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USER GUIDE

HLS 44-SE

Produal

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PRODUAL

HLS 44-SE - room controller

USER GUIDE

This user guide is for devices with the software version 2.1.3 or newer.

Made in Finland

5 years warranty

MANAGEMENT SYSTEM CERTIFICATION DNV ISO 9001 • ISO 14001

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1 About this user guide

This user guide contains important information about the installation, wiring, configuration and use of the product. Read this guide carefully before you install the product, connect the wires, or operate the product. Make sure that you fully understand all instructions before you start work. If you are not sure what the instructions mean, contact the seller or the manufacturer.

Follow all instructions in this user guide carefully. Always obey the applicable local rules and regulations.

The original instructions were written in English. If there are differences between the English instructions and the translations, refer to the English instructions.

If you find a mistake in the English instructions or in the translations, please send the details to the manufacturer.

1.1 Intended use

The intended use of HLS 44-SE room controller is to control temperature, humidity, CO_2 and air flow in rooms and other indoor areas.

This device is intended to be connected to building automation systems in the HVAC/R industry.

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2 Safety precautions

The product is developed, manufactured and tested according to high quality standards. However, instructions for safe use must be followed when installing, using or disposing the product or parts of product.

Read this user guide carefully before you commission, use or service this device. To avoid any kind of damage to people or property, follow the instructions carefully. Produal is not liable for any hazards, injury to people, or damage to property caused by incorrect installation or misuse of the device.

To avoid electrical shock or damage to equipment, disconnect power before you install or service the product. Use only proper wiring that is rated for the full operating voltage and maximum current in the system. The wiring must also withstand fault conditions.

To avoid fire and/or explosion, do not use the product in potentially flammable or explosive atmosphere.

Make sure that the product is not damaged before installation. Do not drop the product or use excessive force during installation. Do not use the product if you can see any damages.

After installation, the product will be part of a system whose specifications and performance characteristics are not designed or controlled by Produal. Refer to national and local authorities to ensure that the installation is functional and safe.

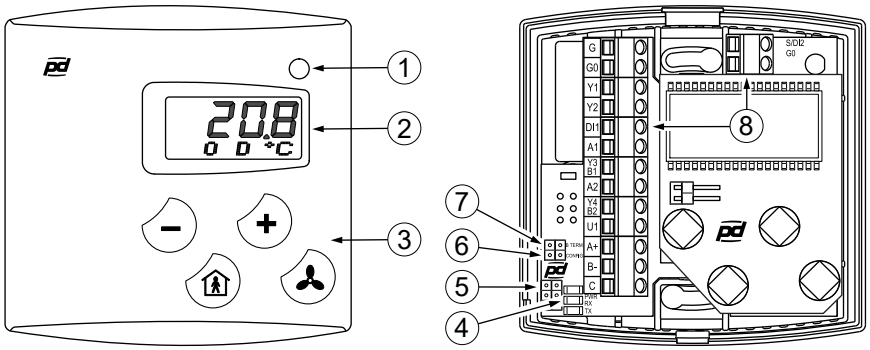
The product should only be used in professionally designed applications. Unauthorised modifications are not allowed. The product must not be used in relation with any equipment that in case of a failure may threaten, directly or indirectly, human health or life or result in danger to human beings, animals or property.

In this document, there are different warnings and notes. The warning and note types are defined in the following table.

Sign	Description
WARNING:	The warning symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION:	The caution symbol indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
Important:	The important symbol indicates a potentially hazardous situation which, if not avoided, could result in damage to the device or property.
Note:	The note symbol indicates a useful tip or a recommended way to complete a task. These notes also provide information that is useful but not critical to the user.

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3 Main components

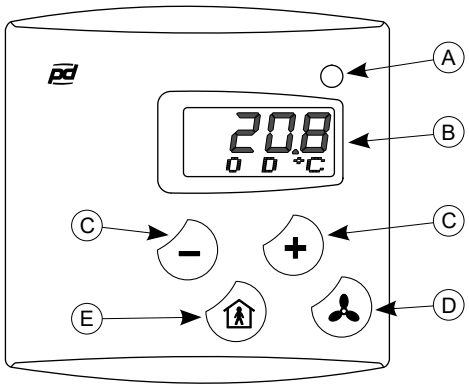


1	Indicator light	2	Display
3	Control buttons	4	Indicator lights inside the device
5	Commissioning tool connector	6	Configuration mode selector
7	Modbus termination jumper	8	Terminal block

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4 Functional description

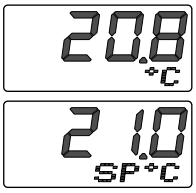
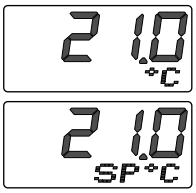
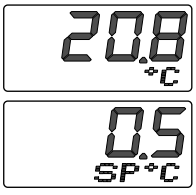
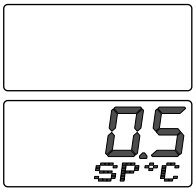
4.1 User interface



A	Indicator light • red = heating • green = cooling
B	Display • temperature, setpoint, or deviation from setpoint • fan speed (0, 1 , 2, 3, A) • day mode (D), night mode (N) • VAV forcing status (*VAV* = forcing is active)
C	Setpoint change buttons The setpoint changes in larger steps when you tap the buttons quickly several times in a row.
D	Fan speed button
E	Occupancy button (man in house)

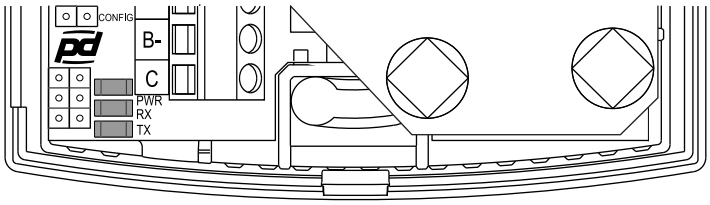
4.1.1 Display modes

There are five display modes available in the controller. You can select the display mode using the *DISPM* parameter.

Parameter value		Description
0		The display and the indicator light are off.
1		The display shows the measured temperature value. When you tap the setpoint change buttons, the display shows the setpoint. The indicator light indicates the heating and cooling status.
2		The display shows the setpoint. The indicator light indicates the heating and cooling status.
3		The display shows the measured temperature value. When you tap the setpoint changing buttons, the display shows the deviation from the setpoint. The indicator light indicates the heating and cooling status.
4		The display shows the deviation from the setpoint when you tap the buttons. The indicator light indicates the heating and cooling status. The display and the indicator light turn off 10 seconds after the last tap.

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4.1.2 Indicator lights inside the device



PWR	The light is on when the supply voltage is connected.
RX	The light indicates that the controller receives data from bus.
TX	The light indicates that the controller sends data to bus.

4.2 Operation modes

The room controller has two operation modes that can have their own control settings. These operation modes are called day and night modes.

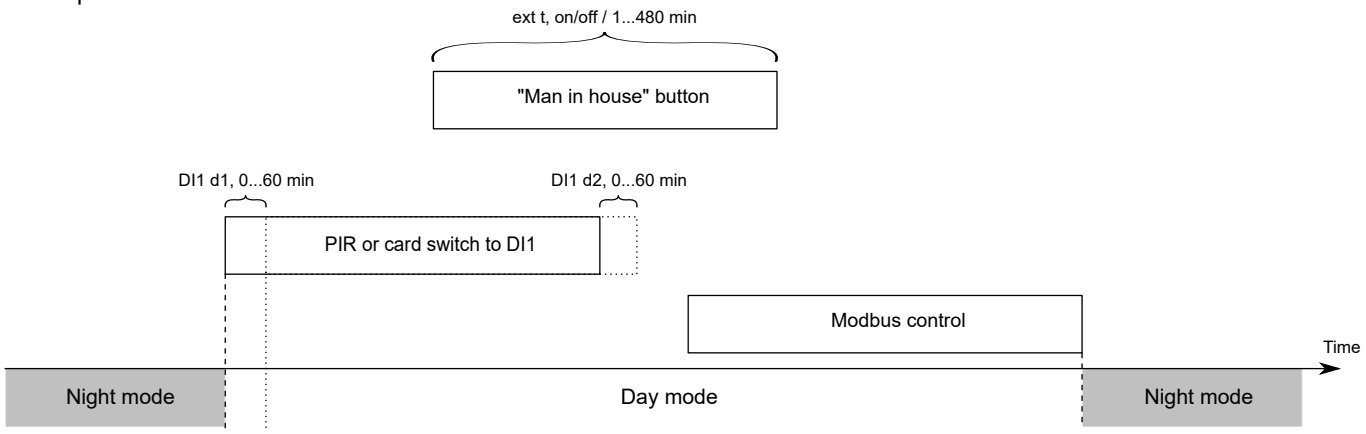
You can control the operation modes:

- Using controller's input information
- Using button
- Via Modbus communication

4.2.1 Controls for day and night operation modes

- *NIGHT* parameter is *OFF*: The controller is fixed to the day mode.
- *NIGHT* parameter is *On*: The controller activates the day mode when the first control requests the day mode. The controller activates the night mode when the last control requests the night mode.

Example:



When the controller activates the day mode, following occurs:

1. The fresh air supply increases (*DI1bst* parameter defines the amount, 0…100 %). You can set the *DI1bst* parameter value to 0 % to keep the fresh air supply at the normal level.
2. The temperature setpoint defined in the *SP:nd* parameter becomes effective.
3. The day mode dead zone becomes effective. If the frost guard mode is active, the controller shifts to the controlling mode.

Note the following parameters (*H* = holding register, *C* = coil):

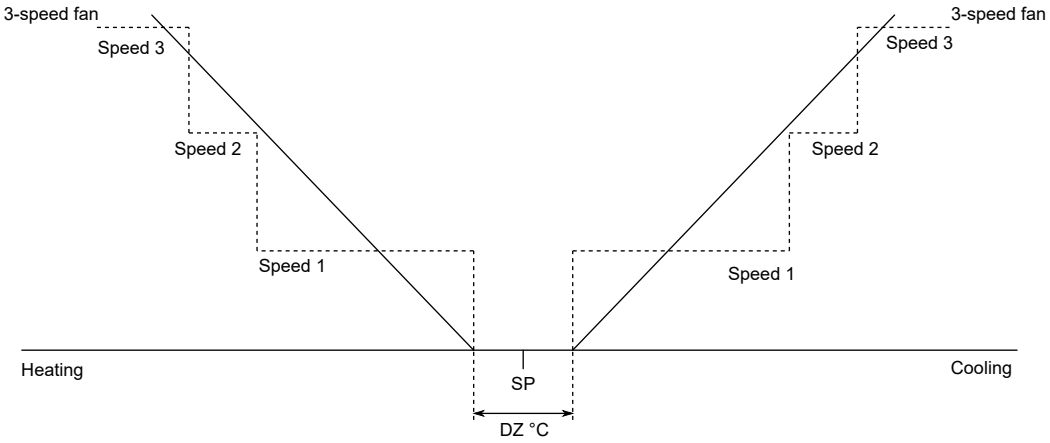
Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	S/DI2 connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
DI2dir	*C: 27*	*0*	*0 / 1*	DI2 operation direction. *0* Normally closed (NC) *1* Normally open (NO)
DI1mod	*H: 20*	*OFF*	*OFF / 1*	DI1 usage. *OFF* Not in use *1* Control to day mode with NO/NC switch
DI1dir	*H: 21*	*0*	*0 / 1*	DI1 operation direction. *0* Normally closed (NC) *1* Normally open (NO)
DI1 d1	*H: 22*	*0*	*0...60 min*	DI1 delay from passive to active.
DI1 d2	*H: 23*	*5*	*0...60 min*	DI1 delay from active to passive.
DI1bst	*H: 25*	*0.0 %*	*0.0...100.0 %*	Minimum VAV output in day mode.
SP:nd	*C: 20*	*OFF*	*OFF / On*	Effective setpoint after the change from night mode to day mode. *OFF* Last user setting. *On* Set by Modbus.
ext t	*H: 24*	*120*	*0...480 min*	Temporary day mode duration.
NIGHT	*C: 13*	*OFF*	*OFF / On*	Night/day mode selection. *OFF* Day mode *On* Night mode

4.2.2 Expanded dead zone in night mode

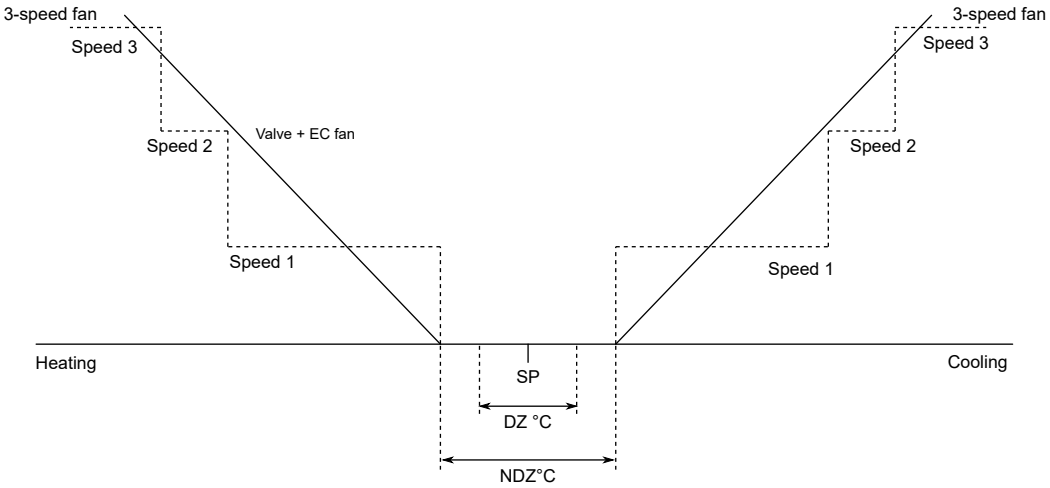
With the expanded dead zone, you can save energy by allowing lower temperature and ventilation. You can also set the night dead zone to a smaller value than the day dead zone.

