JOY HC AO2DO

Room Regulator (from Version 1.6.0)

thermokon®
HOME OF SENSOR TECHNOLOGY

Datasheet

Subject to technical alteration
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Application

Room thermostat in an appealing design for heating/cooling (230 V) and controlling a 6-way valve (Sauter or Belimo). Used for individual control of temperature in commercial, industrial and residential buildings. The device combines a modern design with a 2,5" touch surface, which enables the single room controller to be used intuitively. 3 time channels with 4 periods of time can be configured via the menu. This device is suitable for a flush mount box.

Security Advice – Caution

The installation and assembly of electrical equipment should only be performed by authorized personnel.

The product should only be used for the intended application. Unauthorised modifications are prohibited! 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 assets. Ensure all power is disconnected before installing. Do not connect to live/operating equipment.

CAUTION! Risk of electric shock due to live components within the enclosure, especially devices with mains voltage supply (usually between 90..265 V).

Please comply with

- Local laws, health & safety regulations, technical standards and regulations
- Condition of the device at the time of installation, to ensure safe installation
- This data sheet and installation manual

Notes on Disposal

As a component of a large-scale fixed installation, Thermokon products are intended to be used permanently as part of a building or a structure at a pre-defined and dedicated location, hence the Waste Electrical and Electronic Act (WEEE) is not applicable. However, most of the products may contain valuable materials that should be recycled and not disposed of as domestic waste. Please note the relevant regulations for local disposal.

Remarks to Room Sensors

Location and Accuracy of Room Sensors

The room sensor should be mounted in a suitable location for measuring accurate room temperature. The accuracy of the temperature measurement also depends directly on the temperature dynamics of the wall. It is important, that the back plate is completely flush to the wall so that the circulation of air occurs through the vents in the cover. Otherwise, deviations in temperature measurement will occur due to uncontrolled air circulation. Also the temperature sensor should not be covered by furniture or similar devices. Mounting next to doors (due to draught) or windows (due to colder outside wall) should be avoided.

The temperature dynamics of the wall will influence the temperature measurement. Various wall types (brick, concrete, dividing and hollow brickwork) all have different behaviours with regards to thermal variations.

Surface and Flush Mounting

The temperature dynamics of the wall influence the measurement result of the sensor. Various wall types (brick, concrete, dividing and hollow brickwork) have different behaviours with regard to thermal variations. A solid concrete wall responds to thermal fluctuations within a room in a much slower way than a light-weight structure wall. Room temperature sensors installed in flush boxes have a longer response time to thermal variations. In extreme cases they detect the radiant heat of the wall even if the air temperature in the room is lower for example. The quicker the dynamics of the wall (temperature acceptance of the wall) or the longer the selected inquiry interval of the temperature sensor is the smaller the deviations limited in time are.

Technical Data

Measuring values	temperature		
Output voltage	0..10 V = (for 6-way valves)		
Output switch contact	2x normally open contacts (heating/cooling), 240 V max. load 3 A		
Power supply	85..260 V ~		
Power consumption	max. 2 VA (260 V ~)		
Measuring range temp	0..+50 °C		
Accuracy temperature	±1 °C (typ. at 21 °C)		
Inputs	input for NTC 10 K or floating contact	digital input for floating contact	digital input for floating contact (230 V ~)
Control functions	setpoint adjustment +0..+50 °C		
Display	LCD 60x44 mm, 240x160 px, white backlighting		
Functions	integrated PI- and 2-point-/ 3-point-controllers		
Enclosure	PC, hardened acrylic glass with high scratch resistance		
Protection	IP30 according to EN 60529		
Connection electrical	**Terminal 1..8** terminal block max. 1,5 mm²	**Terminal 9..12** terminal block max. 1.0 mm²	
Ambient condition	0..+50 °C, max. 85% rH non-condensing		
Weight	195 g		
Mounting	flush mounted with standard EU box (Ø=55 mm)		

