terminals contained in the controller's socket and then plug the Regio electronics cassette into the terminals at the top of the device. Testing takes place via a standard multimeter.

6.4 Wiring for basic models with 3 universal outputs (RC-C3H, RC-C3, RC-C3O)

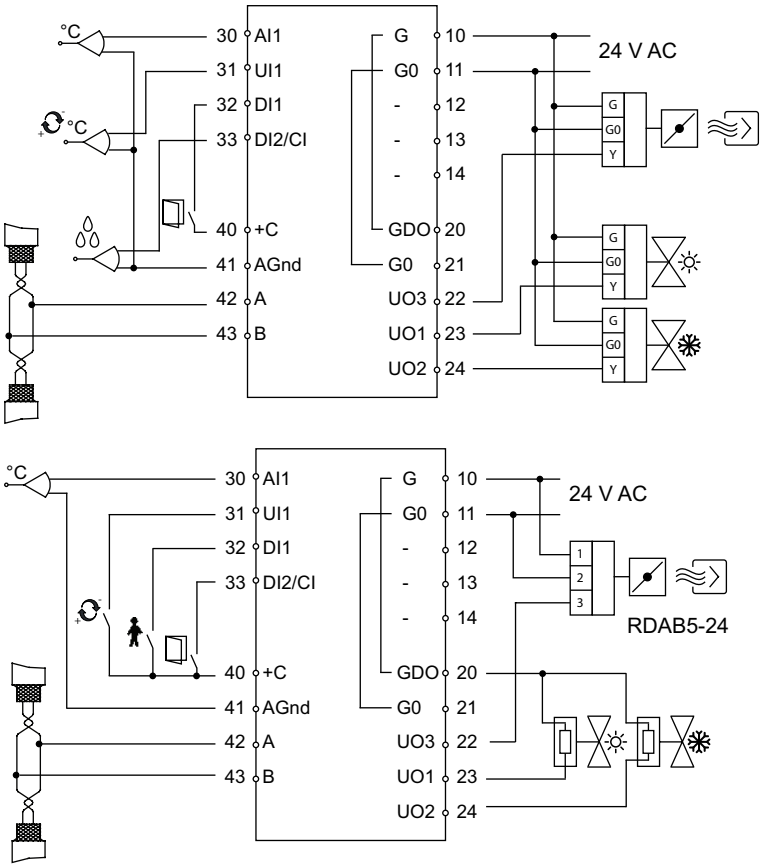


Figure 6-2 Connection diagrams for basic models with 3 universal outputs.

Table 6-1 I/O connection terminals for basic models with 3 universal outputs.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12-14		No function.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	UO3	For VAV control *alternatively* For forced ventilation. 24 V AC output, max. 2.0 A. 24 V actuator is connected between terminal 22 and terminal 20, GDO. *alternatively* For 0…10 V DC damper control/EC-fan. The damper actuator/EC-fan 0…10 V control signal terminal is connected to terminal 22, and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* Lighting control On/Off

Table 6-1 I/O connection terminals for basic models with 3 universal outputs. (continued)

Terminal	Designation	Operation
23	UO1	Control of heating (FS) cooling or heating/cooling via change-over. For 0...10 V DC valve actuators, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. Using DIP-switch SW8, the output can be set to suit actuator type NO or NC. **N.B.:** when UO1 has been set for use with thermal actuators for 24 V AC (digital output function) the controller utilizes time-proportional control to give a smooth control of the connected actuator. The output signal for UO1 can be set to NC (normally closed) or NO (normally open) by changing the position of DIP-switch SW8 for models without display and by changing parameter 73 for models with display. This setting refers to which type of actuator, NC or NO, it is intended for. For choice of output function, analogue or digital, see *Table 6-2*, SW5. On models with display, go into the parameter menu and change parameter 20 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).
24	UO2	Control output heating or cooling (FS). For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 24 and 20, GDO. For choice of output function, analogue or digital, see *Table 6-2*, SW6. On models with display, go into the parameter menu and change parameter 21 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor, PT1000 or supply air temperature limitation sensor. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd. See *Table 6-2*, SW7.
31	UI1	For switching between heating and cooling on a two-pipe system (change-over). A PT1000-sensor is connected between terminals 31 and 41, AGnd. Measuring range: 0...100°C. *alternatively* For a potential-free contact. A potential-free contact is connected between terminals 31 and 40, +C.
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *See also the section Occupancy detector in the chapter Operating modes.*

Table 6-1 I/O connection terminals for basic models with 3 universal outputs. (continued)

Terminal	Designation	Operation
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C. *See Table 6-2, SW4.*
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.4.1 DIP switches (only models without display)

The ON-position is marked on the DIP switch.

Table 6-2 DIP switches SW4-SW8.

	ON	OFF	Comment
SW4	DI, window contact. Closed contact indicates closed window.	CI, Regin's condensation sensor, KG-A/1 (FS).	Function terminal 33, DI2/CI.
SW5	Digital output for 24 V AC thermal actuator.	Analogue output for 0...10 V DC valve actuator (FS).	Function terminal 23, UO1.
SW6	Digital output for 24 V AC thermal actuator.	Analogue output for 0...10 V DC valve actuator (FS).	Function terminal 24, UO2.
SW7	External, PT1000-sensor.	Internal NTC-sensor (FS).	Temperature sensor.
SW8	NO	NC (FS)	Function terminal 23, UO1

Choosing NC (FS) gives direct action on output UO1, i.e. increasing signal (longer pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAM-24 (NC). In the event of a power cut the valve will close.

Choosing NO gives reverse action on output UO1, i.e. decreasing signal (shorter pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAOM-24 (NO). In the event of a power cut the valve will open.

6.5 Wiring for model for CO_2 control (RC-C3DOC)

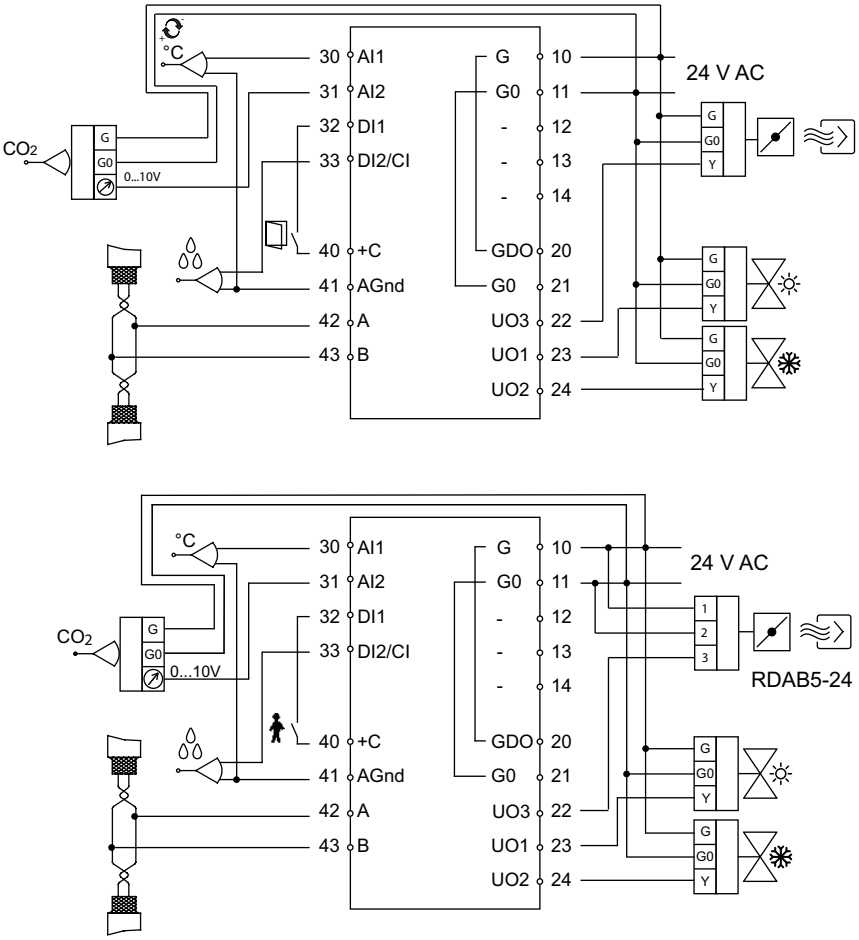


Figure 6-3 Connection diagrams for model for CO2 control.

Table 6-3 I/O connection terminals for model for CO2 control.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12-14		No function.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	UO3	Output for VAV or EC-fan. For forced ventilation. 24 V AC output, max. 2.0 A. 24 V actuator is connected between terminal 22 and terminal 20, GDO. *alternatively* For 0…10 V DC damper control/EC-fan. The damper actuator/EC-fan 0…10 V control signal terminal is connected to terminal 22 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* Lighting control On/Off.

Table 6-3 I/O connection terminals for model for CO2 control. (continued)

Terminal	Designation	Operation
23	UO1	Control output heating (FS), cooling or heating or cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).
24	UO2	Control output heating or cooling (FS). For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 24 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor or supply air temperature, PT1000. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd.
31	AI2	For a 0…10 V CO_2 sensor *alternatively* Flow input *alternatively* 0…10 V input
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Change-over.
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Change-over. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C.
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.6 Wiring for model with built-in CO_2 sensor (RCC-C3DOCS, RCC-C3HCS)

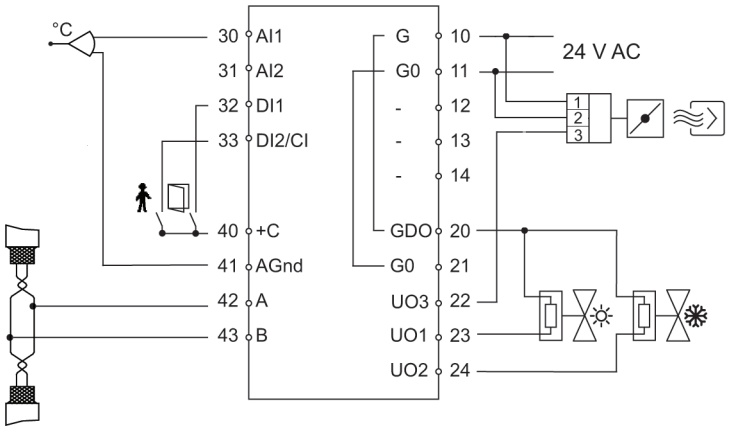


Figure 6-4 Connection diagrams for model with built-in CO2 sensor.

