domat
control system

UI09x

Communicative room unit with CO₂ sensor

Summary   **The room unit with CO₂ sensor contains temperature sensor, NDIR CO2 sensor for carbon dioxide concentration measurement, optional humidity sensor, and control knob for setpoint control and other settings. The binary output is controlled either on a remote basis, or as thermostat, hygrostat or CO₂ controller. The units communicate over Modbus RTU / RS485 and they can be used as open system components with majority of building control system and controllers.**

Application
- **Air handling units and air condition in rooms with variable load – schools, cinemas, lecture halls etc.**
- **monitoring and recording of temperature, and CO₂ concentration indoors**

Function   The units acquire temperature, CO₂ concentration, and optionally relative humidity in the room, temperature correction (controlled by the knob) and required operation status which is set by short push of the knob or in the menu. In the configurable menu following values can be set and displayed:

- temperature, actual temperature correction
- humidity (actual value only at room units containing the humidity sensor)
- time (only display at room units with RTC)
- basic setpoint - day
- basic setpoint - night
- outside temperature for heating enable
- DHW temperature
- heating curve type (1...4)
- operation mode (Residential with Day, Night, Time schedule, Off, or Hotel / Office with Comfort, Standby, Party, Off)
- fan stage (Auto, Off, St.1, St. 2, St. 3)
- A/C mode (Auto, Heating, Cooling, Off, Fan only)
- weekly scheduler: 7 days, up to 6 events per day

— another 5 variables (air quality, fan speed etc.) – each has a profile where max. and min. values, step, number of decimals, and symbol set are defined.

It is also possible to set / reset any of the LCD symbols on the display over Modbus. The turn / push knob has three basic functions:

- instant edit (turning the knob) – settings of one predefined analogue value, usually room temperature correction
- quick edit (short push) – change of predefined state, e.g. Presence (Comfort / Standby / Off), Air condition (Auto / Heating / Cooling / Fan only / Off) etc.
- long push – jump to menu where values are listed by turning the knob, short push selects the value to be edited, and the value is changed by turning the knob followed by short push for confirmation.

After definable inactivity time, the display goes back to its basic state with rolling display of selected values (e.g. actual temperature and CO_2).

The unit Modbus address and functionality is defined over the RS485 interface with service software **ModComTool** which is free for download at **http://domat-int.com/en/downloads/software**. To interface the room unit to the computer use the USB/485 converter **M080**, RS232/RS485 converter **M011**, or any suitable RS485 converter.

Technical data		
	Power supply	24 V AC +/- 10%
	Consumption	600 mVA
	Temperature measuring range	-20 ÷ 70 °C, accuracy according to DIN IEC 751, Class B
	Humidity (selected types only, see table below)	10 ÷ 90 %rH (30-70% +/- 3.5%, 10-90 +/- 4.5%)
	CO_2 measuring range	0 ... 5000 ppm
	CO_2 measuring method	NDIR (Non-dispersive Infra Red)
	CO_2 measuring accuracy	$\pm$ 30 ppm $\pm$ 5 % of measured value, software correction possible
	Reaction time of CO_2 sensor (90 %)	60 s
	Protection degree	IP20
	Input	1x for dry contact, 24 V AC, 5 mA
	Output	1x solid state relay, zero switching, AC load, 24 V AC, maximum switched current 0,4 A
	Setpoint	according to configuration, +/- 10 to +/- 1 K
	Communication	RS485 - Modbus RTU, slave, selectable speed 1200 ... 115200 bps, N,8,1
		The interface is optically separated.
	Display	LCD 60 x 60 mm, symbol set see above
	Terminals	screw terminals for wires 0,14 – 1,5 mm^2

| Cover	ABS, RAL9010, other colours
Weight	0,17 kg
Dimensions	see below

Terminals
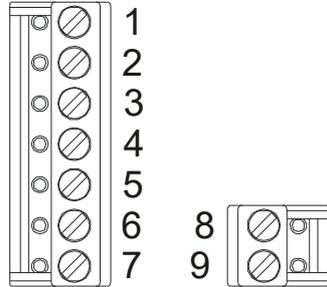
As seen when removing the display part. The wiring goes towards the center of the unit so that the cable can be brought through the aperture in the middle of the bottom part.