Diagnostics Menu

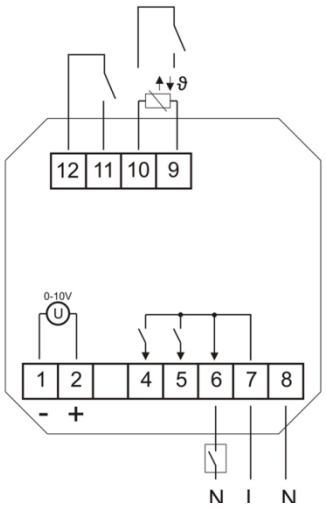
To access the diagnostics menu, select the header in the startscreen of the parameter menu, and press the ENTER key. Here you will find various information, such as device type, software version, state of the inputs and outputs and controller state (current manipulated variable).

Mounting Advices

Plasterboard boxes shall be covered by wall paper or paint to avoid that the plasterboard box's front rim will be partially visible underneath JOY.

Maybe consider using white plasterboard boxes (i.e. Kaiser 9063-77)

Connection Plan



1	**GND (6-way valve)**	**7**	**L**
2	**0..10 V (6-way valve)**	**8**	**N**
3		**9**	**input 1/universal/floating**
4	**Cooling**	**10**	
5	**Heating**	**11**	**input 2/digital/floating**
6	**230 V digital input**	**12**	

Function Description - Buttons

On the touch-surface are the keys for setpoint adjustment. While pressing of these buttons, the white LED of the Power-button lights up for visual feedback.

The room thermostat can be set in standby mode by pressing the power button 3 for at least 3 seconds.

The buttons (1) and (2) change the setpoint in the range ± 3 ° C (default setting, configurable).

With power-button (5), the device can be set in standby mode by pressing the button (if keycard-switch is NOT used). If the button is used as a occupancy button, the button must be pressed for at least 3s, in all other cases, a short actuation is sufficient. In standby mode, the display and all outputs are switched off (controller deactivated). The frost and heat protection monitoring remains active.

Function Description – Controller

Room temperature controls for heating and cooling can be individually adjusted and can be achieved as required using a **"2-point/3-point controller"** or a continuous **"PI controller".**

6WV (PI-controller 0..10 V)

The manipulated variable is output as a proportional control signal at the output for the 6-way valve. The type of valve used is set via the configuration software.
You can choose from 2..10 V / 2..10 V INV (Belimo), 0..10 V DN15 / DN15 INV, DN20 / DN20 INV (Sauter).

Heating/ cooling with 2-point-/ 3-point-controller

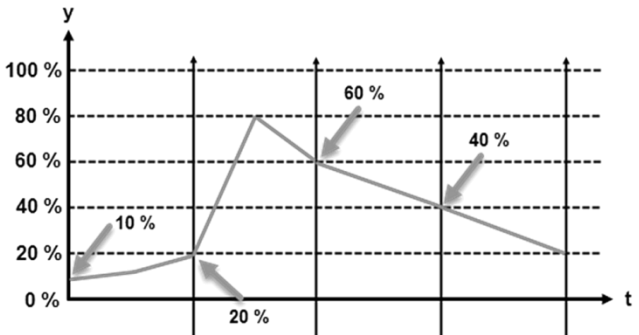
In the case of temperature control, the 2-point controller only knows the switching states heating ON and heating OFF. The 3-point controller also knows the switching state of cooling. Two - and three-point controller work with a hysteresis.

Heating/ cooling with PI-controller (PWM)

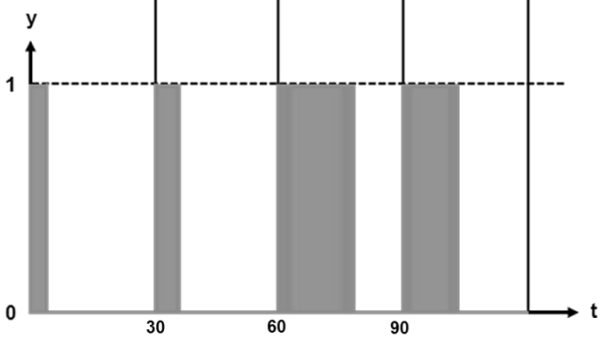
The time response of the PI control loop depends on the control parameters xp for the proportional area and tn for the reset time of the integral range. In case of an error, the P portion immediately changes the position value proportionally to the error variable, while the integral portion takes effect after a certain time. The resulting actuating variable is output as a pulse-width-modulated signal directly to the outputs.