Table 6-4 I/O connection terminals for model with built in CO2 sensor.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12-14		No function.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	UO3	Output for VAV or EC-fan. For forced ventilation. 24 V AC output, max. 2.0 A. 24 V actuator is connected between terminal 22 and terminal 20, GDO. *alternatively* For 0…10 V DC damper control/EC-fan. The damper actuator/EC-fan 0…10 V control signal terminal is connected to terminal 22 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* Lighting control On/Off.
23	UO1	Control output heating (FS), cooling or heating or cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).

Table 6-4 I/O connection terminals for model with built in CO2 sensor. (continued)

Terminal	Designation	Operation
24	UO2	Control output heating or cooling (FS). For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 24 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor or supply air temperature, PT1000. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd.
31	AI2	For a 0…10 V CO_2 sensor *alternatively* Flow input *alternatively* 0…10 V input
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window.
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C.
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.7 Wiring for models for CO_2 control and fan control (RC-C3DFOC)

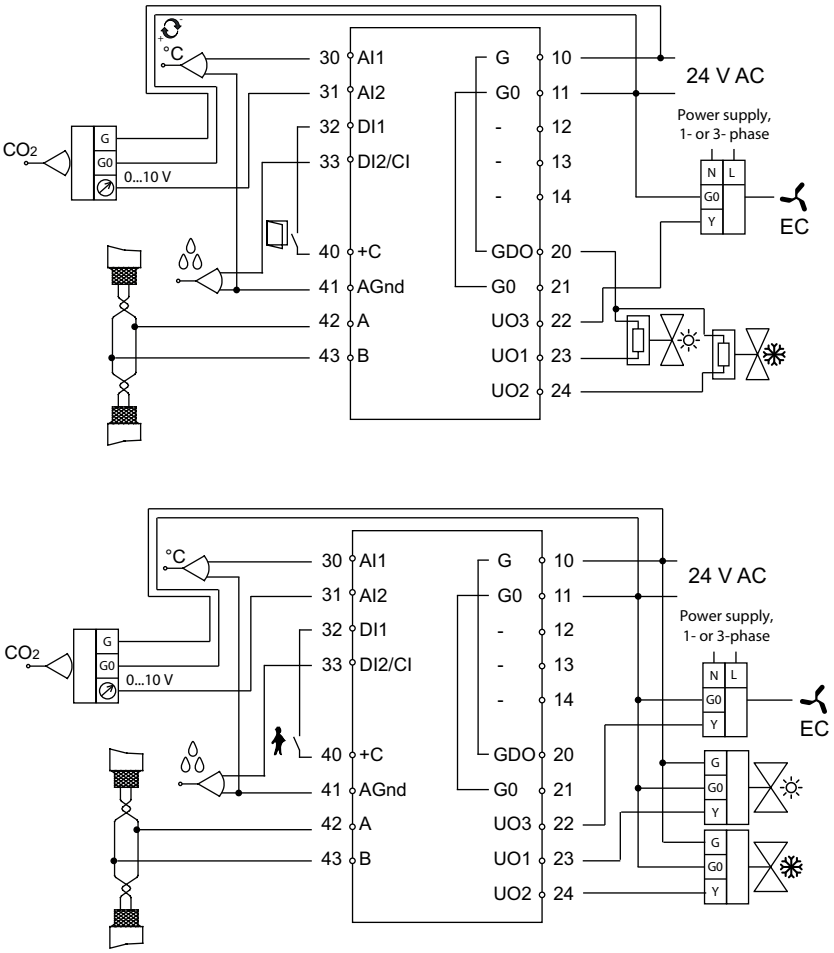


Figure 6-5 Connection diagrams for models for CO2 control and fan control.

Table 6-5 I/O connection terminals for CO2 control and fan control.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12-14		No function.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	UO3	Control EC fan, 0…10 V DC.

Table 6-5 I/O connection terminals for CO2 control and fan control. (continued)

Terminal	Designation	Operation
23	UO1	Control output heating (FS), cooling or heating or cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).
24	UO2	Control output heating or cooling (FS). For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 24 and 20, GDO. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor or supply air temperature, PT1000. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd.
31	AI2	For a 0…10 V CO_2 sensor *alternatively* Flow input *alternatively* 0…10 V input
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Change-over.
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Change-over. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C.
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.8 Wiring for models for fan control (RC-CF, RC-CFO, RC-CDFO)

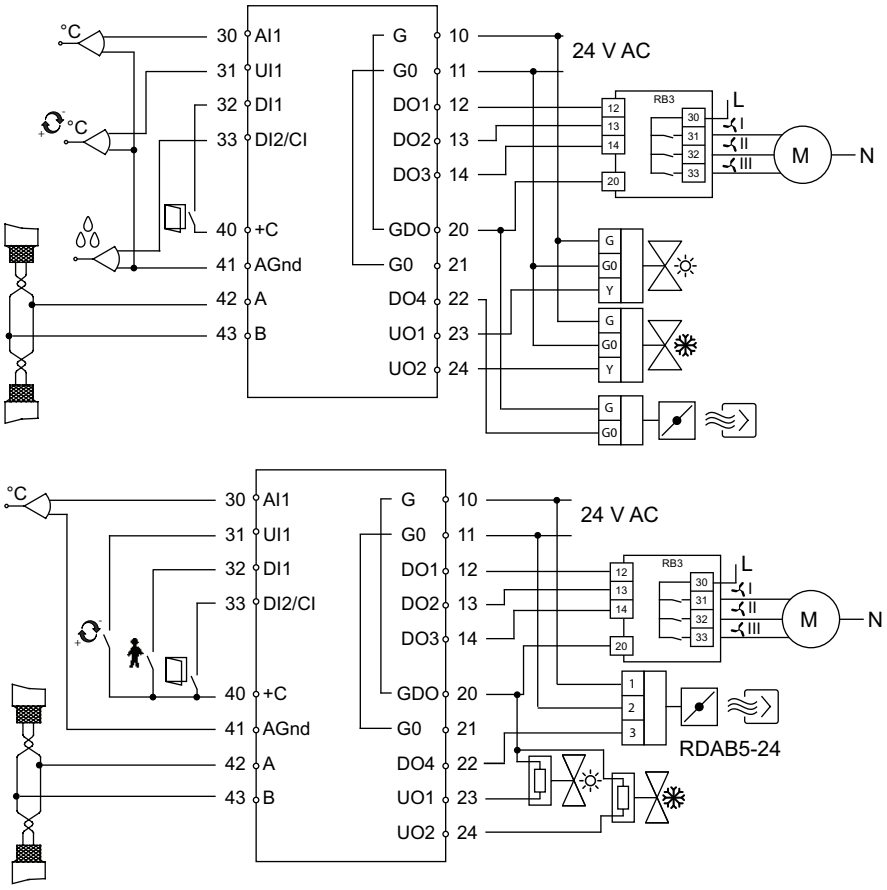


Figure 6-6 Connection diagrams for models for fan control.

Table 6-6 I/O connection terminals for models for fan control.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12	DO1	For fan control, low speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 12 and terminal 20, GDO.
13	DO2	For fan control, medium speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 13 and terminal 20, GDO.
14	DO3	For fan control, high speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 14 and terminal 20, GDO.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	DO4	For forced ventilation. 24 V AC output, max 0.5 A. A 24 V AC actuator is connected between terminal 22 and terminal 20, GDO.

Table 6-6 I/O connection terminals for models for fan control. (continued)

Terminal	Designation	Operation
23	UO1	Control of heating (FS), cooling or heating/cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. Using DIP-switch SW8, the output can be set to NO or NC. **N.B:** when UO1 has been set for use with thermal actuators for 24 V AC (digital output function) the controller utilizes time-proportional control to give a smooth control of the connected actuator. The output signal for UO1 can be set to NC (normally closed) or NO (normally open) by changing the position of DIP-switch SW8 for models without display and by changing parameter 73 for models with display. This setting refers to which type of actuator, NC or NO, it is intended for. For choice of output function, analogue or digital, see *Table 6-7*, SW5. On models with display, go into the parameter menu and change parameter 20 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).
24	UO2	Control of heating, cooling (FS) or heating/cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2,0 A. The thermal actuator is connected between terminals 24 and 20, GDO. For choice of output function, analogue or digital, see *Table 6-7*, SW6. On models with display, go into the parameter menu and change parameter 21 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor or supply air temperature limitation sensor, PT1000. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd. *See Table 6-7, SW7.*
31	UI1	For switching between heating and cooling on a two-pipe system (change-over). A PT1000-sensor is connected between terminals 31 and 41, AGnd. Measuring range: 0...100°C. *alternatively* For a potential-free contact. A potential-free contact is connected between terminals 31 and 40, +C.
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 32 and 40, +C. Closed contact indicates closed window. *See also the section Occupancy detector in the chapter Operating modes.*

Table 6-6 I/O connection terminals for models for fan control. (continued)

Terminal	Designation	Operation
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C. *See Table 6-7, SW4.*
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.8.1 DIP switches (only models without display)

The ON-position is marked on the DIP switch.

Table 6-7 DIP switches SW4-SW8.

	ON	OFF	Comment
SW4	DI, window contact. Closed contact indicates closed window.	CI, Regin's condensation sensor, KG-A/1 (FS).	Function terminal 33, DI2/CI.
SW5	Digital output for 24 V AC thermal actuator.	Analogue output for 0...10 V DC valve actuator (FS).	Function terminal 23, UO1.
SW6	Digital output for 24 V AC thermal actuator.	Analogue output for 0...10 V DC valve actuator (FS).	Function terminal 24, UO2.
SW7	External, PT1000-sensor.	Internal NTC-sensor (FS).	Temperature sensor.
SW8	NO	NC (FS)	Function terminal 23, UO1

Choosing NC (FS) gives direct action on output UO1, i.e. increasing signal (longer pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAM-24 (NC). In the event of a power cut the valve will close.

Choosing NO gives reverse action on output UO1, i.e. decreasing signal (shorter pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAOM-24 (NO). In the event of a power cut the valve will open.