When the *nI OP* parameter is *DZ*, the controller works just like in the day mode but uses the night dead zone. The night dead zone is defined in the *NDZ°C* parameter.

Day mode:



Night mode:



Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	S/DI2 connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
nI OP	*C: 19*	*DZ*	*DZ / FG*	Night operation mode. *DZ* Control uses night operation mode dead zone. *FG* Frost guard mode.
NDZ °C	*H: 18*	*6.0 °C*	*0.0...10.0 °C*	Night mode dead zone.

4.2.3 Temporary day mode

You can use the button to control the temporary day mode. This means that the controller is normally in the night operation mode and uses a wider dead zone to reduce energy consumption. When you tap the button, the temporary day mode activates, either with a timer or with on/off function.

On/off function means that when you activate the day mode with the button, the mode stays active until you tap the button again.

In the timer mode, you set the timer value to the *ext t* parameter. When the timer reaches 0, the controller returns to night mode.

To enable temporary day mode, set the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
NIGHT	*C: 13*	*OFF*	*OFF / On*	Night/day mode selection. Set the parameter to *On* to enable temporary day mode.
ext t	*H: 24*	*120*	*0...480 min*	Temporary day mode duration. Set the duration to 0 min to enable on/off function.
tyPE	*C: 35*	*DAY*	*DAY / VAV*	Man in house button function. Set the parameter value to *DAY*.

4.2.4 VAV forcing function

You can use the button to force the VAV output. When the function is active and you tap the button, the VAV output is set to the *Vmax%* parameter value for the time that you set with the *ext t* parameter. If the timer value is *0*, the forcing function is active until you tap the button again.

To enable the VAV forcing function, set the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
ext t	*H: 24*	*120*	*0...480 min*	VAV forcing duration. Set the duration to 0 min to enable on/off function.
F Air	*H: 17*	*0*	*0 / 1 / 2 / 3 / 4*	Fresh air control source. Define if CO_2 and temperature should also be a controlling factor for the VAV output. *0* CO_2 or temperature *1* Day mode or temperature *2* CO_2 *3* Day mode *4* Day mode, CO_2 or temperature
tyPE	*C: 35*	*DAY*	*DAY / VAV*	Man in house button function. Set the parameter value to *VAV*.
U1mod	*H: 26*	*0*	*0 / 1 / 2 / 3*	U1 function. U1 must be activated if *F air* is *0*, *2* or *4* (external CO_2 is used also to control the VAV output). If external CO_2 is not used, *U1mod* can be set to *0*. *0* Not in use *1* CO_2 *2* External setpoint *3* Temperature measurement
Vmax%	*H: 34*	*100.0*	*50...100.0 %*	Maximum of VAV output.

4.3 Heating and cooling stages

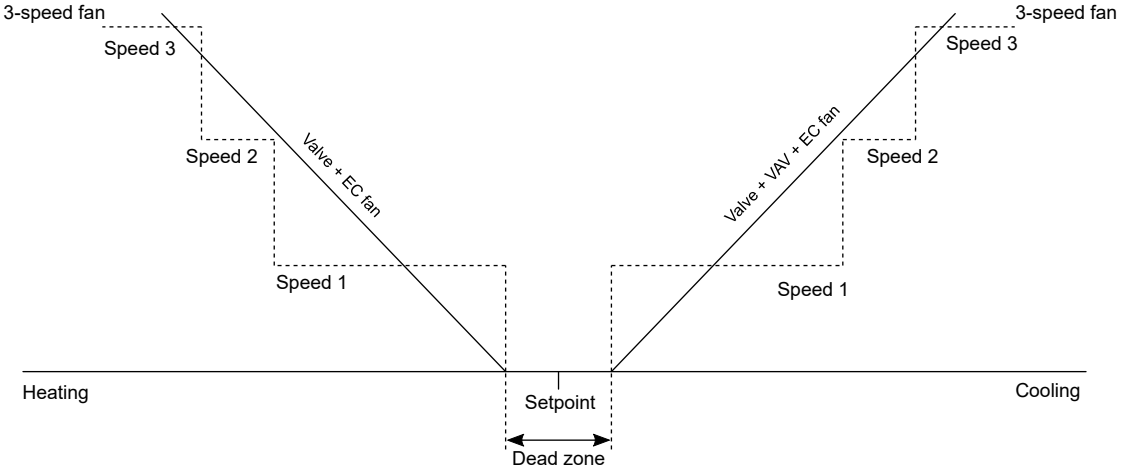
The controller can have one or two heating and cooling stages. You can also select VAV to a heating stage.

Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
Cramp	*C: 16*	*1St*	*1St / 2St*	Number of cooling stages.
CSEq	*C: 17*	*Valve*	*Valve / VAV*	Cooling stage sequence. *Valve* Valve outputs (A1, Y3) first *VAV* VAV and fan outputs (Y1, Y2) first
HVAV	*C: 25*	*OFF*	*OFF / On*	VAV heating.
Hramp	*C: 32*	*1St*	*1St / 2St*	Number of heating stages.
HSEq	*C: 34*	*Valve*	*Valve / VAV*	Heating stage sequence. *Valve* Valve outputs (A4, Y4) first *VAV* VAV and fan outputs (Y1, Y2) first
Fan=	*C:18*	*OFF*	*OFF / On*	Fan output (Y2) simultaneously with valve stages (A1, A2, Y3, Y4).

4.3.1 Examples for using heating and cooling stages

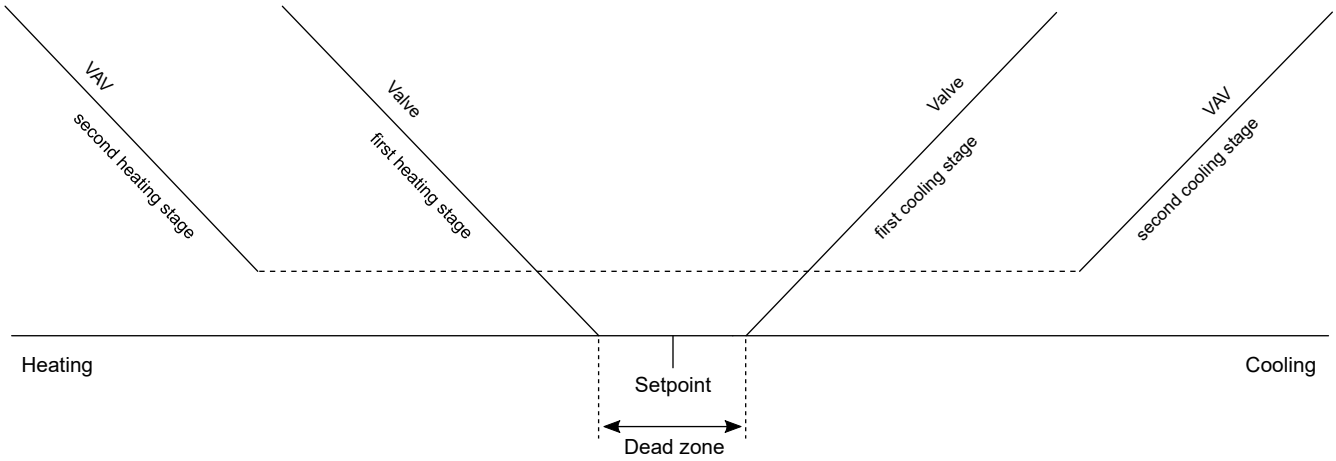
One stage heating and cooling.



Set the parameters according to the following table (*H* = holding register, *C* = coil).

Parameter	Modbus register	Description	Value
Cramp	*C: 16*	Number of cooling stages.	*1St*
HVAV	*C: 25*	VAV heating.	*OFF*
Hramp	*C: 32*	Number of heating stages.	*1St*

Two stage heating and two stage cooling, valve opens before the fan speed increases. VAV is used for heating and cooling. Minimum VAV output is 20 %.

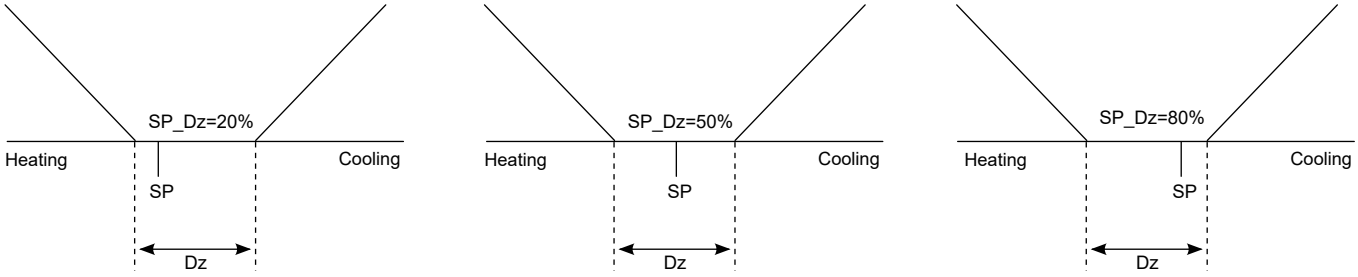


Set the parameters according to the following table (*H* = holding register, *C* = coil).

Parameter	Modbus register	Description	Value
Cramp	*C: 16*	Number of cooling stages.	*2St*
CSEq	*C: 17*	Cooling stage sequence.	*Valve*
HVAV	*C: 25*	VAV heating.	*On*
Hramp	*C: 32*	Number of heating stages.	*2St*
HSEq	*C: 34*	Heating stage sequence.	*Valve*
Fan=	*C: 18*	Fan output (Y2) simultaneously with valve stages (A1, A2, Y3, Y4).	*OFF*
Vmin%	*H: 33*	Minimum of VAV output signal.	*20.0*

4.4 Asymmetric dead zone

You can adjust the dead zone centre in relation to the temperature setpoint with the *SP_Dz* parameter (0…100 %) according to the following figure.



4.5 Temperature sensor selection

You can import the temperature information to the controller by using the following methods:

1. Controller inner temperature measurement (*EXT.S* parameter is *0*, *2* or *3*)
2. External temperature measurement with NTC10 sensor (*EXT.S* parameter is *1*)
3. External 0...10 V temperature measurement (*U1mod* parameter is *3*)

Note: The external 0…10 V temperature transmitter range must be 0…+50 °C.