Example:
t in min., cycle time 30 mins. (default)

Calculated control variable



Output control variable



Proportional range Xp
The proportional band is the deviation in which controller emits 100% value. A small Xp leads to a stronger control action in case of slight deviations, but increases the oscillation tendency.

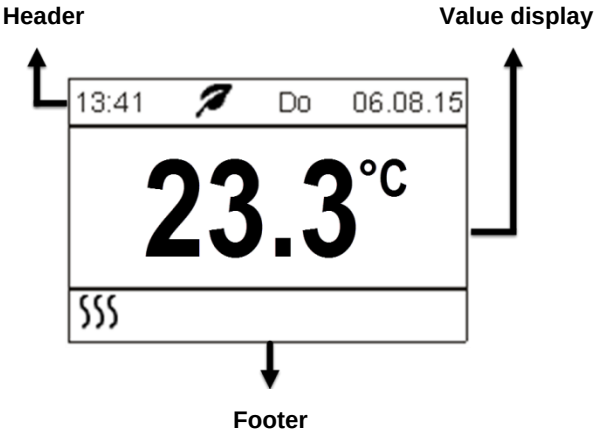
Integral time Tn
The reset time Tn is the time which the I-component of the controller would require to produce the same positioning signal that the P-component forms immediately once the control deviation is present. The effect of the I component decreases with increasing reset time.

Minimum and maximum actuating variable
This setting defines a fixed minimum or maximum value of the actuating variable. The parameter "Mode selection actuating variable" can be used to select whether the minimum actuating variable a) is retained until the controller changes its mode or b) whether the actuating variable of the controller is output to the output only when the minimum actuating variable is exceeded.

Parameter	Value (factory default)
Hysteresis	± 0,5 °C
PWM cycle time	30 min.
Dead band Heating/Cooling	2,0 °C
Dead band Heating/Cooling ECO-mode	10 °C
Min. set point	0,0 °C
Max. set point	50 °C
Standby set point decrease (unoccupied)	-2,0 °C
Frost protection	7,0 °C
Heat protection	35 °C
Step width	0,5 °C
Set point adjustment	± 3 °C

Main screen/ Value display

The Display shows the measured value of the internal sensor. The value of an external sensor will be shown if connected and configured accordingly. The room thermostat controls in this case according to the external sensor.



Header

Current date and time will be displayed in the header. If enabled, ECO-mode status is indicated via symbol .

Footer

Depending upon the heating or cooling mode, occupancy or window contact status, the corresponding symbols will be shown in the footer. The symbol “active timechannel” will be shown only if active.