6.9 Wiring for models for three-point control (RC-CTH, RC-CT, RC-CTO, RC-CDTO)

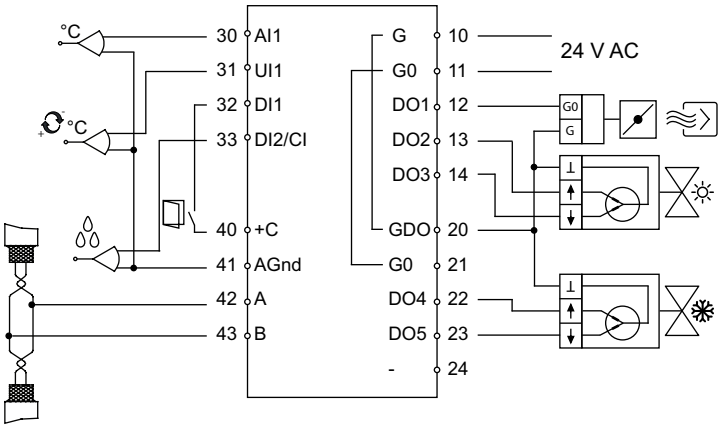


Figure 6-7 Connection diagrams for models for three-point control.

Table 6-8 I/O connection terminals for models for three-point control.

Terminal	Designation	Operation
10	G	Supply voltage 24 V AC
11	G0	Supply voltage 0 V
12	DO1	For fan control, low speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 12 and terminal 20, GDO.
13	DO2	For fan control, medium speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 13 and terminal 20, GDO.
14	DO3	For fan control, high speed. 24 V AC output, max 0.5 A. A 24 V AC relay is connected between terminal 14 and terminal 20, GDO.
20	GDO	24 V AC out common for DO. Internally connected to terminal 10, G.
21	G0	0 V common for UO. Internally connected to terminal 11, G0.
22	DO4	For forced ventilation. 24 V AC output, max 0.5 A. A 24 V AC actuator is connected between terminal 22 and terminal 20, GDO.
23	UO1	Control of heating (FS), cooling or heating/cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 23 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2.0 A. The thermal actuator is connected between terminals 23 and 20, GDO. Using DIP-switch SW8, the output can be set to NO or NC. **N.B:** when UO1 has been set for use with thermal actuators for 24 V AC (digital output function) the controller utilizes time-proportional control to give a smooth control of the connected actuator. The output signal for UO1 can be set to NC (normally closed) or NO (normally open) by changing the position of DIP-switch SW8 for models without display and by changing parameter 73 for models with display. This setting refers to which type of actuator, NC or NO, it is intended for. For choice of output function, analogue or digital, see *Table 6-9*, SW5. On models with display, go into the parameter menu and change parameter 20 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 23 and 20. This can be configured either through the display or through Application tool. The output signal for UO1 can be set to NC (normally closed) or NO (normally open).

Table 6-8 I/O connection terminals for models for three-point control. (continued)

Terminal	Designation	Operation
24	UO2	Control of heating, cooling (FS) or heating/cooling via change-over. For a 0...10 V DC valve actuator, max 5 mA (FS). The valve actuator's 0…10 V control signal terminal is connected to terminal 24 and its supply terminals to terminals 10 and 11. Make sure that the reference pole G0 is connected to the correct terminal on the actuator. *alternatively* For a 24 V AC thermal actuator, max 2,0 A. The thermal actuator is connected between terminals 24 and 20, GDO. For choice of output function, analogue or digital, see *Table 6-9*, SW6. On models with display, go into the parameter menu and change parameter 21 to thermal actuator. *alternatively* For a 24V AC actuator with spring return, max. 2.0 A. The actuator is connected between terminals 24 and 20. This can be configured either through the display or through Application tool.
30	AI1	For an external room sensor or supply air temperature limitation sensor, PT1000. Measuring range 0...50°C. The sensor is connected between terminals 30 and 41, AGnd. *See Table 6-9, SW7.*
31	UI1	For switching between heating and cooling on a two-pipe system (change-over). A PT1000-sensor is connected between terminals 31 and 41, AGnd. Measuring range: 0...100°C. *alternatively* For a potential-free contact. A potential-free contact is connected between terminals 31 and 40, +C.
32	DI1	Occupancy detector. A potential-free contact is connected between terminals 32 and 40, +C. Closed contact corresponds to occupancy. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 32 and 40, +C. Closed contact indicates closed window. *See also the section Occupancy detector in the chapter Operating modes.*
33	DI2/CI	Regin's condensation sensor, KG-A/1 (FS). The sensor is connected between terminals 33 and 41, AGnd. *alternatively* Window contact (DI). A potential-free contact is connected between terminals 33 and 40, +C. Closed contact indicates closed window. *alternatively* Run indication from e.g. an air handling unit. A potential-free contact is connected between terminals 33 and 40, +C. *See Table 6-9, SW4.*
40	+C	24 V DC out common for DI and UI (with digital function)
41	AGnd	Analogue ground, reference for AI and UI (with analogue function)
42	A	RS485-communication A
43	B	RS485-communication B

6.9.1 DIP switches (only models without display)

The ON-position is marked on the DIP switch.

Table 6-9 DIP switches SW4-SW8.

	ON	OFF	Comment
SW4	DI, window contact. Closed contact indicates closed window.	CI, Regin's condensation sensor, KG-A/1 (FS).	Function terminal 33, DI2/CI.
SW5	DO5 activated (FS).	Not permitted.	Shall be ON.

Table 6-9 DIP switches SW4-SW8. (continued)

	ON	OFF	Comment
SW6			Not used.
SW7	External, PT1000-sensor.	Internal NTC-sensor (FS).	Temperature sensor.
SW8	NO	NC (FS)	Function terminal 23, UO1

Choosing NC (FS) gives direct action on output UO1, i.e. increasing signal (longer pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAM-24 (NC). In the event of a power cut the valve will close.

Choosing NO gives reverse action on output UO1, i.e. decreasing signal (shorter pulses) on increasing control output. This setting is used when UO1 is connected to a thermal actuator of type Regin RTAOM-24 (NO). In the event of a power cut the valve will open.

7 Special functions

7.1 Condensation sensor

Special input CI There is a special input (CI) on all Regio controllers. This input is intended for Regin's condensation sensor, KG-A/1, and functions internally as a digital input, i. e. condensation or no condensation.

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.

Window contact When window contact has been configured, the controller is set to normal mode on closed window. On open window, the controller is set to off mode, the heating and cooling outputs are set to 0 V and the frost protection function is activated.

Run indication, DI2 Digital input 2 (DI2) can be configured for run indication of e.g. an air handling unit. This indication can then be read in EXOline and Modbus. The change is made in parameter 18.

7.2 High/low room temperature alarm

High/low temperature alarm is a function to indicate if the room temperature is too high or too low.

The high room temperature alarm will trigger when the room temperature exceeds the configured high temp limit (FS=40°C).

The low room temperature alarm will trigger when the room temperature falls below the configured low temp limit (FS=15°C).

The alarms are implemented as points that trigger when the temperature either exceeds or falls below the limits, and return as soon as the temperature returns. There is no advanced alarm handling, incorporating blocking or acknowledging or so forth. There is only an indication for faulty temperatures. All other alarm and alarm handling functions must be handled by a supervisory system.

7.3 Lighting control

UO3/DO4/DO1 can be used for lighting control. When UO3/UO4/DO1 is configured for lighting control, the following applies:

Digital input 1 UO3/UO4/DO1 is activated when presence is detected via DI1. The output then remains active for as long as presence is detected. The Standby/Occupied/Bypass operating modes are active as usual.

Off mode If the controller is in Off-mode (Off/Unoccupied), the occupancy input (DI1) will be active if UO3/DO4/DO1 is configured for lighting control.

Occupancy button This button still controls On/Off and forced ventilation. If UO3/DO4/DO1 is configured for lighting control, the output will not be activated if a button is pressed.

8 Memory function on power failure

On power failure, settings and configurations are preserved in the controller in a so-called nonvolatile memory (EEPROM). All changes made to the settings and configuration is saved in the memory, which means that the latest values are always stored. Measured values, as well as other variables that change often, are not stored.

Values can be saved up to approximately 100 000 times in the nonvolatile memory. Therefore, changed values should not systematically and very often be sent to the controller via network communication. Normal changes may still be sent via the network; for example if the operating mode is changed a few times per day.

Disable autosave There is a function to disable the automatic saving to EEPROM. We recommend to use this function when huge amount of changes are sent to the unit via network communication.

Save now to EEPROM This function saves all settings right now to the EEPROM. If autosave is disabled, it is highly recommended to save all settings to the EEPROM after configuring the unit for all settings to be kept after any type of power failure or restart of the unit.

Example Activation of Bypass is not stored in the memory. Instead, the controller will return to the pre-set operating mode after power failure. However, the set operating mode will be saved if central control is being used (parameter 47).