Note the following parameters (*H* = holding register, *C* = coil):

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Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	S/DI2 connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
TE °C	*H: 9*	*0.0*	*-3.0...3.0 °C*	Temperature sensor adjustment. **Important:** Eliminate all error factors that can affect the temperature measurement before changing the parameter value. This parameter cannot be reset to the factory value.
U1mod	*H: 26*	*0*	*0 / 1 / 2 / 3*	U1 function. *0* Not in use *1* CO_2 *2* External setpoint *3* Temperature measurement

4.6 Temperature setpoint

You can set the temperature setpoint using the following methods:

1. Set with the controller buttons (parameters *SPcnt* and *±SP °C*).
2. Set with external 0...10 V signal (*U1mod* parameter must be *2*). The external setpoint 0...10 V signal range is the same as the setpoint range (parameters *SPcnt* and *±SP °C*).
3. Set via Modbus.
4. Set the frost guard mode for the night mode (*nI OP* parameter is *FG*). The setpoint is the frost guard setpoint (*FG °C* parameter) in the night mode.

With the *Sp:nd* parameter, you can select the setpoint either to be the latest user value or to be read via Modbus. The user value can be the 0...10 V signal connected to the U1 input or the value set by the controller buttons.

The controller uses the latest value as the setpoint (set by user or set via the Modbus). You can view the effective setpoint by tapping the - or + button. The display shows the setpoint continuously if the *dISP* parameter value is *SP*.

Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
SPcnt	*H: 10*	*21.0 °C*	*18.0...26.0 °C*	User setpoint range centre.
±SP °C	*H: 11*	*±3.0 °C*	*±0.0...16.0 °C*	User setpoint range.
SP_Dz	*H: 14*	*50 %*	*0...100 %*	Setpoint position in the dead zone.
FG °C	*H: 19*	*17 °C*	*8.0...50.0 °C*	Frost guard mode setpoint.

Parameter	Modbus register	Default	Range	Description
SP:nd	*C: 20*	*OFF*	*OFF / On*	Effective setpoint after the change from night mode to day mode. *OFF* Last user setting. *On* Set by Modbus.
U1mod	*H: 26*	*0*	*0 / 1 / 2 / 3*	U1 function. *0* Not in use *1* CO_2 *2* External setpoint *3* Temperature measurement
DISPM	*H: 43*	*1*	*0 / 1 / 2 / 3*	Display mode. *0* Display off *1* Measured temperature *2* Temperature setpoint *3* Deviation from temperature setpoint.

When you change the setpoint range centre (parameter *SPcnt*) via the Modbus, the user setpoint deviation remains unchanged.

Example:

1. *SPcnt* parameter value is 21 °C and the user has changed the setpoint to 23 °C (deviation is +2 °C).
2. *SPcnt* parameter value changes to 22 °C via the Modbus (register 40011).
3. The controller takes 24 °C as the effective setpoint (22 °C + 2 °C = 24 °C).

4.6.1 Examples for using temperature setpoint

Case 1: You want the setpoint to return to a constant value (21 °C, for example), when the controller changes from night mode to day mode (in hotels, for example).

Set the parameters according to the following table (*H* = holding register, *C* = coil).

Parameter	Modbus register	Description	Value
SP:nd	*C: 20*	Effective setpoint after the change from night mode to day mode.	*On*
	H: 1	Setpoint by Modbus.	*210*

Case 2: You want the setpoint to return to the user setpoint value, when the controller changes from night mode to day mode (in offices, for example).

Set the parameters according to the following table (*H* = holding register, *C* = coil).

Parameter	Modbus register	Description	Value
SP:nd	*C: 20*	Effective setpoint after the change from night mode to day mode.	*OFF*

Case 3: You want the setpoint to stay at the value set via Modbus (21 °C for example)

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Set the parameters according to the following table (*H* = holding register, *C* = coil).

Parameter	Modbus register	Description	Value
SPcnt	*H: 10*	User setpoint range centre.	*21.0*
±SP °C	*H: 11*	User setpoint range.	*0*

Note: You can also write the setpoint to the Modbus holding register 1. However, the holding register 10 value is shown on the display when you tap the - and + buttons.

4.7 Fan speed control

You can control the fan speed (output Y2) as follows (the most recent value is effective):

1. Set the value with the controller button (0 - 1 - 2 - 3 - A, A = automatic).
2. Set the value via Modbus.

The parameter *FANND* defines which of the above values is used after the shift from night mode to day mode.

Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
FANLI	*C: 23*	*On*	*OFF / On*	Fan speed 3 usage in auto mode. *OFF* Fan speed 3 enabled *On* Fan speed 3 disabled
FANND	*C: 24*	*OFF*	*OFF / On*	Fan speed after operation mode change. *OFF* Last user setting. *On* Set by Modbus.
	H: 0	*0*	*0 / 1 / 2 / 3 / 4*	Fan speed by Modbus. *0* Off *1* Speed 1 *2* Speed 2 *3* Speed 3 *4* Automatic

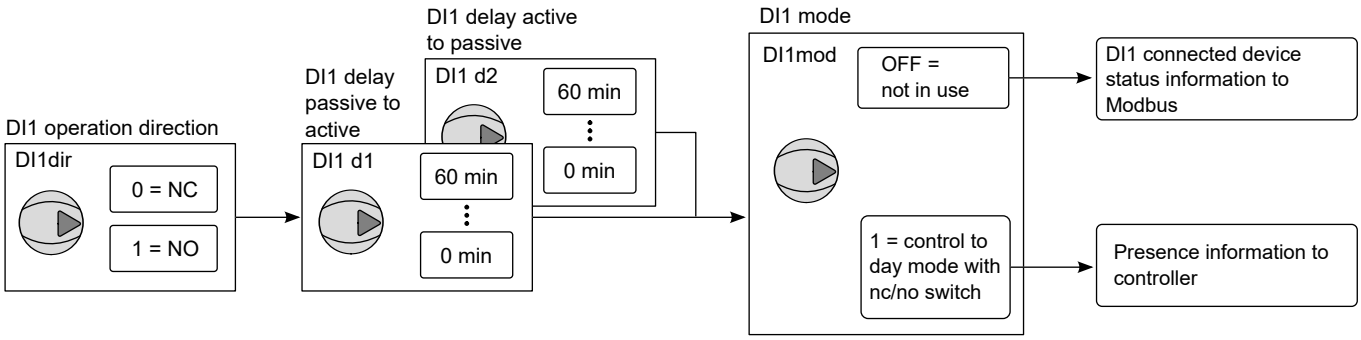
You can also control the fan speed by using Modbus output overrides.

4.8 Digital input functions

4.8.1 DI1 input functions

You can use the *DI1* input to control when the controller shifts between day and night modes by connecting a home/away switch, card reader or motion detector to the input.

You can also use the *DI1* input to read other device statuses via Modbus, if you do not use the input for the room control.



Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
DI1mod	*H: 20*	*OFF*	*OFF / 1*	DI1 usage. *OFF* Not in use *1* Control to day mode with NO/NC switch
DI1dir	*H: 21*	*0*	*0 / 1*	DI1 operation direction. *0* Normally closed (NC) *1* Normally open (NO)
DI1 d1	*H: 22*	*0*	*0...60 min*	DI1 delay from passive to active.
DI1 d2	*H: 23*	*5*	*0...60 min*	DI1 delay from active to passive.

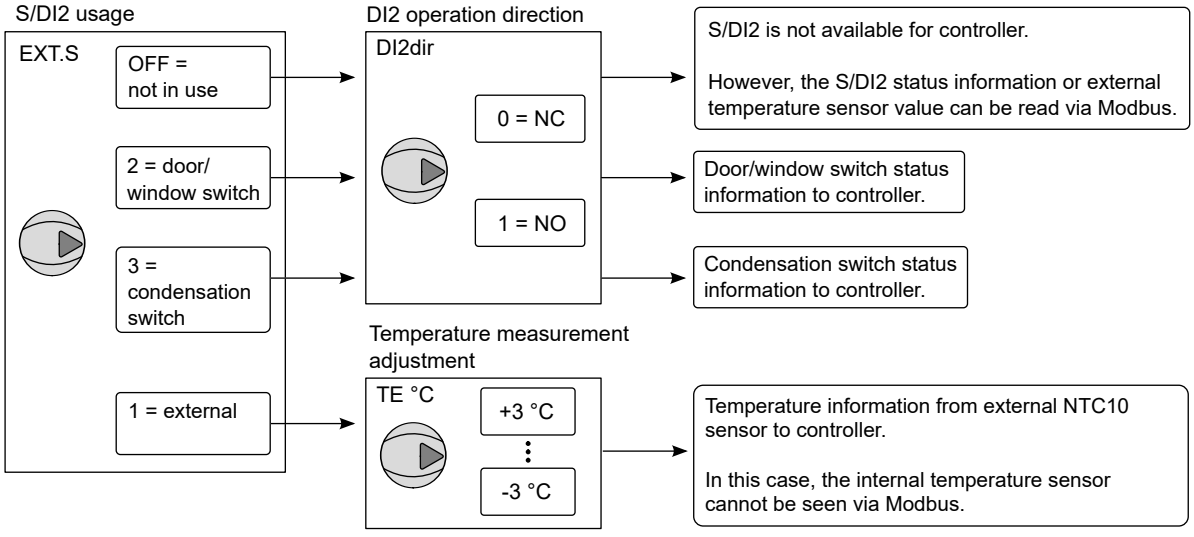
4.8.2 S/DI2 input functions

You can use the *S/DI2* input to control the controller by connecting a door/window contact or condensation switch to the input.

If you use a door/window contact, cooling and heating do not operate when the door or window is opened. This way you can avoid the energy loss and cooling beam condensation problems.

If you use a condensation switch, the cooling does not operate when the contact activates.

You can also use the *S/DI2* input to read other device statuses via Modbus, if you do not use the input for the room control.



Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	*S/DI2* connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
DI2dir	*C: 27*	*0*	*0 / 1*	*DI2* input operation direction. *0* Normally closed (NC) *1* Normally open (NO)
TE °C	*H: 9*	*0.0*	*-3.0...3.0 °C*	Temperature sensor adjustment. **Important:** Eliminate all error factors that can affect the temperature measurement before changing the parameter value. This parameter cannot be reset to the factory value.

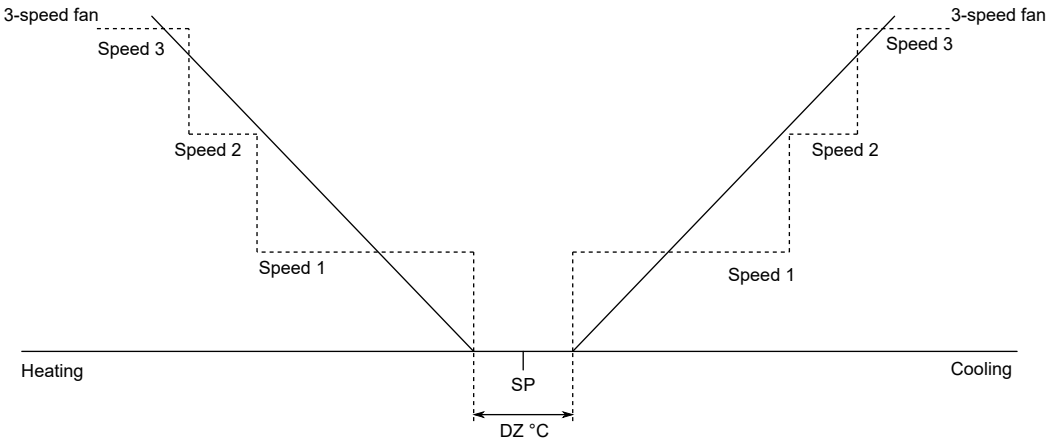
4.9 Frost guard function

You can activate the frost guard function for night mode in the *nI OP* parameter. When the temperature drops below the frost guard setpoint (*FG °C* parameter), the heating valve opens and the fan starts (the *FAN* parameter must be ”2” or ”3”) at speed 1. The EC motor control signal is 33 %.

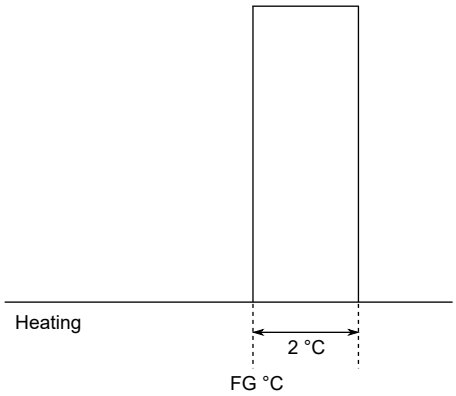
Note: You cannot use the frost guard function when the 6-way valve control is enabled (*6WCTL* parameter is *COOL* or *HEAT*).

When the temperature rises 2 °C over the setpoint (*FG °C* parameter), the heating valve closes and the fan stops. This procedure repeats until the controller changes to day mode.