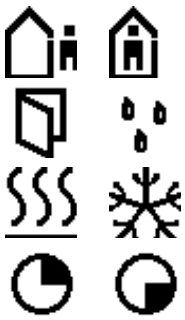
Symbols

Occupancy

Window contact/dewpoint

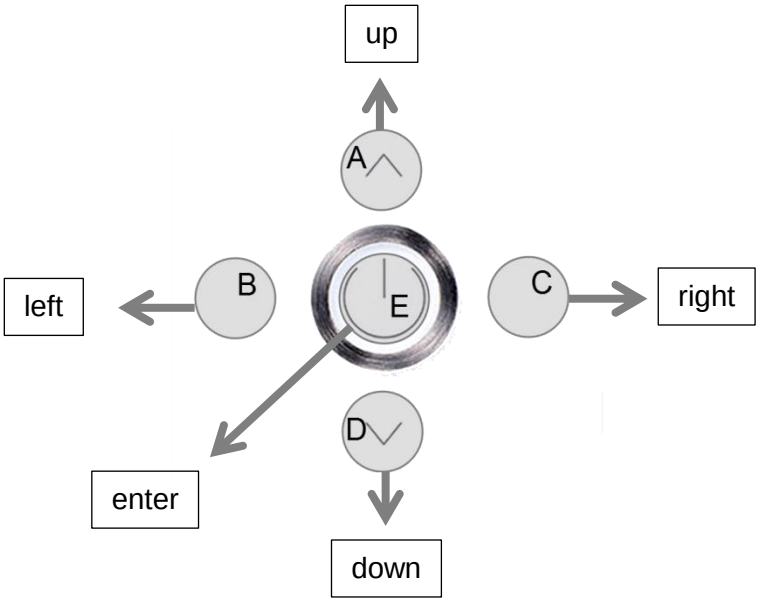
Heating/Cooling

Active timechannel



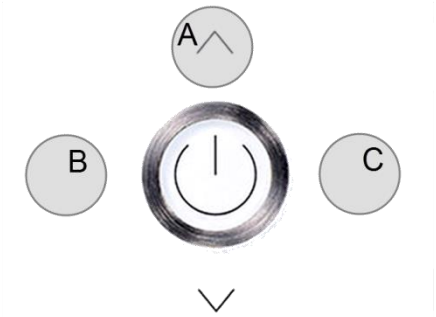
Configuration

Navigation

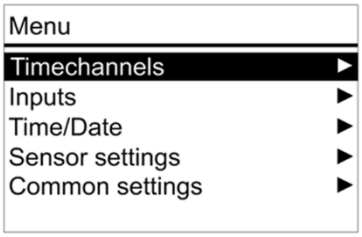


Menu navigation on the touch-surface is performed by pressing the buttons “up” (A), “down” (C), “left” (D), “right” (B) or the power button. Choose the desired parameter and press “right” (B) to open up the submenu. The menu will default after 30 seconds if no button is pressed. To exit the menu select the header line and press “left” (D)

Enter Parameter Menu

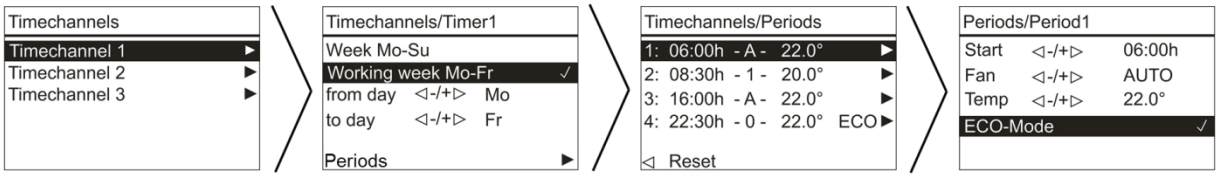


The configuration menu is called up by simultaneously pressing the buttons “up” (A), “left” (D) and “right” (B) for at least 3 seconds.



Menu → Timechannels

Set point and timer can be set in this menu. Three different time channels with four periods of time are available. The Time channels are prioritised. Channel 3 has the highest priority.