Appendix A Technical data

A.1 General data

Supply voltage	18 - 30 V AC, 50 - 60 Hz
Power consumption	< 3 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	IP20
Material casing	Polycarbonate, PC
Colour	Cover: RAL9010 (polar white) / RAL9005 (black) Bottom plate: Light grey
Communication	RS485 (EXOline or Modbus with automatic detection or BACnet*). Note: BACnet communication is only an option for models with display
Modbus	8 bits, 1 or 2 stop bits. Odd, even (FS) or no parity.
Communication speed	9600, 19200, 38400 bps (EXOline, Modbus and BACnet) or 76800 bps (BACnet only)
Built-in temperature sensor	0…50° C NTC linearised 15 kΩ
Accuracy	±0.5° C at 15…30° C
Measuring range, temperature	0…50° C
Built-in CO_2 sensor	0…5000 ppm
Mounting	Room
Weight	110 g
Dimensions	Models without setpoint knob: 95 x 95 x 28 mm Models with setpoint knob: 95 x 95 x 31 mm Models with built-in CO_2 sensor 95 x 95 x 38 mm

A.2 Inputs/outputs

Article	AI	DI	UI	UO	DO	Total number of I/O:s
RC-C3	1	2	1	3	-	7
RC-C3H	1	2	1	3	-	7
RC-C3O	1	2	1	3	-	7
RC-C3DOC	2	2	-	3	-	7
RC-C3DOC-BLACK	2	2	-	3	-	7
RC-CF	1	2	1	2	4	10
RC-CFO	1	2	1	2	4	10
RC-CDFO	1	2	1	2	4	10
RC-C3DFOC	2	2	-	3	-	7
RC-CT	1	2	1	-	5	9
RC-CTH	1	2	1	-	5	9
RC-CTO	1	2	1	-	5	9
RC-CDTO	1	2	1	-	5	9
RCC-C3DOCS	2	2	-	3	-	7
RCC-C3DOCS-BLACK	2	2	-	3	-	7
RCC-C3HCS	2	2	-	3	-	7

A.2.1 Inputs

Analogue inputs (AI)	PT1000, 0…50°C, 0…10 V (CO_2)
Condensation input (CI)	Digital input for condensation detector
Digital inputs (DI)	Closing potential-free contact
Universal inputs (UI)	Analogue input, PT1000 sensor, 0…100°C or digital input

A.2.2 Outputs

Digital outputs (DO)	24 V AC, max. 0.5 A
Universal outputs (UO)	Digital output 24 V AC, max. 2.0 A or analogue output, 0…10 V DC, max 5.mA
+C power output for DI only	24 V DC, max. 10 mA, short-circuit-protected

Appendix B Modbus signal lists

B.1 Modbus signal types

B.1.1 EXOL types

The EXOL types of the signals:

- ✓ R = Real (-3.3E38 - 3.3E38)
- ✓ I = Integer (-32768 - 32767
- ✓ X = Index (0 - 255)
- ✓ L = Logic (0/1)

B.1.2 Modbus types

The Modbus types of the signals (types in the list below):

- ✓ 1 = Coil Status Register (Modbus function = 1, 5 and 15
- ✓ 2 = Discrete input (Modbus function = 2)
- ✓ 3 = Holding register (Modbus function = 3, 6 and 16)
- ✓ 4 = Input register (Modbus function = 4)

Supported Modbus functions:

1 = Read Coils

2 = Read Discrete Input

3 = Read Holding Register

4 = Read Input Register

5 = Write Single Coil

6 = Write Single Register

15 = Write Multiple Coils

16 = Write Multiple Registers

B.1.3 Scale factor Modbus

Discrete Inputs and *Coil status register* always have scale factor 1. For *Input register* and *Holding register*, see their respective variable list.

B.1.4 EXOline/Modbus

The Midi controller automatically switches between EXOline and Modbus depending on the present communication type, without any communication error.

B.1.5 Modbus wiring etc.

A protocol such as Modbus consists of several layers (OSI-model). The bottom layer is always the physical layer, number of wires and signal levels. The next layer describes the communication digits (number of data bits, stop-bits, parity etc). Then come the layers describing the Modbus specific functions (number of digits

per message, the meaning of different messages etc). For Modbus, the bottom layer can be RS485, RS422 or RS232.

B.2 Discrete inputs

Signal name	Type	Modbus Address	Description
RC_Actual_L.RegioDigIn(0)	L,2	1	Not used
RC_Actual_L.RegioDigIn1	L,2	2	Value of digital input 1
RC_Actual_L.RegioDigIn2	L,2	3	Value of digital input 2
RC_Actual_L.RegioUDigIn1	L,2	4	Value of universal digital input 1
RC_Actual_L.RegioDigOut(0)	L,2	5	Not used
RC_Actual_L.RegioDigOut1	L,2	6	Value of digital output 1
RC_Actual_L.RegioDigOut2	L,2	7	Value of digital output 2
RC_Actual_L.RegioDigOut3	L,2	8	Value of digital output 3
RC_Actual_L.RegioDigOut4	L,2	9	Value of digital output 4
RC_Actual_L.RegioDigOut5	L,2	10	Value of digital output 5
RC_Actual_L.RegioUDigOut1	L,2	11	Value of universal digital output 1
RC_Actual_L.RegioUDigOut2	L,2	12	Value of universal digital output 2
RC_Actual_L.RegioDIOpenWindow	L,2	13	Indicate open window
RC_Actual_L.RegioDICondenseAlarm	L,2	14	Indicate condense alarm from digital input
RC_Actual_L.RegioDIPresences	L,2	15	Indicate presence from digital input
RC_Actual_L.RegioDIChangeOver	L,2	16	Indicate change over from digital input
RC_Actual_L.RegioFanSpeed1	L,2	17	Indicate fan speed 1
RC_Actual_L.RegioFanSpeed2	L,2	18	Indicate fan speed 2
RC_Actual_L.RegioFanSpeed3	L,2	19	Indicate fan speed 3
RC_Actual_L.RegioForcedventilation	L,2	20	Indicate forced ventilation
RC_Actual_L.RegioCVHeatPulsProp	L,2	21	Indicate pulse prop heating
RC_Actual_L.RegioCVCoolPulsProp	L,2	22	Indicate pulse prop cooling
RC_Actual_L.RegioCVHeatInc	L,2	23	Indicate increase heating
RC_Actual_L.RegioCVHeatDec	L,2	24	Indicate decrease heating
RC_Actual_L.RegioCVCoolInc	L,2	25	Indicate increase cooling
RC_Actual_L.RegioCVCoolDec	L,2	26	Indicate decrease cooling
RC_Actual_L. RegioAIChangeOverState	L,2	27	Indicate change-over state from analogue input
RC_Actual_L.RegioChangeOverState	L,2	28	Indicate change-over state from both digital and analogue input
Not used in this model	L,2	29	
RC_Actual_L.RegioDigOut3	L,2	30	Value of universal digital output 3
RC_Actual_L.RegioPresence	L,2	31	Indicate presence
RC_Actual_L. RegioRoomTempHighTempAlarm	L,2	32	Indicate high room temperature alarm
RC_Actual_L. RegioRoomTempLowTempAlarm	L,2	33	Indicate low room temperature alarm
RC_Actual_L.RegioDICO2	L,2	34	Indicate high CO_2 level
RC_Actual_L.RegioLighting	L,2	38	Lighting control, indication
RC_Actual_L.RegioDlindacation	L,2	39	Run indication, when DI2 is configured as such

Signal name	Type	Modbus Address	Description
RC_Actual_L.RegioPresenceByCo2	L,2	40	Indicates presence from CO_2 sensor
RC_Actual_L. RegioRoomCO2HighAlarm	L,2	41	Indicates High CO^2 (will revert to 0 if CO_2 level< CO_2 High Limit) (Regio Midi 1.7 or newer)

B.3 Coil status registers

Signal name	Type	Modbus address	Default value	Description
RC_Setp_L.RegioBypass	L,1	1	0	Force the unit in Bypass mode. Is automatically returned after Bypass time. 0 = No bypass 1 = Bypass
RC_Setp_L.RegioShutDown	L,1	2	0	Force the unit in Shutdown state. 0 = No Shutdown 1 = Shutdown
RC_Setp_L.RegioNotUsed	L,1	3		Not used
RC_Setp_L.RegioDiNC(0)	L,1	4		Not used
RC_Setp_L.RegioDi1NC	L,1	5	0	State NO/NC digital input 1: 0 = NO (Normally open) 1 = NC (Normally closed)
RC_Setp_L.RegioDi2NC	L,1	6	1	State NO/NC digital input 2: 0 = NO (Normally open) 1 = NC (Normally closed)
RC_Setp_L.RegioUDi1NC	L,1	7	0	State NO/NC universal input 1: 0 = NO (Normally open) 1 = NC (Normally closed)
RC_Setp_L.RegioCVHeatPulsPropNC	L,1	8	0	Selection of heating output function (NC/NO): 0 = NC (Normally closed) 1 = NO (Normally open)
Not used in this model	L,1	9-13	0	
RC_Setp_L.RegioMinFanSpeed	L,1	14	0	The fan will never stop: 0 = Off 1 = On
RC_Setp_L.RegioCVCoolPulsPropNC	L,1	15	0	Selection of cooling output functions (NC/NO): 0 = NC (Normally closed) 1 = NO (Normally open)
RC_Setp_L.RegioComFactoryDefault	L,1	16	0	Resets communication to default values: 1 = Reset (returns to 0)
RC_Setp_L.RegioBlockConfig	L,1	21	0	Prevents parameter menu access via display
RC_Setp_L. RegioPreventManualFanSpeed	L,1	22	0	Function to prevent user from setting manual fan speed if fan should not run due to cooling/heating output according to parameter 50. 0 = Not active 1 = Active
RC_Setp_L.Regio3PEndlimProtect	L,1	23	0	Shuts down the three-position actuator output after 1 minute at 0 % or 100 % output
RC_Setp_L.RegioSteppableBPTimer	L,1	24	0	Activate manual bypass timer setting. When the function is active, the user may step through bypass time in 1 hour increments. 0 = Not active 1 = Active
RC_Setp_L. RegioChangeOverAdvanced	L,1	25	1	Select simple or advanced analog change-over
RC_Setp_L.RegioDisableAutoSave	L,1	26	0	Disables automatic saving to EEPROM

Signal name	Type	Modbus address	Default value	Description
RC_Setp_L.RegioSaveNow	L,1	27	0	Save current settings to EEPROM now
RC_Setp_L.RegioDisableLeds	L,1	28	0	If true all the leds in the controller will be turned off (Regio Midi 1.7 or newer)
RC_Setp_L. Regio2ndZoneDisableCooling	L,1	29	1	If Enabled it will disable Extra zone when main controller is cooling (Regio Midi 1.7 or newer)
RC_Setp_L. RegioSixWayValveSequenceOrder	L,1	30	1	Sequence order (Regio Midi 1.7 or newer) 0 = Cool 1st Sequence 1 = Heat 2nd Sequence
RC_Setp_L. RegioDisplayCO2TempSwitch	L,1	31	0	Display Switch values (Regio Midi 1.7 or newer) 0 = Don't switch values 1 = Switch between Temperature and CO2
RC_Setp_L.RegioMouldProt	L,1	32	0	If active the Fan will always run at least at speed 1, it will override open window and manual (Regio Midi 1.7 or newer)

