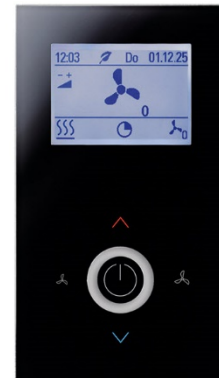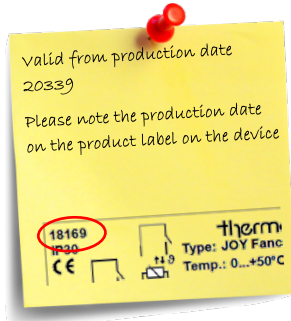# » JOY 5DO | EC AO2DO | EC 3AO

Fancoil Regulator
(from Version 2.6.x)

thermokon®
HOME OF SENSOR TECHNOLOGY

Datasheet

Subject to technical alteration
Issue date: 26.02.2021 • A122

»APPLICATION

JOY Fancoil 5DO (85..260 V ~)

Modern design, flush mounting fan coil room thermostat. Used for individual control of temperature in commercial and residential buildings. It is tailored for two-pipe and four-pipe fan coil units with two-wire electric valves. The device combines a modern design with a 2,5" LCD and a touch-sensitive surface, 3 time program options each with 4 time periods options.

JOY Fancoil EC AO2DO (85..260 V ~)

Modern fan coil room thermostat to control fan coil units with EC fans. It is suitable for 2- and 4-pipe systems. It has 2 relays and 1 analogue output 0-10V (heating valve, cooling valve and EC fan). The device combines a modern design with a 2,5" LCD and a touch-sensitive surface, 3 time program options each with 4 time periods options.

JOY Fancoil EC 3AO (24 V ~/=)

Modern design, flush mounting fan coil room thermostat. Used for individual control of temperature in commercial, industrial and residential buildings. It is tailored for two-pipe and four-pipe fan coil units with two-wire electric valves or controlling a 6-way valve. The device combines a modern design with a 2,5" LCD and a touch-sensitive surface, 3 time program options each with 4 time periods options.

»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.

»PRODUCT TESTING AND CERTIFICATION

Declaration of conformity

The declaration of conformity of the products can be found on our website https://www.thermokon.de/.

»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).

»APPLICATION NOTICE

Boot Loader

A bootloader integrated in the device, makes it possible to install a new application (update, upgrade) using a MicroSD 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 MicroSD card with a valid application the update process is started. Now, ring illumination blinks fast in a 300ms cycle. After a successful update process (Duration approx. 20-30 seconds!), the new application is started automatically. Afterwards, SD card have to be removed!

MicroSD-Card

MicroSD cards can be used to upload a new application or a new device configuration. Only MicroSD cards formatted in the FAT file system can be used! NTFS and exFAT file systems are not supported.

Software

A detailed description of the parameter and the configuration software can be downloaded from our website.

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

» CONFIGURATION VIA UCONFIG | MICROSD-CARD

Configuration software:
uConfig | *Windows 10 is required to use the uConfig configuration software*

The JOY room thermostat can be parameterised using the uConfig configuration software. An SD card is used to transfer the created configuration file to the device. For BUS devices, a live configuration can also be performed via the BUS interface.

The online installer for the configuration software can be found in our download center. The installer retrieves all necessary files and plug-ins from our web server. In this version an update function is integrated in the software.
→ **Download Online-Installer**