Day mode:



Night mode:



Note the following parameters:

Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	*S/DI2* connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
nI OP	*C: 19*	*DZ*	*DZ / FG*	Night operation mode. *DZ* Control uses night operation mode dead zone. *FG* Frost guard mode.
FG °C	*H: 19*	*17 °C*	*8.0...50.0 °C*	Frost guard mode setpoint.
6WCTL	*H: 46*	*OFF*	*OFF / COOL / HEAT*	6-way valve control status. *OFF* 6-way valve control disabled *COOL Y3* 6-way valve control enabled for terminal Y3 (cooling) *HEAT Y4* 6-way valve control enabled for terminal Y4 (heating)

4.10 Thermostat function

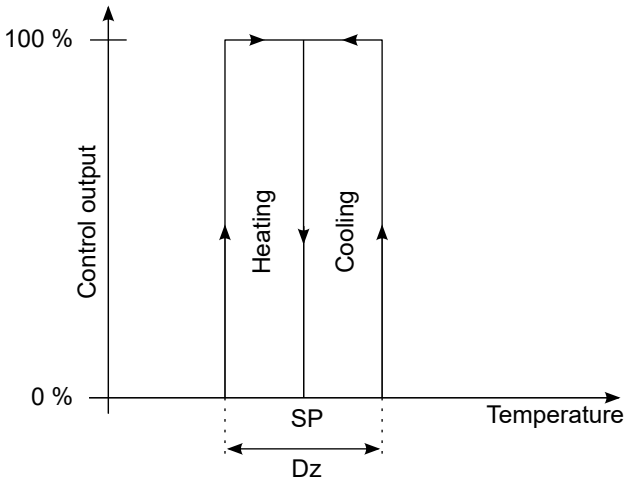
With the thermostat function, you can control the actuators using a thermostat-type control. You can use the thermostat function either for cooling or heating or for both cooling and heating.

- In heating control, the heating valve opens fully when the temperature falls below the dead zone (*DZ*) lower limit. The heating valve closes when the temperature reaches the setpoint (*SP*).
- In cooling control, the cooling valve opens fully when the temperature rises over the dead zone higher limit. The cooling valve closes when the temperature reaches the setpoint.

In the night mode, the controller works according to the chosen function, either in thermostat mode or in frost guard mode.

When you use the thermostat function, all the corresponding outputs are controlled using thermostat-type control (A1 and Y3 for cooling, A2 and Y4 for heating).

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Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	*S/DI2* connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
SPcnt	*H: 10*	*21.0 °C*	*18.0...26.0 °C*	User setpoint range centre.
±SP °C	*H: 11*	*±3.0 °C*	*±0.0...16.0 °C*	User setpoint range.
DZ °C	*H:13*	*1.0 °C*	*0.0...3.0 °C*	Dead zone.
nl OP	*C: 19*	*DZ*	*DZ / FG*	Night operation mode. *DZ* Control uses night operation mode dead zone. *FG* Frost guard mode.
FAN	*H:37*	*OFF*	*OFF / 1 / 2 / 3*	Fan function. *OFF* Not in use *1* Cooling *2* Heating *3* Cooling and heating
Fmin%	*H: 31*	*0.0 %*	*0.0...50.0 %*	Minimum of fan output signal.
Fmax%	*H: 32*	*100.0 %*	*50.0...100.0 %*	Maximum of fan output signal.
Vmin%	*H: 33*	*0.0 %*	*0.0...50.0 %*	Minimum of VAV output signal.
Vmax%	*H: 34*	*100.0 %*	*50.0...100.0 %*	Maximum of VAV output signal.
ThrmC	*C: 28*	*OFF*	*OFF / On*	Thermostat function, cooling. *OFF* Thermostat function not in use. *On* Thermostat function is in use in cooling.

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Parameter	Modbus register	Default	Range	Description
ThrmH	*C: 29*	*OFF*	*OFF / On*	Thermostat function, heating. *OFF* Thermostat function not in use. *On* Thermostat function is in use in heating.

4.11 Electric heater control

The controller can control an electric heater if you install a PR 50/440 solid state relay between the A2 output and the heater. The relay must be equipped with a PRMK auxiliary card.

Important: The controller does not include a heater overheating protector. The overheating protection must be included in the heater itself. You can read the overheating alarm signal from digital input, but the signal does not deactivate the heater control.

You can connect the overheating alarm signal to the *DI1* or *DI2* input, and then read the signal via the Modbus. Set the digital input to "not in use" position (*DI1mod = 0* or *EXT.S = OFF*).

Note the following parameters (*H* = holding register, *C* = coil):

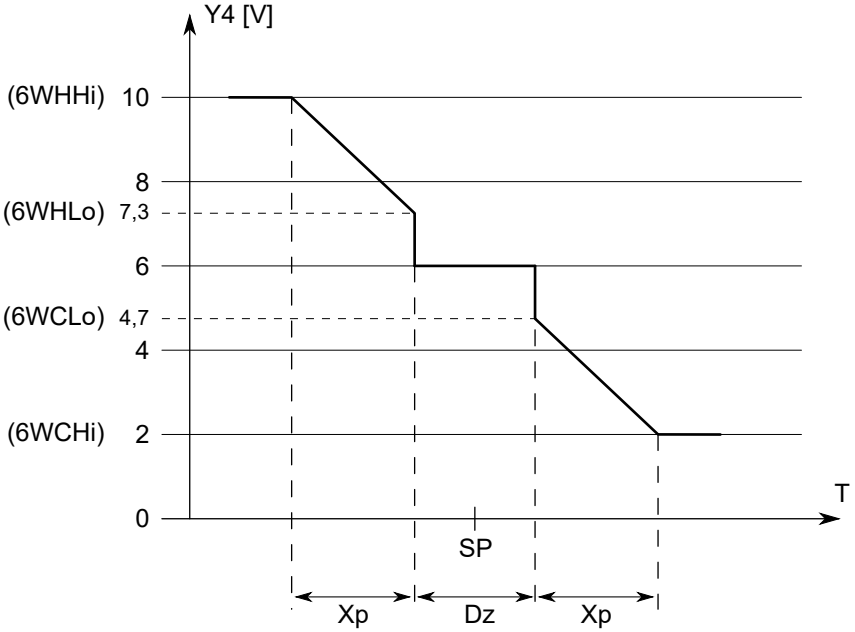
Parameter	Modbus register	Default	Range	Description
EXT.S	*H: 8*	*OFF*	*OFF / 1...3*	*S/DI2* connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch
DI2dir	*C: 27*	*0*	*0 / 1*	*DI2* operation direction. *0* Normally closed (NC) *1* Normally open (NO)
DI1mod	*H: 20*	*OFF*	*OFF / 1*	*DI1* usage. *OFF* Not in use *1* Control to day mode with NO/NC switch
DI1dir	*H: 21*	*0*	*0 / 1*	*DI1* operation direction. *0* Normally closed (NC) *1* Normally open (NO)

4.12 6-way valve control

The controller can control 6-way valves (e.g. Belimo EXT-K3B2 valves with LR24A-MP/LR24A-SR rotary actuator) by using the Y4 output (enable the control with the parameter *6WCTL* or the Modbus holding register 46).

Note: The controller default values are for the Belimo LR24A-MP/LR24A-SR rotary actuator.

The controller controls the 6-way valve output according to the following diagram.



Note the following parameters (*H* = holding register, *C* = coil):

Parameter	Modbus register	Default	Range	Description
6WCTL	*H: 46*	*OFF*	*OFF / COOL Y3 / HEAT Y4*	6-way valve output terminal. *OFF* 6-way valve control disabled *COOL Y3* 6-way valve control enabled for terminal Y3 (cooling) *HEAT Y4* 6-way valve control enabled for terminal Y4 (heating)
6WHLo	*H: 47*	*7.30*	*0.0...10.00 V*	6-way valve heating, low limit.
6WHHi	*H: 48*	*10.00*	*0.0...10.00 V*	6-way valve heating, high limit.
6WCLo	*H: 49*	*4.70*	*0.0...10.00 V*	6-way valve cooling, low limit.
6WCHi	*H: 50*	*2.00*	*0.0...10.00 V*	6-way valve cooling, high limit.

4.13 Output limitations

You can limit the minimum and maximum values of each output separately. The controller does not drive the output outside the given limits. For example, you can set the heating output minimum limit to prevent discomfort caused by cold air that flows down the windows. You can override the limits only by controlling the outputs directly via Modbus.

Note the following parameters:

Parameter	Modbus register	Default	Range	Description
Cmin%	*H: 27*	*0.0 %*	*0.0...50.0 %*	Minimum of cooling actuator signal.
Cmax%	*H: 28*	*100.0 %*	*50.0...100.0 %*	Maximum of cooling actuator signal.
Hmin%	*H: 29*	*0.0 %*	*0.0...50.0 %*	Minimum of heating actuator signal.

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Parameter	Modbus register	Default	Range	Description
Hmax%	*H: 30*	*100.0 %*	*50.0...100.0 %*	Maximum of heating actuator signal.
Fmin%	*H: 31*	*0.0 %*	*0.0...50.0 %*	Minimum of fan output signal.
Fmax%	*H: 32*	*100.0 %*	*50.0...100.0 %*	Maximum of fan output signal.
Vmin%	*H: 33*	*0.0 %*	*0.0...50.0 %*	Minimum of VAV output signal.
Vmax%	*H: 34*	*100.0 %*	*50.0...100.0 %*	Maximum of VAV output signal.

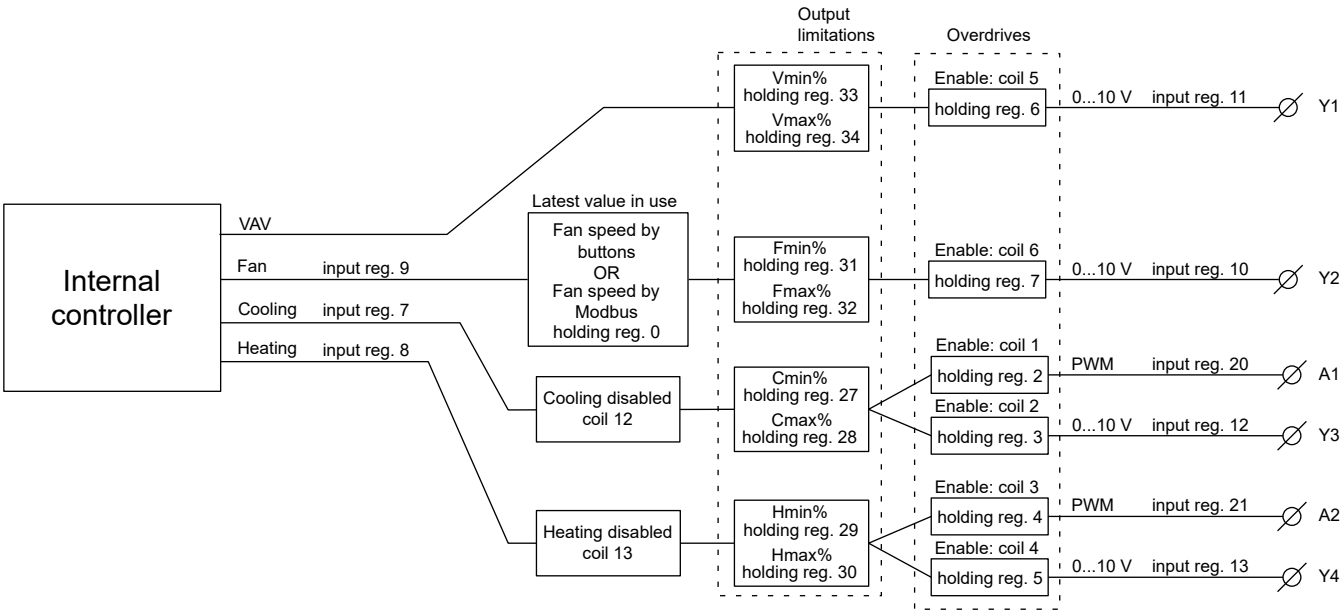
4.14 Output overrides

You can override all outputs separately via Modbus.

The controls that are marked with * are stored in the volatile memory. These controls return to factory defaults after a power failure.

The controls that are written without * are stored in the non-volatile memory. These controls remain after a power failure.

Important: The non-volatile memory durability is 100000 write cycles.