1: K- communication RS485 -
2: K+ communication RS485 +
3: DI input (dry contact against G0)
4: DO output against G0
5: G0 power, DI, DO – common point
6: G0 power, DI, DO – common point
7: G power

8: -- connector not installed
9: -- connector not installed

DIP switches
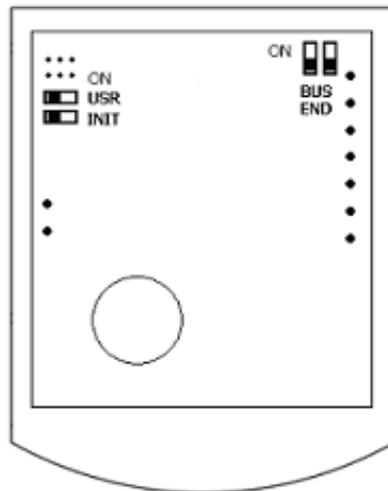
Back of the PCB

BUS END: if ON, the bus is terminated (if last device on the line)

USR: not used, reserved for future applications

INIT: sets the controller into default state and sets bus address to 1, baud rate to 9600. To init, proceed as follows:
- connect the device over RS485 to a PC with domat.exe config tool
- set INIT to ON
- apply power (use only the connector without bottom)
- find the controller in the tool (Scan)
- set INIT to OFF
- in the **ModComTool** tool, open the controller window
- click the Init button in the tool
- remove and apply power.

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Measuring range	The integrated temperature sensor range is -20 to +70 °C. Read and entered values are available at the RS485 bus where a controller or SCADA reads them. The supervising system can also write values to the unit (operation mode, fan stage, etc.), which are displayed on a large LCD display.
	The CO_2 measuring range is 0...5000 ppm. A range defined by two parameters is then recalculated to 0...100 %, value, which is displayed on the LCD, e.g. 300...2500 ppm displays as 100...0 % (of air quality) or 0...100 % (of air pollution). At the bus it is possible to read the absolute value in ppm, too. The parameters are set through the configuration software **ModComTool** or by direct writing into Modbus registers. Default values are 0% ... 350 ppm (fresh air), 100 % ... 2500 ppm (maximum pollution).
Autocalibration	Transportation and aging may cause sensor drift. The sensor records the lowest reading and expects that at least once per 8 days the CO_2 level reaches the outside air concentration (400 ppm). The lowest measured value is then assigned the 400 ppm level. Autocalibration does not work if the room is occupied 24 hours a day, or there are no periods when the gas level drops to background (e.g. greenhouses). Then, the autocalibration function can be disabled through the configuration program or by direct writing into the Modbus register. The autocalibration is set to on by default.
	During the first days of operation, until the first autocalibration, the sensor may read values which differ from the real values by several hundreds ppm, e.g. 200 ppm at night etc. This error is automatically corrected with the first autocalibration.
Room unit as controller	The binary output (SSR), if available, may be controlled either from a PLC over the bus, or configured as one of controllers:

- thermostat
- hygrostat (only at devices with rH sensor)
- controller switching at a predefined CO_2 level.

Setpoint and hysteresis are set over the bus. This function is not suitable for standard integrated room control, it is to be used as supplementary only. The setpoints are not influenced by operation modes (Day, Night, Off).

Installation	Units are intended for operating in a normal and chemically non-aggressive environment. They do not need any servicing or maintenance. Install them in a vertical position at places where they can be operated easily and measure correct values of temperature and humidity, i.e. in the height of about 150 cm, with no direct sunlight or other heat / cool source (AHU outlets, refridgerator, electrical appliances). The device consists of two parts: bottom with screw terminal block and cover containing PCB, display, and the knob. The bottom part is fixed by 2 or 4 screws to any flat surface or a flush-mounting box Ø 50 mm. At the back of the bottom there is an aperture for cabling. The bottom should be installed and cabling connected first, and the upper part inserted after the construction works have been finished to prevent damage to the unit.
	Seal the conduits to avoid influencing the sensor by draught. Use insulating pad when installing the sensor on cold walls. Avoid sensor exposition to sunlight or other heat sources.
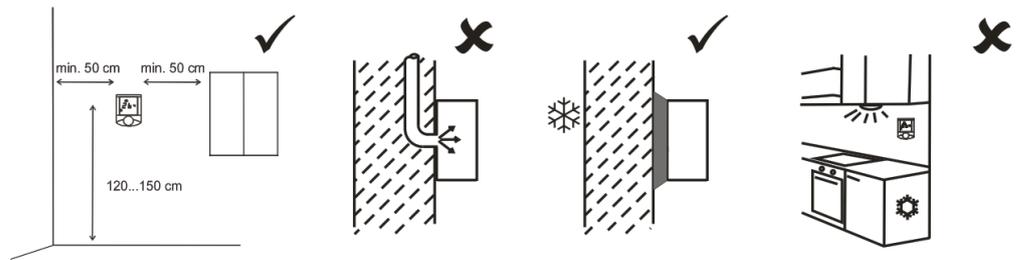
Opening the cover

When removing the display part, proceed as follows:

- press gently the side parts of the unit and pull the right of the display part by several milimeters
- pull the left of the display part
- pull the display part and remove it from the bottom.