A separate offline installer is available for installations on PCs/Notebooks without internet connection. For an update of the software a recurring reinstallation is necessary.
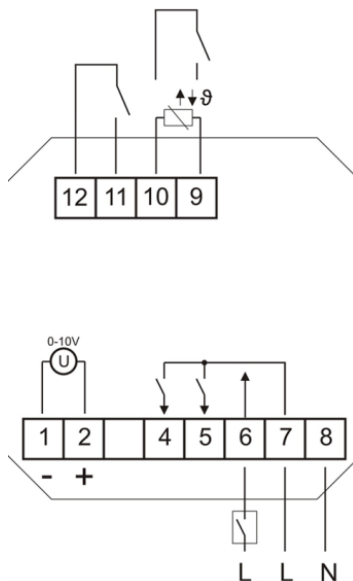→ **Download Offline-Installer**
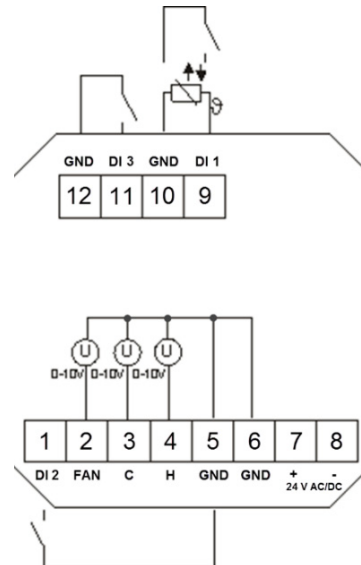
» CONNECTION PLAN
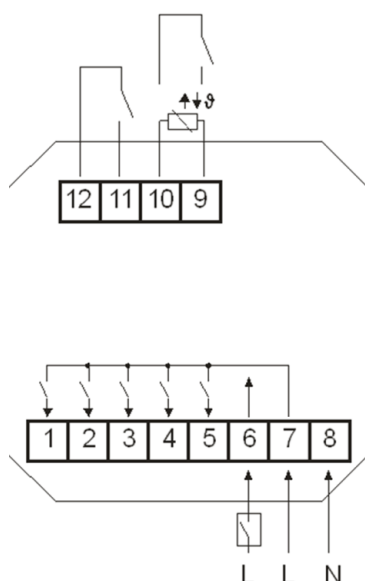
JOY FANCOIL 5DO (85..260 V ~)	JOY FANCOIL EC AO2DO (85..260 V ~)	JOY FANCOIL EC 3AO (24 V ~/=)

1 Fan Speed 3	1 EC Fan GND	1 Digital Input 2
2 Fan Speed 2	2 EC Fan (0..10 V)	2 EC Fan (0..10 V)
3 Fan Speed 1		3 Cooling (0..10 V) or 6-way valve
4 Cooling	4 Cooling	4 Heating (0..10 V) or 6-way valve
5 Heating	5 Heating	5 GND DI 2
6 Digitaler Input 2 (230 V)	6 Digital Input 2 (230V)	6 GND
7 L	7 L	7 24 V = (±10%) or 24 V ~ (±10%)
8 N	8 N	8 GND
12 GND DI 3	12 GND DI 3	12 GND DI 3
11 Digital Input 3	11 Digital Input 3	11 Digital Input 3
10 GND DI 1	10 GND DI 1	10 GND DI 1
9 Digital Input 1 (or NTC10K)	9 Digital Input 1 (or NTC10K)	9 Digital Input 1 (or NTC10K)

Note: Parallel connection of the potential-loaded inputs is not permitted!
If the operating mode (change-over DI) of several devices is to be switched together by one contact, the potential-free 230V input must be used (DI2, only possible with the 230V version). It must be ensured that the same phase is used for jointly switched devices.

»TECHNICAL DATA

JOY Fancoil 5DO | JOY Fancoil EC AO2DO | JOY Fancoil EC 3AO

Measuring values	temperature, humidity *(optional)*
Measuring range temp.	0..+50 °C
Accuracy temperature	±1 K (typ. bei 21 °C)
Measuring range humidity *(optional)*	0..100% rH non-condensing
Accuracy humidity *(optional)*	±2% between 10..90% rH (typ. at 21 °C)
Control function	setpoint adjustment +0..+50 °C, fan stages
Display	LCD 2,5", 240x160 px, white backlighting
Functions	integrated PI- and 2-point-/ 3-point-controllers, 2nd control loop: 2-point controller
Enclosure	PC and glass, optional black or white
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=60 mm)

JOY FANCOIL 5DO

Output switch contact	3x normally open contacts (fan speed), 240 V, load max. 3 A	2x normally open contacts (heating/cooling), 240 V, load max. 500 mA
Power supply	85..260 V ~	
Power consumption	max. 2,5 VA (260 V ~)	
Inputs	**DI1** input for NTC 10 K or floating contact	**DI2** digital input for non-floating contact (230 V ~) **DI3** digital input for floating contact

JOY FANCOIL EC AO2DO

Output voltage	1x 0..10 V, max. load 5 mA, EC FAN control
Output switch contact	2x normally open contacts (heating/cooling), 240 V max. load 500 mA
Power supply	85..260 V ~
Power consumption	max. 3 VA (260 V ~)
Inputs	**DI1** input for NTC 10 K or floating contact **DI2** digital input for non-floating contact (230 V ~) **DI3** digital input for floating contact