Coils

Register	Parameter description	Data type	Values	Range	Default
0	*Cooling PWM override enable (A1).	Bit	*0 - 1*	0. Off 1. On	*0*
1	*Cooling 0...10 V override enable (Y3).	Bit	*0 - 1*	0. Off 1. On	*0*
2	*Heating PWM override enable (A2).	Bit	*0 - 1*	0. Off 1. On	*0*
3	*Heating 0...10 V override enable (Y4).	Bit	*0 - 1*	0. Off 1. On	*0*

Register	Parameter description	Data type	Values	Range	Default
4	*VAV override enable (Y1).	Bit	*0 - 1*	0. Off 1. On	*0*
5	*Fan override enable (Y2).	Bit	*0 - 1*	0. Off 1. On	*0*

Input registers

Register	Parameter description	Data type	Values	Range
7	Current cooling (controller).	S16	*0...1000*	0...10.00 V
8	Current heating (controller).	S16	*0...1000*	0...10.00 V
9	Current fan speed (controller).	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Speed 1 2. Speed 2 3. Speed 3 4. Automatic
10	Fan speed (connector Y2).	S16	*0...1000*	0...10.00 V
11	VAV control (connector Y1).	S16	*0...1000*	0...10.00 V
12	Cooling control (connector Y3).	S16	*0...1000*	0...10.00 V
13	Heating control (connector Y4).	S16	*0...1000*	0...10.00 V
20	Cooling control (connector A1).	S16	*0...1000*	0...1000 %
21	Heating control (connector A2).	S16	*0...1000*	0...100.0 %

Holding registers

Register	Parameter description	Data type	Values	Range	Default
0	Fan speed by Modbus.	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Speed 1 2. Speed 2 3. Speed 3 4. Automatic	*4*
2	Cooling override (PWM) by Modbus (A1).	S16	*0...1000*	0...100.0 %	*0*
3	Cooling override (0...10 V) by Modbus (Y3).	S16	*0...1000*	0...10.00 V	*0*
4	Heating override (PWM) by Modbus (A2).	S16	*0...1000*	0...100.0 %	*0*
5	Heating override (0...10 V) by Modbus (Y3).	S16	*0...1000*	0...10.00 V	*0*
6	VAV override by Modbus (Y1).	S16	*0...1000*	0...10.00 V	*0*
7	Fan override by Modbus (Y2).	S16	*0...1000*	0...10.00 V	*0*
27	Minimum of cooling actuator signal.	S16	*0...500*	0...50.0 %	*0*
28	Maximum of cooling actuator signal.	S16	*500...1000*	50.0...100.0 %	*1000*
29	Minimum of heating actuator signal.	S16	*0...500*	0...50.0 %	*0*

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Register	Parameter description	Data type	Values	Range	Default
30	Maximum of heating actuator signal.	S16	*500...1000*	50.0...100.0 %	*1000*
31	Minimum of fan output signal.	S16	*0...500*	0...50.0 %	*0*
32	Maximum of fan output signal.	S16	*500...1000*	50.0...100.0 %	*1000*
33	Minimum of VAV output signal.	S16	*0...500*	0...50.0 %	*0*
34	Maximum of VAV output signal.	S16	*500...1000*	50.0...100.0 %	*1000*

4.15 Service alarm

If the temperature does not reach the dead zone in 120 hours, the Modbus coil 10 value changes to ”ON” position. This alarm is for information purposes only and does not affect to the controller functions. Reset the alarm by writing the value 0 to the register or by switching the power off and on.

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5 Commissioning

5.1 Mounting the room controller

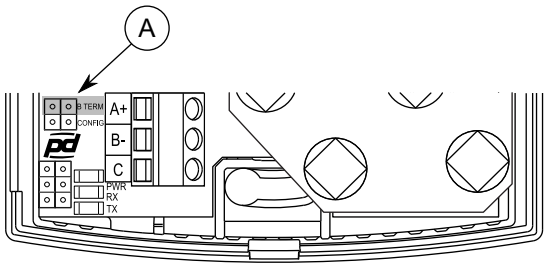
The device must be installed in dry environment. You can install the device on the wall surface or on a standard flush mounting box with screws. The recommended installation height is 150...180 cm.

Select the mounting position carefully. If possible, eliminate all the error factors that can affect the measurements. Typical measurement error factors include:

- direct sun light
- occupant proximity
- air flow coming from windows or doors
- air flow coming from ventilation nozzles
- air flow coming from the flush mounting box
- differential temperature caused by external wall

5.2 Terminating Modbus

1. Disconnect the device supply voltage.
2. Open the cover.
3. Place the termination jumper.



A. Termination jumper

4. Close the cover.
5. Reconnect the device supply voltage.

5.3 Wiring

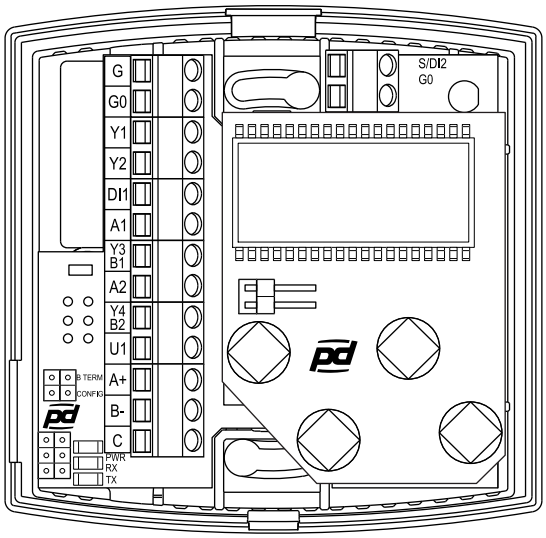
WARNING: Device wiring and commissioning can only be carried out by qualified professionals. Always make the device wirings in de-energised electricity network.

WARNING: This product is appliance class III product according to IEC 60664-1. The product may only be connected to SELV (separated extra low voltage) electricity network.

CAUTION: The product may only be connected to overvoltage category I or II electricity network according to IEC 60664-1. Use external overvoltage protection if the device is connected to the overvoltage category III electricity network.

CAUTION: Extra care should be taken when mixing full and half rectified devices in same AC electricity network. If the outputs are not isolated, connected devices could be damaged.

Important: The supply voltage source must be the same in the transmitter and in the connected devices.



G	24 Vac/dc supply **Note:** Only the DC functions work when using DC supply voltage. To get full functionality, use AC supply.
G0	0 V
Y1	VAV control output, 0...10 Vdc, < 2 mA
Y2	Fan speed output, 0...10 Vdc, < 2 mA
DI1	Digital input, PIR / card switch for day/night mode change
A1	Cooling output, 24 Vac, 1 A (PWM, switched to 0 V)
Y3/B1	Cooling output or 6-way valve control output, 0...10 Vdc, < 2 mA
A2	Heating output, 24 Vac, 1 A (PWM, switched to 0 V)
Y4/B2	Heating output, 0...10 Vdc, < 2 mA
U1	CO_2 or external setpoint input, 0...10 Vdc, < 2 mA
A+	Modbus RTU, RS-485. **Note:** The terminal C is galvanically isolated.
B-	
C	

S/DI2	External temperature sensor (NTC 10) input or digital input for door/window contact or condensation switch.
G0	0 V

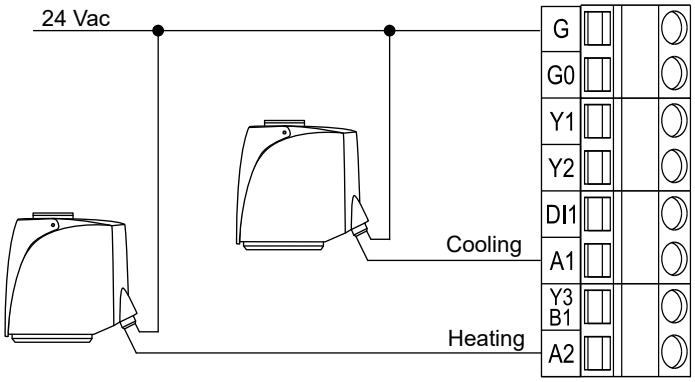
The nominal tightening torque for wire terminal screws is 0.6 Nm.

Important: Do not use excessive force when you tighten the wiring terminal screws.

CAUTION: Ensure that all covers are closed before you connect the supply voltage to the product. Do not remove the covers when the supply voltage is connected.

Note: You can use the unused inputs and outputs to transfer other measurement data and control information over the Modbus network.

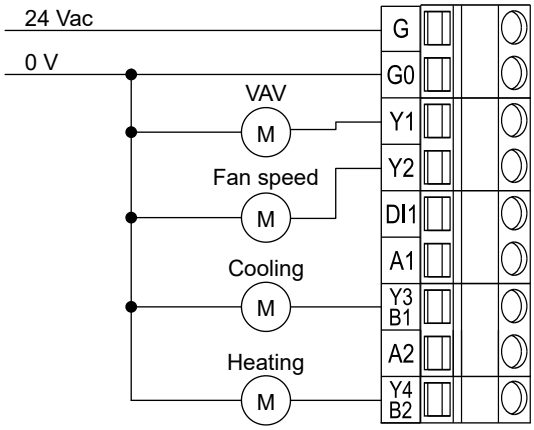
5.3.1 Thermal actuator wiring (24 Vac)



The maximum output current is 1 A. For example, you can connect up to three A 40405 thermal actuators to one output. Then the total current consumption does not exceed 1 A.

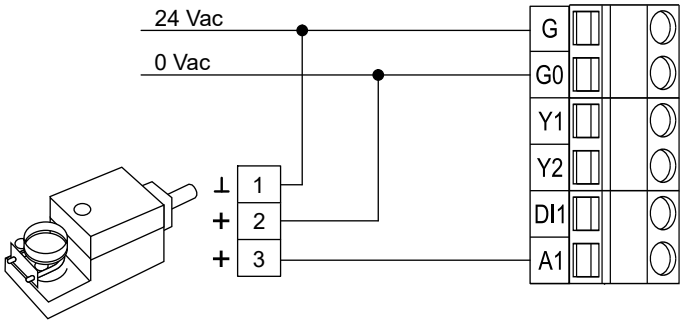
Note: The outputs are protected with fuses that can only be replaced by the manufacturer.

5.3.2 Analogue output wiring (0...10 Vdc)



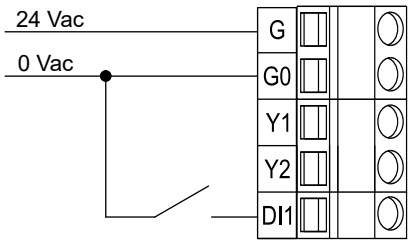
5.3.3 On/off damper motor wiring

When controlling an on/off damper motor with a 24 Vac supply, follow these wiring instructions.

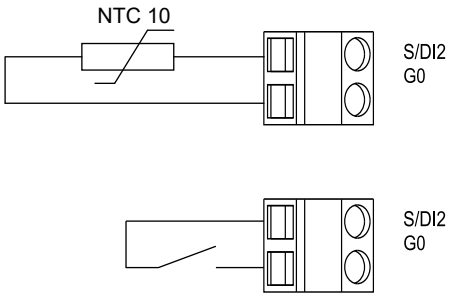


- Invert the power supply's 24 Vac in the motor's connector.
- Set the thermostat function for the corresponding output (A1 in this example).

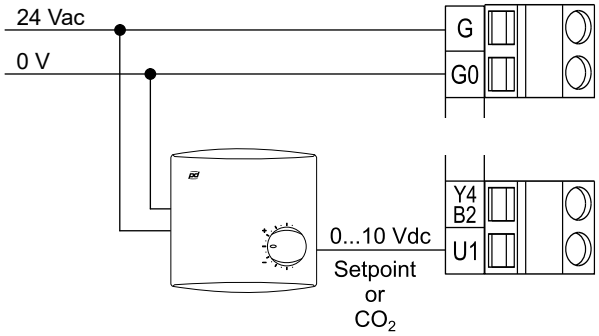
5.3.4 DI1 wiring



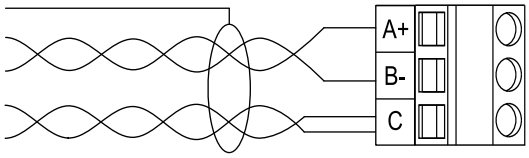
5.3.5 S/DI2 wiring



5.3.6 U1 input wiring



5.3.7 Modbus wiring



Note: The terminal C is galvanically isolated.