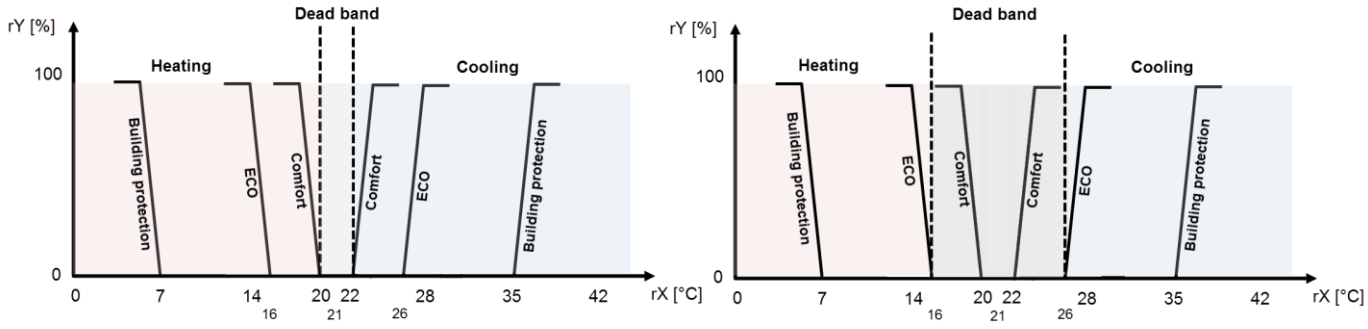
Choose the time channel and press “right” to enter the submenu. It is possible to select the total week as well as individual days

The selected parameter will be marked with the symbol ✓

To edit the parameter of the selected timer, select “Periods” and press “right”.

ECO-mode is also available in the menu “section”, when selecting the dead zone increase from 2 °C to 10 °C. The adjustable dead zone between the activation of heating or cooling modes enables an optimisation between comfort and energy saving.

The dead zone between heating and cooling in the ECO-mode will be set to the configured deadband range (see common settings). (default 10.0 K)



Menu → Inputs

Up to 3 inputs are configurable for functions such as windows contact, dew point, occupancy, change-over or external sensor option.

Sensor (NTC10K)

The value of an external sensor will be shown if connected and configured accordingly. In this case, the room thermostat controls according to the external sensor.

Change-Over DI

Which controller is active depends on the state of the Change-Over contact. (Factory default: contact open heating controller active, contact closed cooling controller active). The terminals 3 and 4 are used as outputs for heating rsp. cooling.

Change-Over Sensor

The Change-Over Sensor is used for switching between heating and cooling mode automatically. If the temperature is below 19 ° C, the controller is in cooling mode. If it is above 28 ° C, it is a heating mode.

If an input is configured as a change-over, the room thermostat is automatically in 2-pipe operating mode and both outputs (terminals 3 and 4) are used as outputs for heating rsp. cooling.

Window contact/Energy hold off

If a window contact is enabled via the digital input, the reference will switch to a setback set point (Heat SP/Cool SP).

Dewpoint

An active dewpoint contact locks the cooling controller.

Occupancy

If occupancy-function is active, the symbol will be displayed automatically. In state of “unoccupied” the heating set point is reduced by 2K (default setting) rsp. the cooling set point raised by 2K.

Keycard-Switch

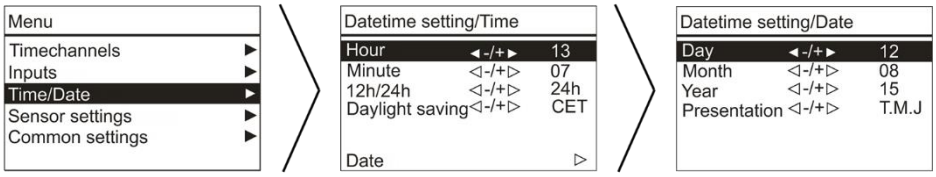
When the card is not inserted, the device is switched in sleep mode. Operation of the keys is locked, the display is switched off and the controller adjusts to the nominal values of the "unoccupied"-State.