JOY FANCOIL EC 3AO

Output voltage	3x 0..10 V, max. load 5 mA, EC Fan control, heating & cooling or control 6-way valves (configurable via Software)
Power supply	24 V = (±10%) oder 24 V ~ (±10%) SELV
Power consumption	max. 2,5 W (24 V =)
Inputs	**DI1** input for NTC 10 K or floating contact **Di 2	DI 3** 2 digital inputs for non-floating contact

»FUNCTION DESCRIPTION – CONTROLLER/FAN STAGES

JOY FANCOIL 5DO (85..260 V ~)	JOY FANCOIL EC AO2DO (85..260 V ~)	JOY FANCOIL EC 3AO (24 V ~/=)
PI controller (PWM) & 2-point/3-point controller *(configurable)*	PI controller (PWM) & 2-point/3-point controller *(configurable)*	PI controller (0..10 V)

Fan stages *(all types)*

In automatic mode the fan speed is linked to the controller. The assignment of the fan stage to the control (heating / cooling, only heating, only cooling) is freely selectable. To ensure that the fan motor starts reliably, a period of time can be configured in which the fan starts with maximal value. Using one or more time channels, the fan control have to be set per timechannel and per period. Via the touch surface the user has the option to override the settings of the device every time. When the next time channel starts, the fan speed is set to the configured value. The fan is set to automatic mode when the user changes the occupancy state (occupied↔unoccupied).

Heating/ cooling with PI-controller (PWM) *(only 5DO and EC AO2DO)*

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.

Heating/ cooling with 2-point-/ 3-point-controller *(only 5DO and EC AO2DO)*

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.
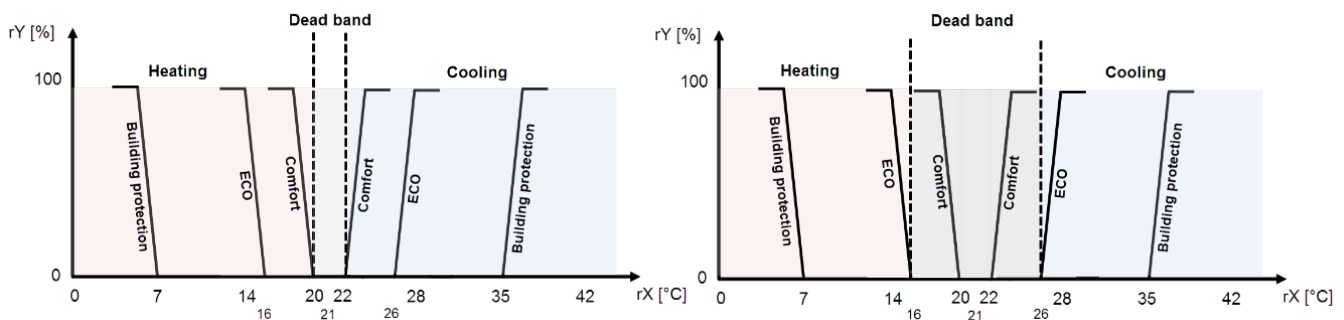
Heating/ cooling with PI-controller (0..10 V) *(only EC 3AO and EC AO2DO)*

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 variable, 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 manipulated variable is output as an analogue 0..10 V signal directly to the outputs.

EC Fan automatic mode with PI-controller *(only EC 3AO and EC AO2DO)*
(for EC AO2DO with two-point/three-point controller, the temperature range for controlling the 0..10 V EC fan is parameterised separately)

The 0..10 V (0..100%) control of the fan is proportional to the calculated manipulated variable of the PI controller.

Example:
Calculated actuating variable 65% → Fan control with 6,5 V.
Calculated actuating variable 22% → Fan control with 2,2 V.

EC Fan manual with PI-controller *(only EC 3AO and EC AO2DO)*

Up to 5 steps (steps) can be set using the configuration software. The set number of steps is divided linearly to the manipulated variable of 0..100%.