5.4 Configuring via Modbus

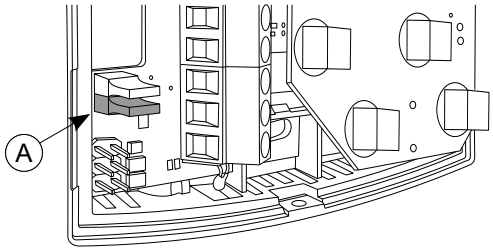
1. Write the settings to the device via Modbus.
2. Set Modbus coil 39 value to 1.
   The configuration values are now stored to non-volatile memory.

   Note: Controller stores the configuration values hourly to non-volatile memory. This ensures that the most recent device settings are not lost during a power failure.

5.5 Configuring through the device menu

Note: A commissioning tool (HLS 44-SE-SER) is also available. For configuration with the commissioning tool, see the commissioning tool instructions.

1. Remove the cover.
2. Set the configuration mode selector to closed position.

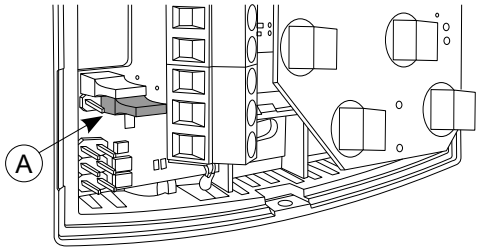


A. Configuration mode selector

3. Tap the button.
4. Configure the required settings.

   You can move in the menu by tapping the and buttons. You can change the values with the and buttons. You can save the value with the button.

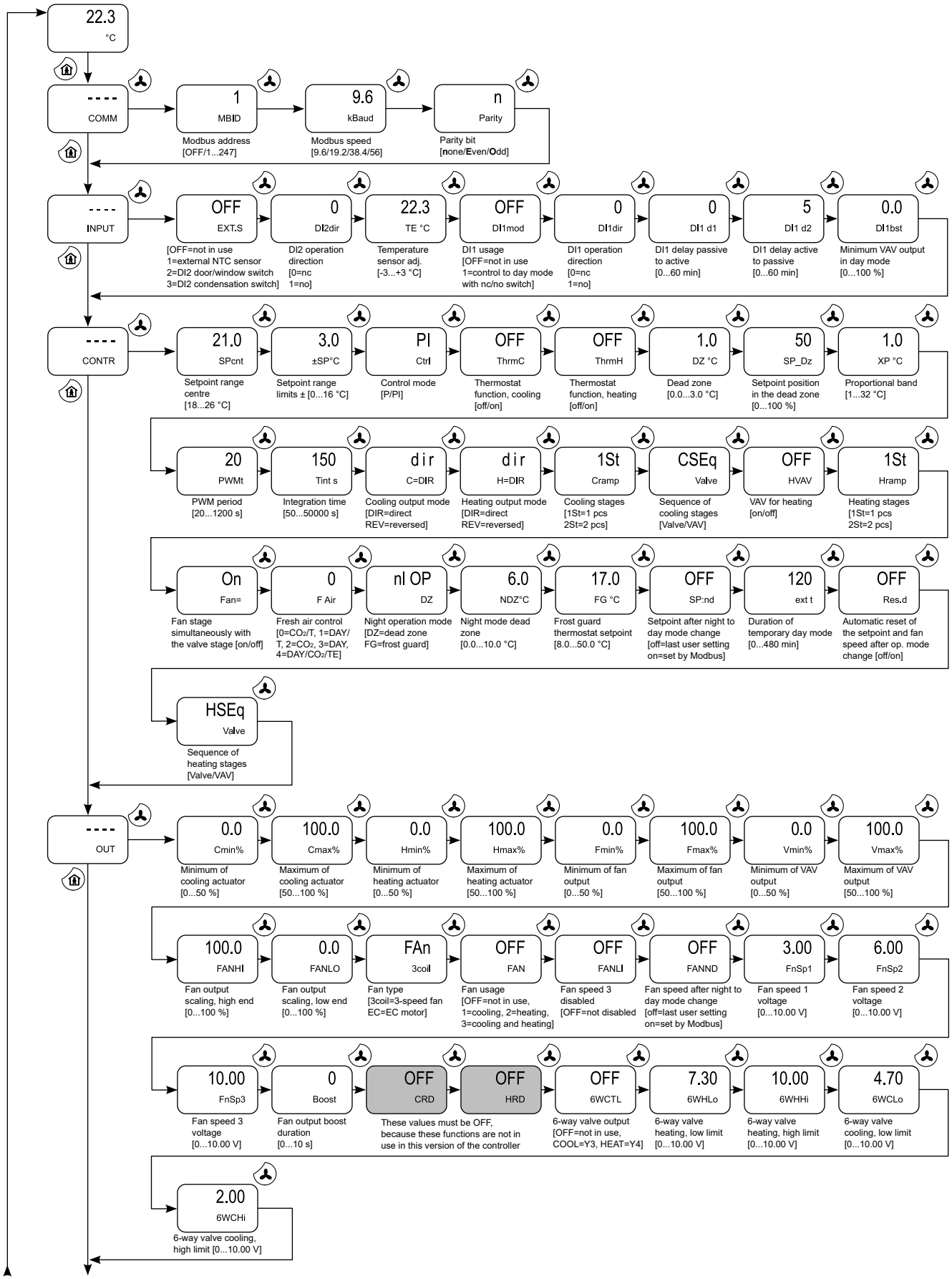
   See chapter Menu structure on page 30 for more details.
5. Set the configuration mode selector to open position.



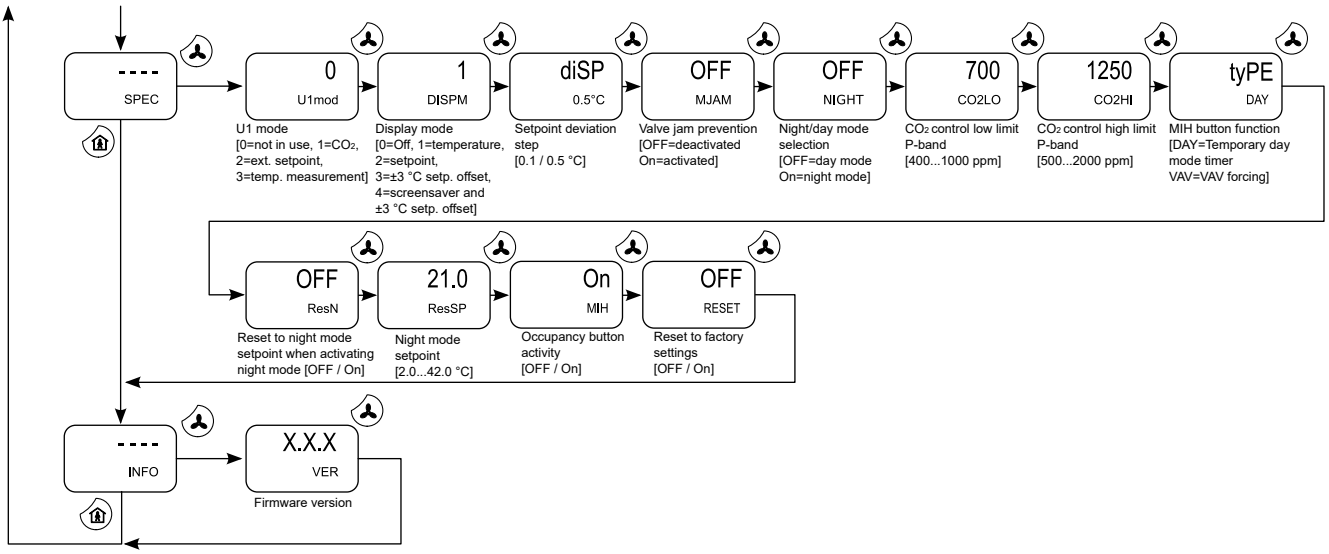
A. Configuration mode selector

5.5.1 Menu structure

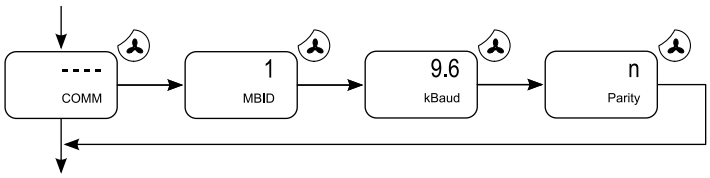
The following menu structure contains the factory settings.



The diagram continues on the next page.

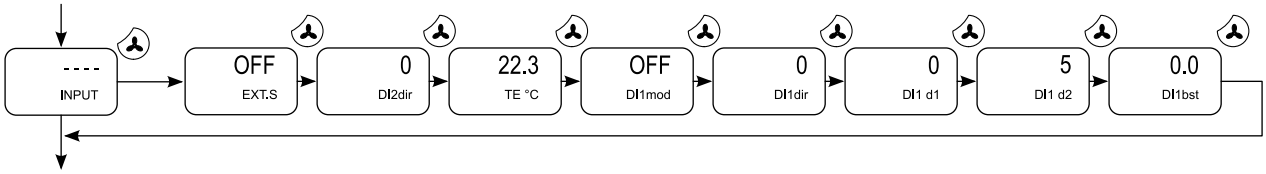


5.5.1.1 Communication menu



Parameter	Available values	Description
MBID	*OFF / 1...247*	Modbus address.
kBaud	*9.6 / 19.2 / 34.8 / 56*	Modbus speed (kbit/s).
Parity	*n / E / O*	Parity bit. *n* None *E* Even *O* Odd

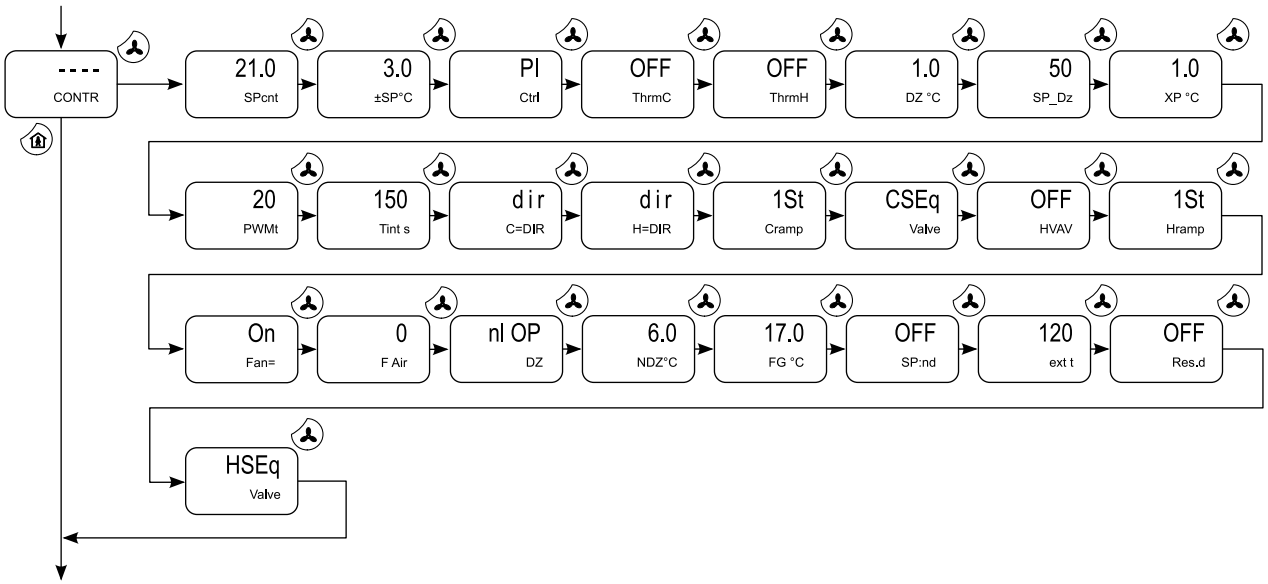
5.5.1.2 Input menu



Parameter	Available values	Description
EXT.S	*OFF / 1...3*	S/DI2 connector usage. *OFF* Not in use *1* External NTC sensor *2* Door/window switch *3* Condensation switch

Parameter	Available values	Description
DI2dir	*0 / 1*	DI2 operation direction. *0* Normally closed (NC) *1* Normally open (NO)
TE °C	*-3.0...3.0 °C*	Temperature sensor adjustment. **Important:** Eliminate all error factors that can affect the temperature measurement before changing the parameter value. This parameter cannot be reset to the factory value.
DI1mod	*OFF / 1*	DI1 usage. *OFF* Not in use *1* Control to day mode with NO/NC switch
DI1dir	*0 / 1*	DI1 operation direction. *0* Normally closed (NC) *1* Normally open (NO)
DI1 d1	*0...60 min*	DI1 delay from passive to active.
DI1 d2	*0...60 min*	DI1 delay from active to passive.
DI1bst	*0.0...100.0 %*	Minimum VAV output in day mode.