B.4 Input registers

Signal name	Type	Modbus address	Scale factor	Description
RC_Actual_X.RegioSoftware	X, 4	1	-	Model
RC_Actual_X.RegioVerMajor	X, 4	2	-	Version Major
RC_Actual_X.RegioVerMinor	X, 4	3	-	Version Minor
RC_Actual_X.RegioVerBranch	X, 4	4	-	Version Branch
RC_Actual_X.RegioRevision	X, 4	5	-	Revision
RC_Actual_X.RegioFanSwitch	X, 4	6	-	Indicates the position of the fan switch: 0 = Fan switched off 1 = Fan speed 1 2 = Fan speed 2 3 = Fan speed 3 4 = Auto
RC_Actual_X.RegioUnitState	X, 4	7	-	Indicate current unit state: 0 = Off 1 = Unoccupied 2 = Stand-by 3 = Occupied 4 = Bypass
RC_Actual_X.RegioControllerState	X, 4	8	-	Indicate current controller state: 0 = Off 1 = Heating 2 = Cooling
RC_Actual_X.RegioFanSpeed	X, 4	9	-	Indicate current fan speed: 0 = Off 1 = Fan speed 1 is on 2 = Fan speed 2 is on 3 = Fan speed 3 is on
RC_Actual_R.RegioNotUsedX	X, 4	10	-	Not used
RC_Actual_R.RegioRoomTemp	R, 4	11	10	Room temperature
RC_Actual_R.RegioRoomTempExt	R, 4	12	10	Room temperature from external sensor
RC_Actual_R.RegioRoomTempInt	R, 4	13	10	Room temperature from internal sensor
RC_Actual_R.RegioAIChangeOver	R, 4	14	10	Change-over temperature
RC_Actual_R.RegioAnaIn1	R, 4	15	10	Value of analogue input 1
RC_Actual_R.RegioUAnaIn1	R, 4	16	1	Value of universal analogue input 1
RC_Actual_R.RegioUAnaOut1	R, 4	17	-	Value of universal analogue output 1

Signal name	Type	Modbus address	Scale factor	Description
RC_Actual_R.RegioUAnaOut2	R, 4	18	-	Value of universal analogue output 2
RC_Actual_R.RegioSetPAdjustment	R, 4	19	10	Setpoint adjustment from internal device
RC_Actual_R.RegioPIDSetP	R, 4	20	10	The controller setpoint
RC_Actual_R.RegioPIDOutput	R, 4	21	-	The controller output (0…100 %)
RC_Actual_R.RegioHeatOutput	R, 4	22	-	Heat output (0…100 %)
RC_Actual_R.RegioCoolOutput	R, 4	23	-	Cool output (0…100 %)
RC_Actual_R.RegioAI1Raw	R, 4	24	10	The raw value on analogue input 1
RC_Actual_R.RegioUI1Raw	R, 4	25	1	The raw value on universal input 1
RC_Actual_R.RegioUO3Output	R, 4	26	10	Value of universal output 3
RC_Actual_R.RegioUAnaOut3	R, 4	27	10	Value of universal analogue output 3
RC_Actual_R.RegioRoomCO2	R, 4	32	-	CO_2 input value (ppm)
RC_Actual_R.Regio2ndZoneTemperature	R, 4	34	-	Zone 2 Temperarature (Regio Midi 1.7 or newer)
RC_Actual_R.Regio2ndZoneOutput	R, 4	35	-	Zone 2 PID Output (Regio Midi 1.7 or newer)
Not used in this model	R, 4	44	-	
RC_Actual_R.RegioVoltInput	R, 4	45	10	Value of 0…10 V DC input at AI2
RC_Actual_R.RegioRoomFlow	R, 4	46	10	Value of Room Air Flow at AI2
RC_Actual_R.RegioSupplyAirTemp	R, 4	47	10	Supply air temperature from sensor connected to A1
RC_Actual_R.RegioSupplyAirPIDout	R, 4	48	-	Supply air controller output
RC_Actual_R.RegioPID2Setp	R, 4	49	10	Room controller output (scaled) and supply air controller setpoint

B.5 Holding registers

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.AlaModStat	X, 3	1	-	-	Not used
RC_SetP_X.RegioFreeCoolAvailable	X, 3	2	0	-	Sequence order for Y2 and Y3: 0 = Y2 activates before Y3 1 = Y3 activates before Y2
RC_Setp_X.RegioHeatOutputSelect	X, 3	3	2	-	Manual/Auto Heating output: 0 = Off 1 = Manual 2 = Auto
RC_Setp_X.RegioCoolOutputSelect	X, 3	4	2	-	Manual/Auto Cooling output: 0 = Off 1 = Manual 2 = Auto
RC_Setp_X.RegioFanSelect	X, 3	5	4	-	Select fan mode: 0 = Off 1 = Manual speed 1 2 = Manual speed 2 3 = Manual speed 3 4 = Auto

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X. RegioFanControlMode	X, 3	6	3	-	Configuration of fan control: 0 = No control 1 = Fan is controlled by heating demand 2 = Fan is controlled by cooling demand 3 = Fan is controlled by both heating and cooling demand
RC_Setp_X.RegioFanSpeed1Start	X, 3	7	5 %	-	Start signal in % for fan speed 1 on heating or cooling control
RC_Setp_X.RegioFanSpeed2Start	X, 3	8	60 %	-	Start signal in % for fan speed 2
RC_Setp_X.RegioFanSpeed3Start	X, 3	9	100 %	-	Start signal in % for fan speed 3
RC_Setp_X.RegioFanSpeedHyst	X, 3	10	5 %	-	Hysteresis for start/stop of fans
RC_Setp_X.RegioFanSpeedMax	X, 3	11	3	-	State number of speeds for the fan
RC_Setp_X.RegioForcedVentSelec	X, 3	12	2	-	Manual/Auto Y3 forced ventilation output: 0 = Off 1 = Manual 2 = Auto
RC_Setp_X.RegioChangeOverSelect	X, 3	13	2	-	Manual/Auto control of change-over mode: 0 = Heat control 1 = Cool control 2 = Automatic change over depending on analogue sensor input or digital input
RC_Setp_X.RegioRemoteState	X, 3	14	5	-	Select operating mode for central control: 0 = Off 1 = Unoccupied 2 = Stand-by 3 = Occupied 5 = No central control
RC_Setp_X.RegioUnitReturnState	X, 3	15	3	-	Pre-set operating mode: 0 = Off 1 = Unoccupied 2 = Stand-by 3 = Occupied. Forced ventilation is not set in Occupied mode.
RC_Setp_X.RegioUnitShutDownState	X, 3	16	1	-	State operating mode by pressing the occupancy button for 5 s: 0 = Off 1 = Unoccupied.
RC_Setp_X.RegioBtnOnOffTime	X, 3	17	5 s (0 s for F-model-s)	-	Time to keep the occupancy button depressed before switching to Shutdown state.
RC_Setp_X.RegioControllerMode	X, 3	18	3	-	Control mode: 0 = Heating 1 = Heating / Heating 2 = Heating or Cooling via change-over 3 = Heating /Cooling 4 = Heating /Cooling with VAV-control and forced supply air function 5 = Heating /Cooling with VAV-control 6 = Cooling 7 = Cooling/Cooling 8 = Heating /Cooling/VAV (C3-models, except RC-C3DFOC) 9 = Heating/Heating or Cooling via change-over (only available in models with fan control) 10 = Change-over with VAV-function 11 = VAV 12 = Heating /Cooling (change-over) + VAV 13 = VAV + VAV

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.RegioCVHeatType	X, 3	19	0	-	State output signal range for Heating-actuators: 0=0…10 V 1=2…10 V 2=10…2 V 3=10…0 V
RC_Setp_X.RegioCVCoolType	X, 3	20	0	-	State output signal range for Cooling actuators: 0=0…10 V 1=2…10 V 2=10…2 V 3=10…0 V
RC_Setp_X.RegioCVHeatExerciseInterval	X, 3	21	23h	-	Time in hours between exercise of heating actuators
RC_Setp_X.RegioCVCoolExerciseInterval	X, 3	22	23h	-	Time in hours between exercise of cooling actuators
Not used in this model	X, 3	23	-	-	
RC_Setp_X.RegioAi1	X, 3	24	0	-	State connected sensor on AI1: 0 = Internal sensor 1 = External room sensor 2 = Change over sensor (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC) 3-10 = No function 11 = Supply air temperature limitation sensor 12 = Extra zone temperature
RC_Setp_X.RegioAi2	X, 3	25	5	-	State the connected sensor at AI2: (Only RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC) 0 = None 1– 4 = No function 5 = CO_2-sensor 6 = No function 7 = 0…100 % (OEM-function) 8 = Flow calculation 9 = 0…10 V 11 = Supply air temperature (0…10 V) 12 = Extra zone temperature (0…10 V)
Not used in this model	X, 3	26	-	-	
RC_Setp_X.RegioDi1	X, 3	27	3	-	State connected sensor on DI1: 0 = Not active 1 = Window contact 2 = No function 3 = Presence detector 4 = Change over sensor (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_X.RegioDi2	X, 3	28	2	-	State connected sensor on DI2: 0 = None 1 = Window contact 2 = Condensation sensor 3 = Presence detection 4 = Change over sensor (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC, RCC-C3HCS) 5 = No function 6 = No function 7 = Run indication / Ext. digital input
Not used in this model	X, 3	29	0	-	

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.RegioUi1	X, 3	30	2	-	State connected sensor on UI1: (All models exceptRC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC) 0 = None 1 = Change-over digital 2 = Change-over analogue 3 = External room sensor 4 = Supply air temperature limitation sensor 5 = Extra zone temperature
Not used in this model	X, 3	31-34	-	-	
RC_Setp_X.RegioDo1	X, 3	35	1 (-F- models), 4 (other models)	-	0 = Not active 1 = Fan speed 1 2 = Fan speed 2 3 = Fan speed 3 4 = Forced ventilation 5 = Thermal actuator heating 6 = Thermal actuator cooling 7 = Increase/Decrease valve, heating increase 8 = Increase/Decrease valve, heating decrease 9 = Increase/Decrease valve, cooling increase 10 = Increase/Decrease valve, cooling decrease 11 = Lighting control
RC_Setp_X.RegioDo2(only used for -F- and -T- models)	X, 3	36	2 (-F- models), 7 (-T- models)	-	2 = Fan speed 2 7 = Heat valve increase
RC_Setp_X.RegioDo3 (only used for -F- and -T- models)	X, 3	37	3 (-F- models), 8 (-T- models)	-	3 = Fan speed 3 8 = Heat valve decrease
RC_Setp_X.RegioDo4 (only used for -F- and -T- models)	X, 3	38	4 (-F- models), 9 (-T- models)	-	4 = Forced ventilation 9 = Cool valve increase
RC_Setp_X.RegioDo5 (only used for -T- models)	X, 3	39	10 (-T- models)	-	10 = Cool valve decrease
Not used in this model	X, 3	40-41	-	-	
RC_Setp_X.RegioUo1 (Not –T- models)	X, 3	42	3	-	State connected function on UO1: 0 = None 1 = Thermal actuator heat 2 = None 3 = Heating actuator 0...10 V 4 = None 5 = On/off actuator heat 6 = None 7 = 6-way valve 8 = VAV 9 = VAV2