Example:
Max. steps (stages) = 5
Stage 1 = 20%
Stage 2 = 40%
Stage 3 = 60%
Stage 4 = 80%
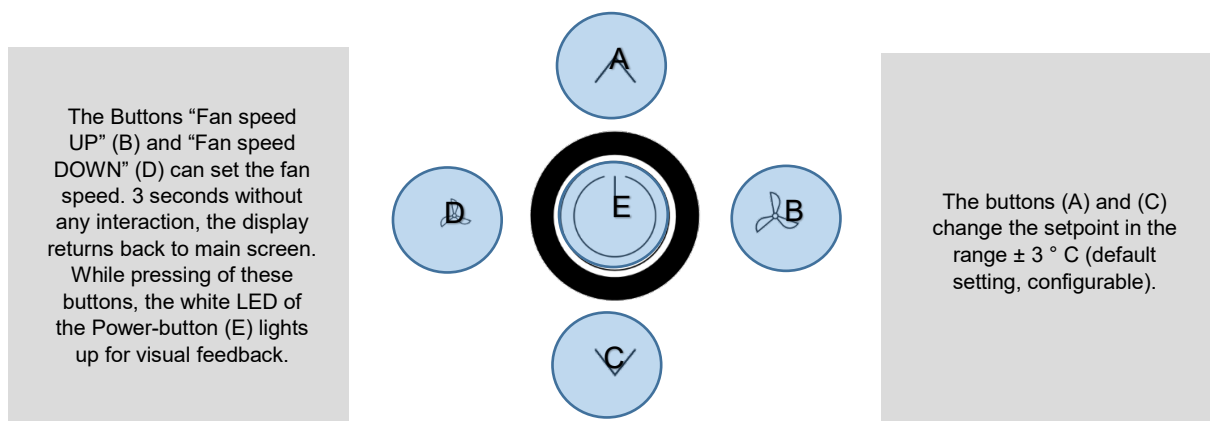Stage 5 = 100%

Max. steps (stages) = 3
Stage 1 = 33%
Stage 2 = 66%
Stage 3 = 100%

» FUNCTION DESCRIPTION - BUTTONS

On the touch surface, there are adjustment options for setpoint and fan speed regulation.

The Buttons "Fan speed UP" (B) and "Fan speed DOWN" (D) can set the fan speed. 3 seconds without any interaction, the display returns back to main screen. While pressing of these buttons, the white LED of the Power-button (E) lights up for visual feedback.

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

With power-button (E), the device can be set in standby mode by pressing the button (if keycard-switch function 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.

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. With an optional humidity sensor, the relative room humidity can also be displayed on the main screen. The display is not active by default and must be activated.

Header →

Value display →
(Humidity optional)

Footer →

13:41	06.08.25
23.3 °C	

13:41	06.08.25
56.6 %rH **23.3** °C	

Header

In the header line, the time, weekday and date are displayed. In addition, the ECO info symbol (sheet) is displayed here when the ECO mode is switched on. It is possible to show an alarm symbol (exclamation mark) in the display. This symbol is located at the same position as the ECO symbol. Since the alarm symbol has a higher priority, it overwrites the ECO symbol.
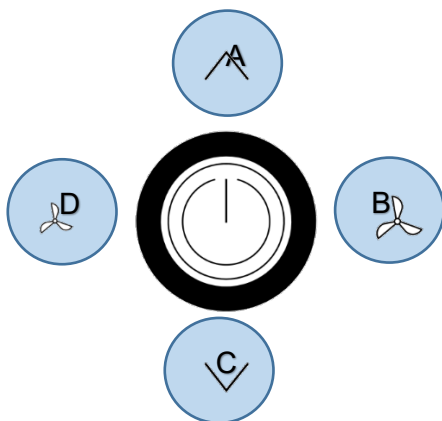
Footer - Symbols

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.

Occupancy

Window contact/dewpoint

Heating/Cooling

Fan Speed

Active timechannel

» CONFIGURATION

Buttons

The configuration menu is activated by simultaneously pressing the buttons "up" (A), "left" (D) and "right" (B) for at least 3 seconds. 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. If no entry is made for 8 minutes, the parameter menu is left automatically. To exit the menu select the header line and press "left" (D)

» MENU → TIME CHANNELS

In the Time Channels menu, setpoint and timer can be set. Up to 3 time channels with 4 time periods each can be parameterized. The time channels are prioritised. Channel 3 has the highest priority. After selecting the line of the time channel to be edited, the next submenu is called up with the "Right" key. It is possible to set any time period within one week in the first two lines with the "Left" (-)/ "Right"(+) keys. In addition, the ECO mode is available in the menu sections. In ECO mode, the dead zone between heating and cooling is automatically set to the ECO dead zone configured in the "General Settings" menu (default: 10 K).