5.5.1.3 Control menu



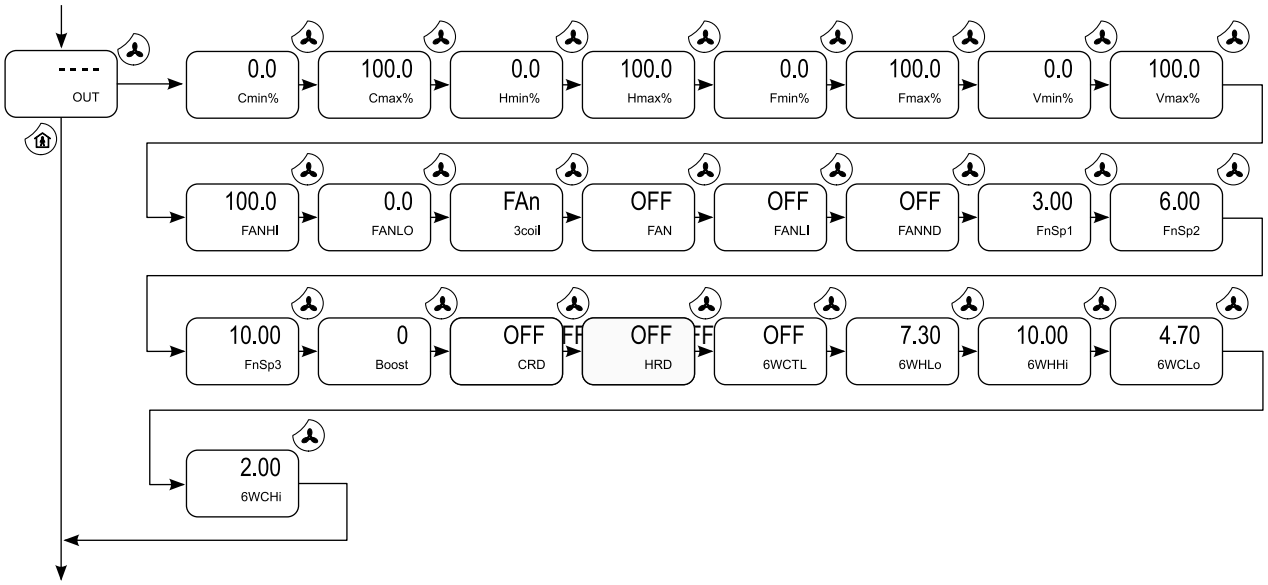
Parameter	Available values	Description
SPcnt	*18.0...26.0 °C*	User setpoint range centre.
±SP°C	*±0.0...16.0 °C*	User setpoint range.
Ctrl	*P / PI*	Control method.
ThrmC	*OFF / On*	Thermostat function, cooling. *OFF* Thermostat function not in use. *On* Thermostat function is in use in cooling.

Parameter	Available values	Description
ThrmH	*OFF / On*	Thermostat function, heating. *OFF* Thermostat function not in use. *On* Thermostat function is in use in heating.
DZ °C	*0.0...3.0 °C*	Dead zone.
SP_Dz	*0...100 %*	Setpoint position in the dead zone.
XP °C	*1.0...32.0 °C*	Proportional band.
PWMt	*20...1200 s*	PWM period.
Tint s	*50...50000 s*	Integration time.
C=DIR	*dir / rev*	Cooling output direction. *dir* Direct *rev* Reversed
H=DIR	*dir / rev*	Heating output direction. *dir* Direct *rev* Reversed
Cramp	*1St / 2St*	Number of cooling stages.
CSEq	*Valve / VAV*	Cooling stage sequence. *Valve* Valve outputs (A1, Y3) first *VAV* VAV and fan outputs (Y1, Y2) first
HVAV	*OFF / On*	VAV heating.
Hramp	*1St / 2St*	Number of heating stages.
Fan=	*OFF / On*	Fan output (Y2) simultaneously with valve stages (A1, A2, Y3, Y4).
F Air	*0 / 1 / 2 / 3 / 4*	Fresh air control source. *0* CO_2 or temperature *1* Day mode or temperature *2* CO_2 *3* Day mode *4* Day mode, CO_2 or temperature
nl OP	*DZ / FG*	Night operation mode. *DZ* Control uses night operation mode dead zone. *FG* Frost guard mode.
NDZ °C	*0.0...10.0 °C*	Night mode dead zone.
FG °C	*8.0...50.0 °C*	Frost guard function setpoint.

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Parameter	Available values	Description
SP:nd	*OFF / On*	Effective setpoint after the shift from night mode to day mode. *OFF* Last user setting. *On* Set by Modbus.
ext t	*0...480 min*	Temporary day mode or VAV forcing duration. *0* On/Off function. *1...480 min* Timer function.
Res.d	*OFF / On*	Setpoint and fan speed reset after operation mode change.
HSEq	*Valve / VAV*	Heating stage sequence. *Valve* Valve outputs (A2, Y4) first *VAV* VAV and fan outputs (Y1, Y2) first

5.5.1.4 Output menu



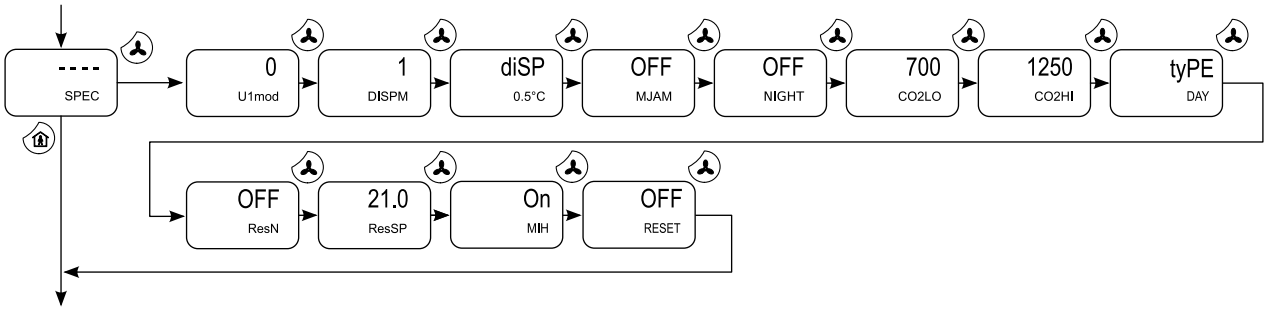
Parameter	Available values	Description
Cmin%	*0.0...50.0 %*	Minimum of cooling actuator signal.
Cmax%	*50.0...100.0 %*	Maximum of cooling actuator signal.
Hmin%	*0.0...50.0 %*	Minimum of heating actuator signal.
Hmax%	*50.0...100.0 %*	Maximum of heating actuator signal.
Fmin%	*0.0...50.0 %*	Minimum of fan output signal.
Fmax%	*50.0...100.0 %*	Maximum of fan output signal.
Vmin%	*0.0...50.0 %*	Minimum of VAV output signal.
Vmax%	*50.0...100.0 %*	Maximum of VAV output signal.
FANHI	*0.0...100.0 %*	Fan output scaling, high end.
FANLO	*0.0...100.0 %*	Fan output scaling, low end.

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Parameter	Available values	Description
FAn	*3coil / EC*	Fan type. *3coil* 3-speed fan *EC* EC fan
FAN	*OFF / 1 / 2 / 3*	Fan function. *OFF* Not in use *1* Cooling *2* Heating *3* Cooling and heating
FANLI	*OFF / On*	Fan speed 3 usage in auto mode. *OFF* Fan speed 3 enabled *On* Fan speed 3 disabled
FANND	*OFF / On*	Fan speed after operation mode change. *OFF* Last user setting. *On* Set by Modbus.
FnSp1	*0.00...10.00 V*	Fan speed 1 voltage.
FnSp2	*0.00...10.00 V*	Fan speed 2 voltage.
FnSp3	*0.00...10.00 V*	Fan speed 3 voltage.
Boost	*0...10 s*	Fan output boost duration.
CRD	*OFF / On*	Use Y1 output for cooling. The value must be *OFF*. The function is not used in this version of the controller.
HRD	*OFF / On*	Use Y2 output for heating. The value must be *OFF*. The function is not used in this version of the controller.
6WCTL	*OFF / COOL Y3 / HEAT Y4*	6-way valve output terminal. *OFF* 6-way valve control disabled *COOL Y3* Terminal Y3 *HEAT Y4* Terminal Y4
6WHLo	*0.00...10.00 V*	6-way valve control, lowest heating.
6WHHi	*0.00...10.00 V*	6-way valve control, highest heating.
6WCLo	*0.00...10.00 V*	6-way valve control, lowest cooling.
6WCHi	*0.00...10.00 V*	6-way valve control, highest cooling.

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5.5.1.5 Special functions menu

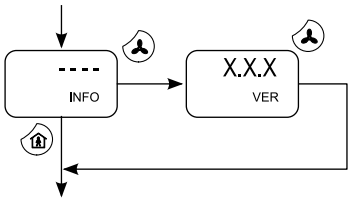


Parameter	Available values	Description
U1mod	*0 / 1 / 2 / 3*	U1 function. *0* Not in use *1* CO_2 *2* External setpoint *3* Temperature measurement
DISPM	*0 / 1 / 2 / 3 / 4*	Display mode. *0* Display off *1* Measured temperature *2* Temperature setpoint *3* Deviation from temperature setpoint. *4* Screen saver and deviation from setpoint
dISP	*0.1 / 0.5 °C*	Setpoint changing step.
MJAM	*OFF / On*	Valve jam prevention function status. *OFF* Disabled *On* Enabled
NIGHT	*OFF / On*	Night/day mode selection. *OFF* Day mode *On* Night mode
CO2LO	*400...1000 ppm*	CO_2 low limit.
CO2HI	*500...2000 ppm*	CO_2 high limit.
tyPE	*DAY / VAV*	button function. *DAY* Button press activates the temporary day mode. Set the day mode duration with *ext t* parameter. *VAV* Button press activates the VAV forcing mode. Set the forcing mode duration with *ext t* parameter.
ResN	*OFF / On*	Reset to night mode setpoint when activating night mode.
ResSP	*2.0...42.0 °C*	Night mode setpoint.

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Parameter	Available values	Description
MIH	*OFF / On*	button activity. *OFF* Button deactivated. *On* Button active.
RESET	*OFF / On*	Reset to factory settings.

5.5.1.6 Info menu



Parameter	Available values	Description
VER	*X.X.X*	Software version.

6 Modbus

The device is equipped with Modbus RTU communication via RS-485 connection.

6.1 Modbus properties

Protocol	RS-485 Modbus RTU
Bus speed	9600*/19200/38400/56000 bit/s
Data bits	8
Parity	none*/odd/even
Stop bits	1
Modbus ID	1*
Unit load	1/8 UL
	* factory setting

6.2 Modbus function codes

The device supports the following Modbus function codes.

Decimal	Hexadec-imal	Function
1	0x01	Read Coils
2	0x02	Read Discrete Inputs
3	0x03	Read Holding Registers
4	0x04	Read Input Registers
5	0x05	Write Single Coil
6	0x06	Write Single Register
15	0x0F	Write Multiple Coils
16	0x10	Write Multiple Registers

6.3 Modbus registers

6.3.1 Coils

The controls marked with * are stored in the volatile memory. These controls are returned to factory defaults after a power failure.

The controls that are written without * are stored in the non-volatile memory. These controls are restored after a power failure.

Important: The non-volatile memory durability is 100000 write cycles.