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.RegioUo2 (Not –T- models)	X, 3	43	4	-	State connected function on UO2: 0 = None 1 = None 2= Thermal actuator Cool 3 = None 4 = Cooling actuator 0…10 V 5 = None 6 = On/off actuator cool 7 = 6-way valve 8 = VAV 9 = VAV2
RC_Setp_X.RegioModbusSlaveAddr	X, 3	44	Factory set	-	Controller Modbus address
RC_Setp_X.RegioModbusParity	X, 3	45	2	-	Parity of Modbus communication: 0 = No parity 1 = Odd parity 2 = Even parity 3 = No parity, 1 stop bit
RC_Setp_X.RegioModbusCharTimeout	X, 3	46	3 ms	-	Modbus timeout for character (t1.5), in ms. Should be 1.5 times a character, i.e. at least 2 ms.
RC_Setp_X.RegioModbusAnswerDelay	X, 3	47	5 ms	-	Answer delay in Modbus (t3.5), in ms. Should be 3.5 times a character, i.e. at least 5 ms.
RC_Setp_X.RegioDispBacklightLO	X, 3	48	10	-	10 = Backlight low
RC_Setp_X.RegioDispBacklightHi	X, 3	49	30	-	30 = Backlight high
RC_Setp_X.RegioDispContrast	X, 3	50	15	-	15 = Display contrast
RC_Setp_X.RegioDisplayViewMode	X, 3	51	0	-	Select if setpoint or actual value is to be shown in the display. 0 = Actual value 1 = Heat setpoint 2 = Cool setpoint 3 = Average value of heating and cooling setpoint 4 = Only setpoint offset 5 = CO_2-concentration in the room in ppm (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC) 6 = Heating setpoint +setpoint offset 7 = Cooling setpoint+setpoint offset 8 = Average of heating and cooling setpoint +setpoint offset 9 = The calculated flow in the duct in l/s (RC-C3DOC, RCC-C3DOCS, RC-C3DFOC)
RC_Setp_X.RegioDispSetpMode	X, 3	52	0	-	Setpoint display at setpoint adjustment: 0 = The offset is shown in the display 1 = The active setpoint + offset is shown in the display. Heat or Cool is shown depending on whether heat or cool is active when entering the menu 2 = Heat setpoint + offset is shown in the display 3 = Cooling setpoint + offset is shown in the display 4 = Heating occupied setpoint + offset is shown in the display 5 = Cooling occupied setpoint + offset is shown in the display 6 = Average of heating and cooling setpoints + offset is shown in the display

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.RegioUo3	X, 3	53	6 (RC-C3DF-OC) or 1 (other C3… model-s)	-	State connected function on UO3: 0 = None 1 = Forced ventilation, digital 2 = Analogue output (OEM) 3 = Lighting control, digital 4 = Ordinary analogue output 5 = None 6 = Control of a EC fan (RC-C3 and RCC-… models) 7 = Extra zone active signal 8 = VAV2 10 = Heat Extra zone 11 = Thermal actuator heat Extra zone
RC_Setp_X.RegioForcedVentControlMode	X, 3	54	0	-	Forced ventilation, control function: 0 = Not active 1 = Forced ventilation at 100 % output of heat or cool 2 = Forced ventilation at 100 % cool output
RC_Setp_X.RegioUnitDIPresenceState	I, 3	55	4	-	Operating mode at presence detection: 3 = Occupied 4 = Bypass
RC_Setp_I.RegioBypassTime	I, 3	56	120 min	-	Time in Bypass mode
RC_Setp_I.RegioPresenceOffTime	I, 3	57	10 min	-	Disconnect timer with Occupancy/ Unoccupancy
RC_Setp_I.RegioPresenceOnTime	I, 3	58	0 min	-	Switch-on delay for Occupancy
RC_Setp_I.RegioCVHeatPeriodTime	I, 3	59	60s	-	Period time for heating actuators with thermal actuator
RC_Setp_I.RegioCVCoolPeriodTime	I, 3	60	60s	-	Period time for cooling actuators with thermal actuator
RC_Setp_I.RegioCVHeatRunTime	I, 3	61	120 s	-	Run time for heating actuators with increase/decrease actuators
RC_Setp_I.RegioCVCoolRunTim	I, 3	62	120 s	-	Run time for cooling actuators with increase/decrease actuators
Not used in this model	X, 3	63-67	-	-	
RC_Setp_R.RegioOccSetPHeat	R, 3	68	22°C	10	Basic Heating setpoint
RC_Setp_R.RegioOccSetPCool	R, 3	69	24°C	10	Basic Cooling setpoint
RC_Setp_R.RegioStandbySetPDeadBand	R, 3	70	3°C	10	Neutral zone at Stand-by, Heating sp= basic sp .heating-3 by default,Coolsp= Basic sp.cool+3 by default
RC_Setp_R.RegioUnOccSetPHeat	R, 3	71	15°C	10	Heating setpoint at Unoccupied
RC_Setp_R.RegioUnOccSetPCool	R, 3	72	30°C	10	Cooling setpoint at Unoccupied
RC_Setp_R.RegioFrostSetP	R, 3	73	8°C	10	Frost protection setpoint
RC_Setp_R.RegioSetpointOffsetPos	R, 3	74	3°C	10	Highest permitted setpoint adjustment uppwards
RC_Setp_R.RegioSetpointOffsetNeg	R, 3	75	3°C	10	Highest permitted setpoint adjustment downwards
RC_Setp_R.RegioSetPOffset	R, 3	76	0 °C	10	The setpoint adjustment
RC_Setp_R.RegioPIDPGain	R, 3	77	10°C	10	P-band for room controller
RC_Setp_R.RegioPIDITime	R, 3	78	300 s	-	I-time (s) for room controller
RC_Setp_R.RegioCVDeadband	R, 3	79	2%	-	Deadband for increase/decrease actuators (%)
RC_Setp_R.RegioAIChangeOverDiffHeat	R, 3	80	3K	10	The difference between the temperature in the room and the media temperature for change over to cooling

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_R.RegioAIChangeOverDiffCool	R, 3	81	4K	10	The difference between the temperature in the room and the media temperature for change over to heating
RC_Setp_R.RegioAi1Comp	R, 3	82	0°C	10	Temperature compensation on AI1
RC_Setp_R. RegioUi1Comp	R, 3	83	0°C	10	Temperature compensation on UI1
RC_Setp_R.RegioInternalTempComp	R, 3	84	0°C	10	Temperature compensation on internal room sensor
RC_Setp_R.RegioTempFilterFactor	R, 3	85	0,2	10	Filter factor for analogue temperature inputs
RC_Setp_R.RegioMinFlow	R, 3	86	20	-	Min flow at cool output when control mode Heating/Cooling with VAV-control is selec-tedMin flow at Y3 output when control mode Heating/Cooling/VAV is selected
RC_Setp_R.RegioMaxFlowHeat	R, 3	87	0%	-	Max flow on cool output when control mode Heating/Cooling with VAV-control is selected and heating is applied.
RC_SetP_R.RegioRoomTempHighLimit	R, 3	88	40°C	10	Alarm limit for high room temperature
RC_SetP_R.RegioRoomTempLowLimit	R, 3	89	15°C	10	Alarm limit for low room temperature
RC_Setp_R.RegioVAVMaxHeatCool	R, 3	90	100 %	-	VAV-damper max limitation.
Not used in this model	R, 3	91-92	-	-	
RC_Setp_R.RegioUo3OutputManual	R, 3	93	0%	-	Y3 Output in manual mode
RC_Setp_R.RegioHeatOutputManual	R, 3	94	0%	-	Heating output in manual mode
RC_Setp_R.RegioCoolOutputManual	R, 3	95	0%	-	Cooling output in manual mode
RC_Setp_R.RegioRoomTempRemote	R, 3	96	-255	10	Room temp set by remote control if external room sensor is configured (-255 = disabled)
RC_Setp_R.RegioCO2_0V	R, 3	120	0ppm	-	CO_2-level at 0 V(RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2_10V	R, 3	121	2000p-pm	-	CO_2-level at 10 V(RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2FilterFactor	R, 3	125	0,2	10	Filter factor for CO_2-input(RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2PresenceLimit	R, 3	133	800pp-m	-	Activate presence if CO_2 level is higher (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2PresenceHyst	R, 3	134	160pp-m	-	Deactivate presence if the CO_2 level is lower than the limit minus this hysteresis (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2LimitLow	R, 3	147	600pp-m	-	Min limit for VAV-damper at CO_2-control (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_Setp_R.RegioCO2LimitHigh	R, 3	148	800pp-m	-	Max limit for VAV-damper at CO_2-control (RC-C3DOC, RCC-C3DOCS, RCC-C3HCS, RC-C3DFOC)
RC_SetpExt_R.RegioFlowFilterFactor	R, 3	149	0	10	Flow filter factor
RC_Setp_R.RegioFanBoostTime	R, 3	276	0	-	Fan boost function. Activation time: 0= Not active 1-10 = The function is active for 10 s. 11-600 = Total activation time
RC_SetpExt_R.RegioFlow_0V	R, 3	277	0 l/s	-	Flow at 0 V input in AI2 (l/s)
RC_SetpExt_R.RegioFlow_10V	R, 3	278	100 l/s	-	Flow at 10 V input in AI2 (l/s)