» MENU → INPUTS

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

The overview of possible combinations can be found in the software specification of the JOY.

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. Alternatively, an external temperature sensor can be used at the universal input to protect floor heating. If a configured temperature is exceeded, the heating sequence is suspended.

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 4 and 5 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 22 ° C, the controller is in cooling mode. If it is above 25 ° 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 4 and 5) 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.

Alarm contact

An alarm symbol can be shown in the header of the display. The backlight flashes when the alarm is active. This symbol is in the same position as the ECO symbol. The alarm symbol has a higher priority and overwrites the ECO symbol!

» 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.

Menu	
Timechannels	▶
Inputs	▶
Time/Date	▶
Sensor settings	▶
Common settings	▶

Settings/Common	
Brightness LCD ◄-/+►	100%
Brightness LED ◁-/+▷	100%
Common	▶

Settings/Common	
Valve protect ◄-/+►	ON
ECO deadband ◁-/+▷	10.0K
Fanstages ◁-/+▷	3
Language	▷

Settings/Language	
Deutsch	✓
English	
Factory setting	▶

Factory settings

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

»DIMENSIONS (MM)
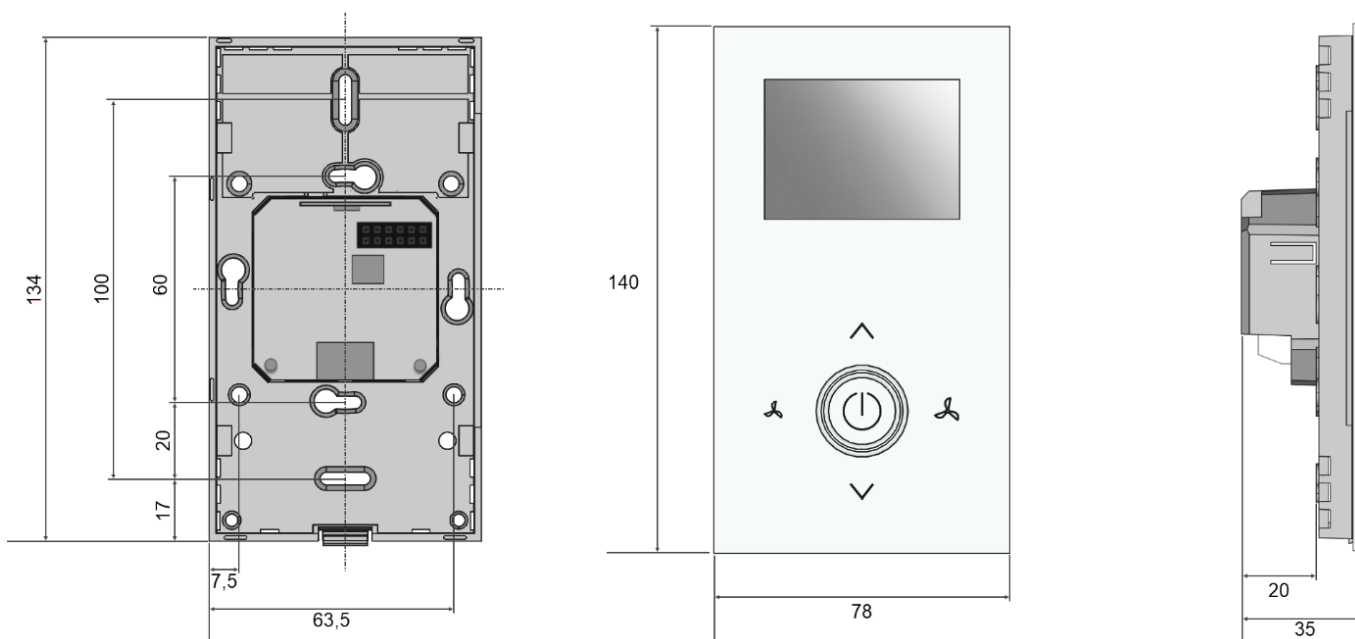
»ACCESSORIES (OPTIONAL)

Decorative frame pure white for JOY	Item No. 681452
Decorative frame black for JOY	Item No. 740951
MicroSD card 2GB	Item No. 500098