Do not bend the display part too much, the connector pins could be damaged. The locks are only at the sides of the display part, not at the top nor bottom.

Communication

The units communicate with a controller (master) over RS485 using Modbus RTU and thus they can be used in a number of control and SCADA systems. The register description is available in a separate document *Room units UI... – Communication description.* User manual for domat.exe and detailed description of the room unit functions find in the document *Room units configuration – User manual.*

Display
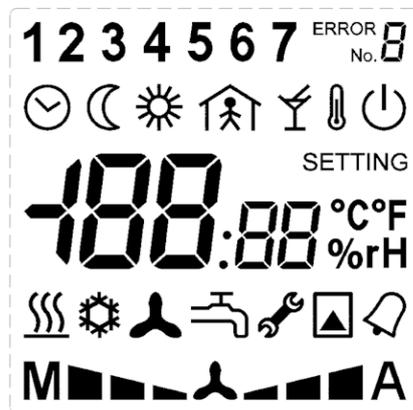
Over Modbus, it is possible to set / reset the complete symbol set except for the 7 segment digits, „Error" and „Setting" texts, and symbols of °C, °F, %, and rH. Those are part of the configurable menu profiles. The register description is available in a separate document *Room units UI... – Communication description.*

LCD symbol set

Type table

Type	LCD	Knob	CO₂	DI	DO	t	rH
UI090			✓	-	-	✓	
UI091	✓	✓	✓	1	1	✓	
UI092	✓	✓	✓	1	1	✓	✓
UI093	✓		✓	1	1	✓	
UI094	✓		✓	1	1	✓	✓
UI095	✓	✓	✓	-	-	✓	

Units with no knobs are used as indicators, units with no knobs / display are used as communicative CO_2 and temperature / rH sensors, both optionally with remote controlled input / output, if available. For simple control applications, control functions may be used (see above).

Dimensions
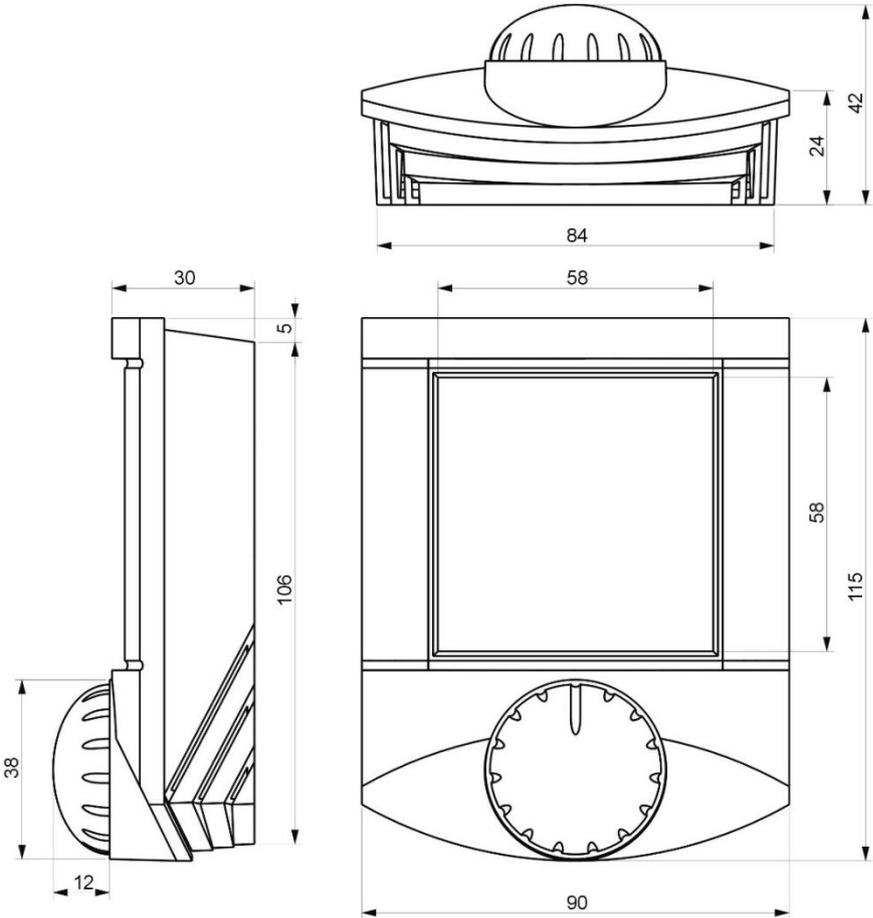
All dimensions in *mm.*

RoHS notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Changes in versions

11/2015 — Default values of ppm for 0 % a 100 % added.
09/2016 — Changed the format and reference to the configuration software.
03/2017 — Added picture and description of the installation and link on the datasheet with other colours.