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_SetpExt_R.RegioThermostatHystHeat	R, 3	279	2K	10	Hysteresis for On/Off actuators and heating
RC_SetpExt_R.RegioThermostatHystCool	R, 3	280	2K	10	Hysteresis for on/off actuators and cooling
RC_SetpExt_R.RegioMinHeat	R, 3	281	0 %	-	Min. limit for the heat output
RC_SetpExt_R.RegioMinECFanSpeed	R, 3	282	10 %	-	Min. limit for EC fan (%)
RC_SetpExt_R.RegioMaxECFanSpeed	R, 3	283	100 %	-	Max. limit for EC fan (%)
RCPSettings.RegioMinFlowStandby	R, 3	285	10 %	-	Basic flow at “Standby” when control state “Heating/Cooling with VAV-control” or “Heating/Cooling/VAV” is configured
RCPSettings.RegioMinFlowUnoccupied	R, 3	286	10 %	-	Basic flow at “Unoccupied” when control state “Heating/Cooling with VAV-control” or “Heating/Cooling/VAV” is configured
RCPSettings.RegioMinFlowOff	R, 3	287	0 %	-	Basic flow at “Off” when control state “Heating/Cooling with VAV-control” or “Heating/Cooling/VAV” is configured
RC_Setp_R.SupplyAirTLim_HeatHi	R, 3	289	35°C	10	Supply air max limitation for cascade control and heating control
RC_Setp_R.SupplyAirTLim_HeatLo	R, 3	290	24°C	10	Supply air min limitation for cascade control and heating control
RC_Setp_R.SupplyAirTLim_CoolHi	R, 3	291	24°C	10	Supply air max limitation for cascade control and cooling control
RC_Setp_R.SupplyAirTLim_CoolLo	R, 3	292	12°C	10	Supply air min limitation for cascade control and cooling control
RC_Setp_R.SupplyAirTLim_CascadeFact	R, 3	293	3°C	10	Cascade factor between room controller and supply air controller
RC_Setp_R.SupplyAirTLim_FrostProtect	R, 3	294	8°C	10	Frost protection temperature for supply air when supply air temperature limitation is active
RC_Setp_X.RegioExerciseSelect	X, 3	296	1	-	Use valve exercise 0 = Never 1 = Regularly 2 = Regularly and at power-up 3 = Regularly, at power-up and when changing state to Occupied
RC_Setp_R.RegioCO2ControlPBand	R,3	297**	100	-	CO_2 PI Control P Band (Regio Midi 1.7 or newer)
RC_Setp_R.RegioCO2ControlITime	R,3	298**	100	-	CO_2 PI Control I Time (Regio Midi 1.7 or newer)
RC_Setp_R.RegioCO2ControlSetpoint	R,3	299**	600	-	CO_2 Setpoint (Regio Midi 1.7 or newer)
RC_Setp_R.Regio2ndZoneSetpoint	R,3	300	22	-	Room Setpoint for Extra zone (Regio Midi 1.7 or newer)
RC_Setp_X.Regio2ndZoneEnable	X,3	301	0	-	Enable options for Extra zone (Regio Midi 1.7 or newer) 0 = Disabled 1 = Main zone state is Unoccupied or higher 2 = Main zone state is Standby or higher 3 = Main zone state is Occupied or higher 4 = Main zone state is Bypass 5 = Always on
RC_Setp_R.Regio2ndZonePBand	R,3	302	10	-	Extra Zone PI Control P Band (Regio Midi 1.7 or newer)
RC_Setp_R.Regio2ndZoneITime	R,3	303	300	-	Extra Zone PI Control I Time (Regio Midi 1.7 or newer)
RC_Setp_R. RegioSixWayValveFirstSeqFullyOpen	R,3	304	0	-	Voltage applied to 6 way valve for fully open at sequence 1 (Regio Midi 1.7 or newer)

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_R. RegioSixWayValveFirstSeqStartOpen	R,3	305	3,3	-	Voltage applied to 6 way valve to start open at sequence 1 (Regio Midi 1.7 or newer)
RC_Setp_R. RegioSixWayValveSecondSeqStartOpen	R,3	306	6,7	-	Voltage applied to 6 way valve to start open at sequence 2 (Regio Midi 1.7 or newer)
RC_Setp_R. RegioSixWayValveSecondSeqFullyOpen	R,3	307	10	-	Voltage applied to 6 way valve for fully open at sequence 2 (Regio Midi 1.7 or newer)
RC_Setp_R. RegioSixWayValveCenterPoint	R,3	308	5	-	Voltage applied to 6 way valve for center point, closed both sequences (Regio Midi 1.7 or newer)
RC_Setp_X. RegioSixWayValveCenterPointHyst	X,3	309	2	-	Center point Hysteresis (Regio Midi 1.7 or newer)
RC_Setp_R.RegioTempAI2_0V	R,3	310	-10	-	Conversion factor for temperature sensor (0-10V) on AI2 at 0V (Regio Midi 1.7 or newer)
RC_Setp_R.RegioTempAI2_10V	R,3	311	50	-	Conversion factor for temperature sensor (0-10V) on AI2 at 10V (Regio Midi 1.7 or newer)
RC_Setp_R.RegioRoomCO2HighLimit	R,3	312	1000	-	CO_2 Level High Limit for alarm (Regio Midi 1.7 or newer)
RC_Setp_R.RegioMinFlowY4	R,3	313	0	-	Min Flow at VAV 2 when control mode is VAV/VAV (Regio Midi 1.7 or newer)
RC_Setp_R.RegioMinFlowStandbyY4	R,3	314	10	-	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in Standby state (Regio Midi 1.7 or newer)
RC_Setp_R.RegioMinFlowUnoccupiedY4	R,3	315	10	-	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in Unoccupied state (Regio Midi 1.7 or newer)
RC_Setp_R.RegioMinFlowOffY4	R,3	316	0	-	Min Flow at VAV 2 when control mode is VAV/VAV and Controller in Off state (Regio Midi 1.7 or newer)
RC_Setp_R.RegioMaxFlowCoolVentY4	R,3	317	100	-	Max Flow in VAV 2 (Regio Midi 1.7 or newer)
RC_Setp_X.RegioVAVBypassBehaviour	X,3	318	0	-	Bypass behaviour in VAV/VAV mode (Regio Midi 1.7 or newer) 0 = DO Forced ventilation 1 = Y1 VAV 2 = Y1 VAV and Y2 VAV 3 = Y1 VAV, Y2 VAV and DO Forced ventilation
RegioButtonActivationConf	3	319	7	-	(Regio Midi 1.7 or newer) 0 = No buttons 1 = Occupancy button only 2 = INCREASE/DECREASE only 3 = Occupancy button and INCREASE/ DECREASE 4 = Fan button only 5 = Occupancy button and fan button 6 = INCREASE/DECREASE and fan button 7 = All buttons
RC_Setp_R.RegioHeat2OutputManual	R,3	320	0	-	Manual value heat output 2 (Regio Midi 1.7 or newer)
RC_Setp_R.RegioCool2OutputManual	R,3	321	0	-	Manual value cool output 2 (Regio Midi 1.7 or newer)
RC_Setp_R.RegioVAV2OutputManual	R,3	322	0	-	Manual value vav output 2 (Regio Midi 1.7 or newer)

Signal name	Type	Modbus address	Default value	Scale factor	Description
RC_Setp_X.RegioHeatOutput2Select	X,3	323	2	-	Manual/Auto for heat output 2 (Regio Midi 1.7 or newer) 0 = Off 1 = Manual 2 = Auto
RC_Setp_X.RegioCoolOutput2Select	X,3	324	2	-	Manual/Auto for cool output 2 (Regio Midi 1.7 or newer) 0 = Off 1 = Manual 2 = Auto
RC_Setp_X.RegioVAVOuput2Select	X,3	325	2	-	Manual/Auto for VAV output 2 (Regio Midi 1.7 or newer) 0 = Off 1 = Manual 2 = Auto

Parameters marked with ** are used only in version 1.7-1-01 and 1.7-1-02.

Appendix C BACnet signals

C.1 BACnet signal types

Note! The BACnet signals are valid for version 1.7 and later. For older versions, please refer to the corresponding manual and variable list.

BACnet Bacnet communication is only available in models with display. In order to communicate via BACnet, the protocol has to be changed either via Application tool or via the parameter list in the display. Once the protocol has been set to BACnet it can only be switched back to EXOline and Modbus via the display.

MS/TP mode Both MS/TP master and slave are supported. The mode is controlled by setting the MAC address. If < 127, master mode is selected. A MAC address of > 127 enables slave.

Object Type The BACnet types of the signals (types in the list below):

- ✓ Analogue inputs
- ✓ Analogue values
- ✓ Binary inputs
- ✓ Binary values
- ✓ Loop
- ✓ Multistate inputs
- ✓ Multistate values
- ✓ Device

Out_of_service The property out_of_service is not writable for all Object Types.

Commandable The value objects are not commandable (i.e. does not use a priority array).