Register	Parameter description	Data type	Values	Range	Default
0	*Cooling PWM override enable (A1).	Bit	*0 - 1*	0. Off 1. On	*0*
1	*Cooling 0...10 V override enable (Y3).	Bit	*0 - 1*	0. Off 1. On	*0*

Register	Parameter description	Data type	Values	Range	Default
2	*Heating PWM override enable (A2).	Bit	0 - 1	0. Off 1. On	0
3	*Heating 0...10 V override enable (Y4).	Bit	0 - 1	0. Off 1. On	0
4	*VAV override enable (Y1).	Bit	0 - 1	0. Off 1. On	0
5	*Fan override enable (Y2).	Bit	0 - 1	0. Off 1. On	0
6	Not in use.	Bit	-	-	0
7	Not in use.	Bit	-	-	0
8	Not in use.	Bit	-	-	0
9	Not in use.	Bit	-	-	0
10	*Service alarm reset.	Bit	0 - 1	0. Off 1. On	0
11	*Cooling disabled.	Bit	0 - 1	0. Off 1. On	0
12	*Heating disabled.	Bit	0 - 1	0. Off 1. On	0
13	Night mode.	Bit	0 - 1	0. Off 1. On	0
14	Cooling output mode.	Bit	0 - 1	0. Direct 1. Reversed	0
15	Heating output mode.	Bit	0 - 1	0. Direct 1. Reversed	0
16	Cooling stages.	Bit	0 - 1	0. 1 stage 1. 2 stages	0
17	Sequence of cooling stages.	Bit	0 - 1	0. Valve first 1. VAV first	0
18	Fan stage simultaneously with valve stage.	Bit	0 - 1	0. Off 1. On	1
19	Night operation mode.	Bit	0 - 1	0. Dead zone 1. Frost guard	0
20	Effective setpoint after night mode changes to day mode.	Bit	0 - 1	0. User 1. Modbus	0
21	Valve jam prevention.	Bit	0 - 1	0. Off 1. On	0
22	Fan type.	Bit	0 - 1	0. 3-speed fan 1. EC fan	0
23	Fan speed 3 usage in auto mode.	Bit	0 - 1	0. Off 1. On	0

Register	Parameter description	Data type	Values	Range	Default
24	Effective fan speed after night mode to day mode change.	Bit	*0 - 1*	0. User 1. Modbus	*0*
25	VAV for heating.	Bit	*0 - 1*	0. Off 1. On	*0*
26	Setpoint changing step.	Bit	*0 - 1*	0. 0.1 °C 1. 0.5 °C	*1*
27	DI2 operation direction.	Bit	*0 - 1*	0. NC 1. NO	*0*
28	Thermostat function, cooling.	Bit	*0 - 1*	0. P/PI 1. Thermostat	*0*
29	Thermostat function, heating.	Bit	*0 - 1*	0. P/PI 1. Thermostat	*0*
30	Y1 usage.	Bit	*0 - 1*	0. VAV 1. Cooling	*0*
31	Y2 usage.	Bit	*0 - 1*	0. Fan 1. Heating	*0*
32	Heating stages.	Bit	*0 - 1*	0. 1 stage 1. 2 stages	*0*
33	Setpoint and fan speed reset after operation mode change.	Bit	*0 - 1*	0. Off 1. On	*0*
34	Sequence of heating stages.	Bit	*0 - 1*	0. Valve first 1. VAV first	*0*
35	button function.	Bit	*0 - 1*	0. Temporary day mode 1. VAV forcing	*0*
36	Reset to night mode setpoint when activating night mode.	Bit	*0 - 1*	0. Off 1. On	*0*
37	Reboot the device.	Bit	*0 - 1*	0. - 1. Reboot	*0*
38	button activity.	Bit	*0 - 1*	0. Button deactivated 1. Button active	*1*
39	Save current configuration to non-volatile memory. The register value changes to 0 automatically after saving.	Bit	*0 - 1*	0. - 1. Save settings	*0*

6.3.2 Discrete inputs

Register	Parameter description	Data type	Values	Range
0	Occupied by PIR	Bit	*0 - 1*	0. Off 1. On

Register	Parameter description	Data type	Values	Range
1	Occupied by button	Bit	*0 - 1*	0. Off 1. On
2	Day extension	Bit	*0 - 1*	0. Off 1. On
3	DI1 Input state	Bit	*0 - 1*	0. Off 1. On
4	DI2 Input state	Bit	*0 - 1*	0. Off 1. On
5	CO_2 overdrives	Bit	*0 - 1*	0. Off 1. On

6.3.3 Input registers

Register	Parameter description	Data type	Values	Range
0	Discrete inputs 16...1.	U16	*bits 0...15*	Discrete inputs 16....1
1	Coils 16...1.	U16	*bits 0...15*	Coils 16....1
2	Coils 32...17.	U16	*bits 0...15*	Coils 32...17
3	Temperature value.	S16	*-600...600*	-60.0...60.0 °C
4	External temperature value.	S16	*-600...600*	-60.0...60.0 °C
5	CO_2 value.	S16	*0...2000*	0...2000 ppm
6	Effective setpoint.	S16	*50...500*	5.0...50.0 °C
7	Current cooling (controller).	S16	*0...1000*	0...10.00 V
8	Current heating (controller).	S16	*0...1000*	0...10.00 V
9	Current fan speed (controller).	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Speed 1 2. Speed 2 3. Speed 3 4. Automatic
10	Fan speed (connector Y2).	S16	*0...1000*	0...10.00 V
11	VAV control (connector Y1).	S16	*0...1000*	0...10.00 V
12	Cooling control (connector Y3).	S16	*0...1000*	0...10.00 V
13	Heating control (connector Y4).	S16	*0...1000*	0...10.00 V
14	U1 input value.	S16	*0...1000*	0...10.00 V
15	External NTC value (connector).	S16	*-600...600*	-60.0...60.0 °C
16	VAV / boosting control.	S16	*0 - 1 - 2*	0. CO_2 1. Temperature 2. PIR
17	Setpoint by user.	S16	*20...420*	2.0...42.0 °C

Register	Parameter description	Data type	Values	Range
18	Fan control by user.	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Speed 1 2. Speed 2 3. Speed 3 4. Automatic
19	User setpoint deviation.	S16	*0...160*	0...16.0 °C
20	Cooling control (connector A1).	S16	*0...1000*	0...100.0 %
21	Heating control (connector A2).	S16	*0...1000*	0...100.0 %
22	Current timer value of temporary day mode.	S16	*0...480*	0...480 min

6.3.4 Holding registers

The controls marked with * are stored in the volatile memory. These controls are returned to factory defaults after a power failure.

The controls that are written without * are stored in the non-volatile memory. These controls are restored after a power failure.

Important: The non-volatile memory durability is 100000 write cycles.

Register	Parameter description	Data type	Values	Range	Default
0	Fan speed by Modbus.	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Speed 1 2. Speed 2 3. Speed 3 4. Automatic	*4*
1	Setpoint by Modbus.	S16	*80...500*	8.0...50.0 °C	*210*
2	*Cooling override (PWM) by Modbus (A1).	S16	*0...1000*	0...100.0 %	*0*
3	*Cooling override (0...10 V) by Modbus (Y3).	S16	*0...1000*	0...10.00 V	*0*
4	*Heating override (PWM) by Modbus (A2).	S16	*0...1000*	0...100.0 %	*0*
5	*Heating override (0...10 V) by Modbus (Y4).	S16	*0...1000*	0...10.00 V	*0*
6	*VAV override by Modbus (Y1).	S16	*0...1000*	0...10.00 V	*0*
7	*Fan override by Modbus (Y2).	S16	*0...1000*	0...10.00 V	*0*
8	External temperature sensor / DI2 input.	S16	*0 - 1 - 2 - 3*	0. Not in use 1. External temperature sensor 2. Door/window switch 3. Condensation switch	*0*
9	Temperature sensor adjustment.	S16	*-30...30*	-3.0...3.0 °C	*0*
10	Centre of user setpoint range.	S16	*180...260*	18.0...26.0 °C	*210*
11	User setpoint range limits.	S16	*0...160*	0...16.0 °C	*30*

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Register	Parameter description	Data type	Values	Range	Default
12	Control mode.	S16	*0 - 1*	0. P 1. PI	*1*
13	Dead zone.	S16	*0...30*	0...3.0 °C	*10*
14	Setpoint position in dead zone.	S16	*0...100*	0...100 %	*50*
15	Proportional band (Xp).	S16	*10...320*	1.0...32.0 °C	*10*
16	Integration time.	S16	*50...5000*	50...5000 s	*150*
17	Fresh air control.	S16	*0 - 1 - 2 - 3 - 4*	0. CO_2 / Temp. 1. Day mode / Temp. 2. CO_2 3. Day mode 4. CO_2 / Temp. / Day mode	*0*
18	Night mode dead zone.	S16	*0...100*	0...10.0 °C	*60*
19	Frost guard function setpoint.	S16	*80...500*	8.0...50.0 °C	*170*
20	DI1 mode.	S16	*0 - 1*	0. Not in use 1. Day/night mode switch	0
21	DI1 operation direction.	S16	*0 - 1*	0. NC 1. NO	*0*
22	DI1 delay passive to active.	S16	*0...60*	0...60 min	*0*
23	DI1 delay active to passive.	S16	*0...60*	0...60 min	*5*
24	Duration of temporary day mode.	S16	*0...480*	0...480 min	*120*
25	Minimum VAV output in day mode or VAV forcing mode. The controlled mode is selected with the coil 35.	S16	*0...1000*	0...100.0 %	*0*
26	U1 mode.	S16	*0 - 1 - 2 - 3*	0. Not in use 1. CO_2 2. Temperature setpoint 3. Temperature measurement	*0*
27	Minimum of cooling actuator signal.	S16	*0...500*	0...50.0 %	*0*
28	Maximum of cooling actuator signal.	S16	*500...1000*	50.0...100.0 %	*1000*
29	Minimum of heating actuator signal.	S16	*0...500*	0...50.0 %	*0*
30	Maximum of heating actuator signal.	S16	*500...1000*	50.0...100.0 %	*1000*
31	Minimum of fan output signal.	S16	*0...500*	0...50.0 %	*0*
32	Maximum of fan output signal.	S16	*500...1000*	50.0...100.0 %	*1000*
33	Minimum of VAV output signal.	S16	*0...500*	0...50.0 %	*0*
34	Maximum of VAV output signal.	S16	*500...1000*	50.0...100.0 %	*1000*
35	Fan output scaling, high end.	S16	*0...1000*	0...100.0 %	*1000*
36	Fan output scaling, low end.	S16	*0...1000*	0...100.0 %	*0*

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Register	Parameter description	Data type	Values	Range	Default
37	Fan usage.	S16	*0 - 1 - 2 - 3*	0. Off 1. Cooling 2. Heating 3. Heating and cooling	*0*
38	Low limit proportional band for CO_2 control.	S16	*400...1000*	400...1000 ppm	*700*
39	High limit proportional band for CO_2 control.	S16	*500...2000*	500...2000 ppm	*1250*
40	Fan speed 1 voltage.	S16	*0...1000*	0...10.00 V	*300*
41	Fan speed 2 voltage.	S16	*0...1000*	0...10.00 V	*600*
42	Fan speed 3 voltage.	S16	*0...1000*	0...10.00 V	*1000*
43	Display mode.	S16	*0 - 1 - 2 - 3 - 4*	0. Off 1. Temperature 2. Setpoint 3. Deviation from setpoint 4. Screen saver and deviation from setpoint	*1*
44	PWM period.	S16	*20...1200*	20...1200 s	*20*
45	Fan output boost duration.	S16	*0...10*	0...10 s	*0*
46	6-way valve output.	S16	*0 - 1 - 2*	0. Off 1. Cooling (Y3) 2. Heating (Y4)	*0*
47	6-way valve heating, low limit.	S16	*0...1000*	0...10.00 V	*730*
48	6-way valve heating, high limit.	S16	*0...1000*	0...10.00 V	*1000*
49	6-way valve cooling, low limit.	S16	*0...1000*	0...10.00 V	*470*
50	6-way valve cooling, high limit.	S16	*0...1000*	0...10.00 V	*200*
51	Night mode setpoint.	S16	*20...420*	2.0...42.0 °C	*210*
52	Firmware version.	S16	*0...1000*	0...1000	-

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7 Disposal

This device is considered as electrical and electronic equipment for disposal in terms of the applicable European Directive. At the end of life, the product must enter the recycling system at an appropriate collection point.

- The device must be disposed through channels provided for this purpose.
- The disposal must be completed according to the local and currently applicable laws and regulations.

Generally all metals can be recycled as material. Plastics and cardboard packaging material can be used in energy recovery. Printed circuit boards need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code. Contact your local Produal distributor for further information on environmental aspects and recycling instructions for professional recyclers.



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