Overview of possible combinations

Input 3 (Clamp 6 and 8)	**Input 2** (Clamp 11 and 12)	**Input 1** (Clamp 9 and 10)
Change-Over DI Dewpoint contact Windows contact	Window contact	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
		Keycard switch
	Dewpoint contact	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
		Keycard switch
	Occupancy contact	Window contact
		Dewpoint contact
		Keycard switch
	Keycard switch	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
Occupancy contact	Window contact	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
	Dewpoint contact	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
	Keycard Switch	Sensor (NTC10K)
		Window contact
		Dewpoint contact
Not used	Change-Over DI	Sensor (NTC10K)
		Window contact
		Dewpoint contact
		Occupancy contact
		Keycard switch
	Window contact	Sensor (NTC10K)
		Change-Over DI
		Change-Over Sensor
		Window contact
		Dewpoint contact
		Occupancy contact
		Keycard switch
	Dewpoint contact	Sensor (NTC10K)
		Change-Over DI
		Change-Over Sensor
		Window contact
		Dewpoint contact
		Occupancy contact
		Keycard switch
	Occupancy contact	Sensor (NTC10K)
		Change-Over DI
		Change-Over Sensor
		Window contact
		Dewpoint contact
		Keycard switch
	Keycard switch	Sensor (NTC10K)
		Change-Over DI
		Change-Over Sensor
		Window contact
		Dewpoint contact

Menu → Time/Date

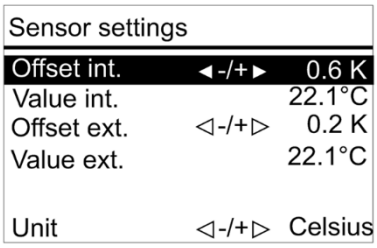
Time, Date and display format can be configured in the menu settings. The room thermostat is equipped with a real-time clock so that it automatically adjusts for daylight-saving time. This function can be disabled in the datetime settings.



Menu → Sensor settings

Offset correction for internal and external sensor value.

The temperature display can also be changed from °C to °F.

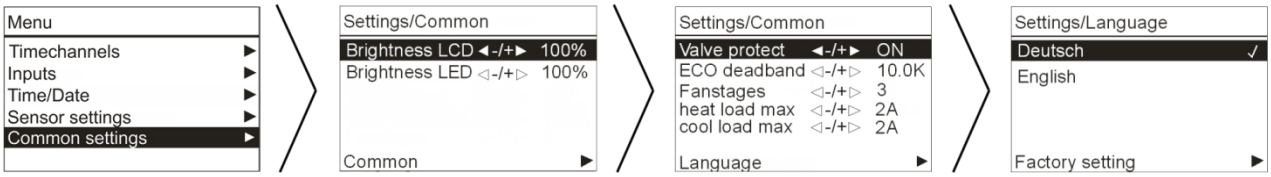


Menu → Common settings

The common settings includes the brightness of the background lighting and the LED.

Valve protection, prevents the valves becoming ceased when they are switched off for long periods.

If the valve protection function is activated, a valve-check is carried out every Friday at 11:00 am for the heating valve and 11:15 am for the cooling valve. The corresponding valve is triggered for 5 minutes, if not activated during the last 96 hours. The dead band can be adjusted (default 10.0 K, see timechannels). The room thermostat has 3 outputs for fan control with up to 3 fan stages. The amount of fan stages are configurable.



Heat / Cool load max.

The maximum heating and cooling load can be set by the user for the best compensation of the sensor self-heating for clamp 4 “cooling” and clamp 5 “heating”. This method ensures the accuracy of the internal temperature measurement.

Factory settings

By selecting “Factory setting”, the room thermostat will be reset and restore the device to factory default settings.

Application notice

SD-Card

A Micro-SD card slot inside the device can be used to update a new firmware version or a new device configuration. With the PC configuration tool a configuration file with extended parameter set can be created and uploaded via SD card. Only SD cards formatted in the FAT file system can be used! NTFS and exFAT file systems are not supported.

Boot Loader

Because of an integrated bootloader a new application (update, upgrade) can be uploaded by means of a SD card. To insert the SD card, the upper part must be removed. If the boot loader is activated, the ring illumination blinks in a 1s cycle, while display is not triggered! After recognition of a SD card with a valid application the update process is started. Now, ring illumination blinks in a 300ms cycle. After a successful update process (Duration approx. 2-3 minutes!) the new application is started automatically. Afterwards, SD card shall be removed!

Software:

A detailed description of the parameter and the configuration software can be found using the following link.

→ **Download**

The parameters for the display, set point and the controller can only be changed via the configuration software.

Dimensions (mm)