C.2 Analogue inputs

Object name	Object-ID	Description	Unit	Writable
RC_Actual_R.RegioRoomTemp	Analog input, 0	Room temperature	°C	No
RC_Actual_R. RegioAIChangeOver	Analog input, 1	Change over temperature	°C	No
RC_Actual_R.RegioAnaIn1	Analog input, 2	Value of analogue input 1	°C	No
RC_Actual_R.RegioUAnaIn1	Analog input, 3	Value of universal analogue input 1	V	No
RC_Actual_R.RegioRoomCO2	Analog input, 4	CO_2 input value	ppm	No
RC_Actual_R. RegioSupplyAirTemp	Analog input, 5	Supply air temperature	°C	No
RC_Actual_R.RegioRoomFlow	Analog input, 6	Air flow	l/s	No
RC_Actual_R.RegioVoltInput	Analog input, 7	Value on analogue input 2	V	No
RC_Actual_R. Regio2ndZoneTemperature	Analog input, 8	Zone 2 Temperature	°C	No

C.3 Analogue values

Object name	Object-ID	Description	Unit	Writable
RC_Actual_R.RegioUAnaOut1	Analog value, 0	Value of universal analogue output 1	V	No
RC_Actual_R.RegioUAnaOut2	Analog value, 1	Value of universal analogue output 2	V	No
AV02	Analog value, 2	Not used		
RC_Actual_R.RegioPIDSetP	Analog value, 3	Controller setpoint	°C	No
RC_Actual_R.RegioPIDOutput	Analog value, 4	Controller output	%	No
RC_Actual_R.RegioHeatOutput	Analog value, 5	Heat output	%	No
RC_Actual_R.RegioCoolOutput	Analog value, 6	Cool output	%	No
RC_Setp_R.RegioOccSetPHeat	Analog value, 7	Room base setpoint heating	°C	Yes
RC_Setp_R.RegioOccSetPCool	Analog value, 8	Room base setpoint cooling	°C	Yes
RC_Setp_R. RegioUnOccSetPHeat	Analog value, 9	Room heat setpoint in unoccupied mode	°C	Yes
RC_Setp_R. RegioUnOccSetPCool	Analog value, 10	Room cool setpoint in unoccupied mode	°C	Yes
RC_Setp_R.RegioFrostSetP	Analog value, 11	Frost protection setpoint	°C	Yes
RC_Setp_R.RegioSetPOffset	Analog value, 12	Setpoint adjustment	°C	Yes
RC_Setp_R. RegioHeatOutputManual	Analog value, 13	Manual value heating output	%	Yes
RC_Setp_R. RegioCoolOutputManual	Analog value, 14	Manual value cooling output	%	Yes
RC_Setp_R. RegioRoomTempRemote	Analog value, 15	Remote control of room temperature	°C	Yes
RC_Setp_R. RegioStandbySetPDeadBand	Analog value, 16	Deadband in Standby mode	°C	Yes
RC_Setp_R.RegioCVDeadband	Analog value, 17	Deadband control valve	%	Yes
AV18	Analog value, 18	Not used		
AV19	Analog value, 19	Not used		
AV20	Analog value, 20	Not used		
AV21	Analog value, 21	Not used		
RC_Setp_R.RegioFlow_0V	Analog value, 22	Flow at 0 V input signal at AI2	l/s	Yes
RC_Setp_R.RegioFlow_10V	Analog value, 23	Flow at 10 V input signal at AI2	l/s	Yes
AV24	Analog value, 24	Not used		
AV25	Analog value, 25	Not used		
RC_Setp_R.RegioMinHeat	Analog value, 26	Minimum heat output at Heat control	%	Yes
RC_Setp_R. RegioMinECFanSpeed	Analog value, 27	Minimum speed for the EC fan	%	Yes
RC_Setp_R. RegioMaxECFanSpeed	Analog value, 28	Maximum speed for the EC fan	%	Yes
RC_Actual_R.RegioUAnaOut3	Analog value, 29	Value on universal analogue output 3	V	No
RC_Actual_R.RegioUO3Output	Analog value, 30	UO3 Output (0…100 %)	%	No
RC_Actual_R.RegioPID2Setp	Analog value, 31	Calculated supply air setpoint	°C	No
AV32	Analog value, 32	Not used		
AV33	Analog value, 33	Not used		
AV34	Analog value, 34	Not used		

Object name	Object-ID	Description	Unit	Writable
CO2LimitLow	Analog value, 35	CO_2 value when damper starts to open (Regio Midi 1.7-1-04 or newer)	ppm	Yes
CO2LimitHigh	Analog value, 36	CO_2 value when damper is fully open (Regio Midi 1.7-1-04 or newer)	ppm	Yes
RC_Setp_R. Regio2ndZoneSetpoint	Analog value, 37	Room setpoint for Extra zone	°C	Yes
RC_Setp_R. RegioRoomCO2HighLimit	Analog value, 38	CO_2 level high limit for alarm	°C	Yes
RC_Setp_R. RegioHeat2OutputManual	Analog value, 39	Manual value heat output 2	%	Yes
RC_Setp_R. RegioCool2OutputManual	Analog value, 40	Manual value cool output 2	%	Yes
RC_Setp_R. RegioVAV2OutputManual	Analog value, 41	Manual value vav output 2	%	Yes
RC_Setp_R. RegioUo3OutputManual	Analog value, 42	Manual value VAV output (Regio Midi 1.7-1-04 or newer)	%	Yes

C.4 Binary inputs

Object name	Object-ID	Description	Values	Writable
RC_Actual_L. RegioDIOpenWindow	Binary input, 0	Indicate open window	ACTIVE/INACTIVE	No
RC_Actual_L. RegioDICondenseAlarm	Binary input, 1	Indicate condense alarm from digital input	YES/NO	No
RC_Actual_L.RegioDIPresences	Binary input, 2	Indicate presence from digital input	ACTIVE/INACTIVE	No
RC_Actual_L.RegioDIChangeOver	Binary input, 3	Indicate change over from digital input	ACTIVE/INACTIVE	No
RC_Actual_L. RegioRoomTempHighTempAlarm	Binary input, 4	Room high temperature alarm	ACTIVE/INACTIVE	No
RC_Actual_L. RegioRoomTempLowTempAlarm	Binary input, 5	Room low temperature alarm	ACTIVE/INACTIVE	No
BI06	Binary input, 6	Not used		
RC_Actual_L.RegioDIindacation	Binary input, 7	Run indication, when DI2 is configured as such	ACTIVE/INACTIVE	No
RC_Actual_L. RegioRoomCO2HighAlarm	Binary input, 8	Indicates high CO_2 (will revert to 0 if CO_2 level < CO_2 high limit)	ACTIVE/INACTIVE	No

All binary inputs have normal polarity.

C.5 Binary values

Object name	Object-ID	Description	Values	Writable
RC_Actual_L. RegioForcedVentilation	Binary value, 0	Indicate forced ventilation	ON/OFF	No
RC_Actual_L. RegioCVHeatPulsProp	Binary value, 1	Indicate pulse prop heating	ACTIVE/INACTIVE	No
RC_Actual_L. RegioCVCoolPulsProp	Binary value, 2	Indicate pulse prop cooling	ACTIVE/INACTIVE	No
BV03	Binary value, 3	Not used		

Object name	Object-ID	Description	Values	Writable
BV04	Binary value, 4	Not used		
BV05	Binary value, 5	Not used		
BV06	Binary value, 6	Not used		
RC_Actual_L. RegioChangeOverState	Binary value, 7	Indicate change over state from both digital and analogue input	ACTIVE/INACTIVE	No
RC_Actual_L. RegioRoomTempSensorAlarm	Binary value, 8	Indicate sensor alarm on room sensor	ACTIVE/INACTIVE	No
RC_Setp_L.RegioBypass	Binary value, 9	Force the unit in Bypass mode. Is automatically returned after Bypass time (default = 120 min)	ACTIVE/INACTIVE	Yes
RC_Setp _L.RegioShutDown	Binary value, 10	Force the unit in ShutDown state	ACTIVE/INACTIVE	Yes
RC_Setp_L. RegioComFactoryDefaults	Binary value, 11	Resets communication settings to default values	ACTIVE/INACTIVE	Yes
RC_Setp_L.RegioBlockConfig	Binary value, 12	Prevents unauthorised access to the configuration menu via controller buttons	ACTIVE/INACTIVE	Yes
RC_Setp_L. RegioChangeOverAdvanced	Binary value, 13	Use advanced analog change-over function	ACTIVE/INACTIVE	Yes

All binary values have normal polarity.

C.6 Loop

Object name	Object-ID	Description
Regulator	Loop, 0	The Regio Regulator

C.7 Multistate inputs

Object name	Object-ID	Description	Values	Writable
RC_Actual_X.RegioFanSwitch	Multistate input, 0	Fan switch state	1 = OFF 2 = LOW 3 = MEDIUM 4 = HIGH 5 = AUTO	No
RC_Actual_X.RegioUnitState	Multistate input, 1	Current unit state	1 = Off 2 = Unoccupied 3 = Stand-by 4 = Occupied 5 = Bypass	No
RC_Actual_X. RegioControllerState	Multistate input, 2	Current controller state	1 = Off 2 = Heating 3 = Cooling	No
RC_Actual_X.RegioFanSpeed	Multistate input, 3	Current fan speed	1 = Off 2 = Fan speed 1 3 = Fan speed 2 4 = Fan speed 3	No

C.8 Multistate values

Object name	Object-ID	Description	Values	Writable
RC_Setp_X. RegioHeatOutputSelect	Multistate value, 0	Manual/Auto heat output	1 = Off 2 = Manual output 3 = Automatic output	Yes
RC_Setp_X. RegioCoolOutputSelect	Multistate value, 1	Manual/Auto cool output	1 = Off 2 = Manual output 3 = Automatic output	Yes
RC_Setp_X.RegioFanSelect	Multistate value, 2	Fan mode select	1 = Off 2 = Manual speed 1 3 = Manual speed 2 4 = Manual speed 3 5 = Auto 6 = Auto 2 7 = Auto 1	Yes
RC_Setp_X. RegioForcedVentSelect	Multistate value, 3	Manual/Auto forced ventilation and VAV Output	1 = Off 2 = Manual On 3 = Auto	Yes
RC_Setp_X. RegioChangeOverSelect	Multistate value, 4	Manual/Auto change-over	1 = Heating 2 = Cooling 3 = Auto	Yes
RC_Setp_X.RegioRemoteState	Multistate value, 5	Remote control unit state	1 = Off 2 = Unoccupied 3 = Stand-by 4 = Occupied 6 = No remote control	Yes
MSV6	Multistate value, 6	Not used		
RC_Setp_X. RegioHeatOutput2Select	Multistate value, 7	Manual/Auto for heat output 2	0 = Off 1 = Manual 2 = Auto	Yes
RC_Setp_X. RegioCoolOutput2Select	Multistate value, 8	Manual/Auto for cool output 2	0 = Off 1 = Manual 2 = Auto	Yes
RC_Setp_X. RegioVAVOuput2Select	Multistate value, 9	Manual/Auto for VAV output 2	0 = Off 1 = Manual 2 = Auto	Yes

C.9 Device

The device object contains two writable properties; Description and Location. Description can be 17 characters long, and Location can be 33 characters long, if using single byte character encoding.

REGIN
THE CHALLENGER

HEAD OFFICE AB Regin, Box 116, SE-428 22 Kållered • Visiting address: Bangårdsvägen 35, SE-428 36 Kållered
Phone: +46 (0)31 720 02 00 • Fax: +46 (0)31 720 02 50 • info@regincontrols.com • www.regincontrols.com