Modbus Interface Description

Room Operating Units P-22RT..-1U00..-2

Edition 2023-04 / V2.02

Contents

BELIMO

Modbus general notes

General information

Date	03.04.2023
Product Name	Room Operating Unit (ROU)
Product Model Number	P-22RT..-1U00A-2 (with virtual display) P-22RT..-1U00D-2 (with ePaper touch display)
Protocol	Modbus RTU over RS-485

Modbus RTU

Transmission Formats	1-8-N-2, 1-8-N-1, 1-8-O-1, 1-8-E-1 (Default: 1-8-N-2)
Baud Rates	9'600, 19'200, 38'400, 76'800, 115'200 (Default: 38'400)
Address	1...247 (Default: 1)
Number of Nodes	Max. 32 (without repeater)
Terminating Resistor	120 Ω (Default: Off)

Parametrisation

Tool	Belimo Assistant App

Register implementation

All data is arranged in a table and addressed by 1..n (Register No.) or 0..n-1 (Address). No distinction is made between data types (Discrete Inputs, Coils, Input Registers and Holding Registers). Therefore, all data can be accessed with the two commands for Holding Register. The commands for Discrete Inputs and Input Registers can be used as an alternative.

Commands

Standard commands:	Optional commands:
Read Holding Registers [3]	Read Discrete Inputs [2]
Write Single Register [6]	Read Input Registers [4]
	Write Multiple Registers [16]

Interpret values in the registers

All values in the register are either unsigned or signed integer data types.

Example unsigned integer	Example signed integer
Read (Function 03, 1 Register) Value Register No. x / Address x-1 = 0001 1010 1100 1000_2 = $6{,}856_{10}$	Read (Function 03, 1 Register) Value Register No. x / Address x-1 = 1111 1101 1111 0010_2 = -526_{10}
Actual value = value * scaling factor * unit = 6,856 * 0.01 * unit = **68.56 unit**	Actual value = value * scaling factor * unit = -526 * 0.01 * unit = **-5.26 unit**

Deactivated registers

If a register is not supported by a device or by a device setting, this is indicated by 65,535 (1111 1111 1111 1111_2).

All writeable registers on registers >100 are persistent and are **not** supposed to be written on a regular basis.

Modbus register overview

Operation

No.	Address	Register	Access
1	0	Room Temperature in °C	R
2	1	Room Temperature in Selected Unit	R
3	2	Relative Humidity	R
4	3	CO_2 Value of the Room	R
5	4	Dew Point Temperature in °C	R
6	5	Dew Point Temperature in Selected Unit	R
7	6	Air Quality Status	R
8	7	Digital Input	R
..	..	..	..
11	10	Display Warning Icon	R / W
12	11	Display Window Icon	R / W
..	..	..	..
22	21	Room/Zone Temperature Setpoint in °C	R / W
23	22	Set Ventilation Stage	R / W
..	..	..	..
31	30	System Operation Mode	R / W
32	31	Ventilation Stage Control Mode	R / W
33	32	Heating and Cooling Application Status	R / W
34	33	Enable Local Adjustment	R / W
35	34	Room/Zone Temperature Setpoint in Selected Unit	R / W
36	35	Relative Room/Zone Temperature Setpoint in °C	R / W
37	36	Relative Room/Zone Temperature Setpoint in Selected Unit	R / W
..	..	..	..

Definition:
R = Read
W = Write

Service

No.	Address	Register	Access
100	99	Bus Termination	R
101	100	Serial Number Device – 1st part	R
102	101	Serial Number Device – 2nd part	R
103	102	Serial Number Device – 4th part	R
104	103	Firmware Version	R
..	..	..	..
111	110	Room Temperature Offset	R / W
112	111	Relative Humidity Offset	R / W
113	112	CO_2 Value Offset	R / W
..	..	..	..
116	115	CO_2 Limit for Good Air Quality	R / W
117	116	CO_2 Limit for Medium Air Quality	R / W
118	117	Air Quality Indication	R / W
..	..	..	..
121	120	Select the preferable temperature unit	R / W
122	121	Unit for temperature shown on display	R / W
123	122	Select the preferable differential temperature unit	R / W
..	..	..	..
131	130	Light/Dark Color Scheme	R / W
132	131	Display Room/Zone Temperature	R / W
133	132	Display Relative Humidity	R / W
134	133	Display CO_2 Value	R / W
135	134	Display Heating/Cooling Icon	R / W
136	135	Warning Icon Function	R / W
137	136	Window Icon Function	R / W
138	137	Mode Temperature on Display	R / W
139	138	Display Ventilation Stages	R / W
140	139	Eco Button Mode	R / W
141	140	Display Boost Button	R / W
142	141	Mode On/Off Button	R / W
143	142	Boost Mode Duration	R / W
..	..	..	..
146	145	Temperature Setpoint Type	R / W
147	146	Default Room Temperature Setpoint	R / W
148	147	Adjustment range temperature setpoint	R / W
149	148	Ventilation Stage Configuration	R / W
150	149	Ventilation Control Mode	R / W

Sensor values

The various measured values can be read out via the Registers No. 1 to 6 / Address 0 to 5.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
1	0	**Room temperature** Temperature feedback value of room/zone in °C	0...50	°C	0.01	R
2	1	**Room temperature** Temperature feedback value of room/zone in selected unit	Range depending on the selected unit (calculated)	°C, K, °F	0.01	R
3	2	**Relative humidity** Feedback value of relative humidity in the zone/room	0...10'000	%	0.01	R
4	3	**CO_2 value of the room** CO_2 feedback value of room/zone	1...2'000	ppm	1	R
5	4	**Dew point temperature** Calculated dew point temperature in room/zone in °C	-50...50	°C	0.01	R
6	5	**Dew point temperature** Calculated dew point temperature in the room/zone in selected unit	Not specified	°C, K, °F	0.01	R

Offset/correction values

These registers can be used to specify offset/correction values for the individual measured values.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
111	110	**Room temperature offset** Offset for actual value input	-15...15	K	0.01	R / W
112	111	**Relative humidity offset** Set an offset to the relative humidity feedback value in percent.	-20...20	%	0.01	R / W
113	112	**CO_2 value offset** Set an offset to the CO_2 concentration feedback value in parts per million.	-500...500	ppm	1	R / W

Temperature unit selection

The unit system can be selected via the Register No. 121 to 123 / Address 120 to 122.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
121	120	**Select preferred temperature unit** Affects room temperature (Register No. 1), dew point temperature (Register No. 6) and room temperature setpoint (Register No. 35)	0: °C 1: K 2: °F	–	1	R / W
122	121	**Unit for temperature on display** Temperature unit shown on display of room unit	0: °C 1: - 2: °F	–	1	R / W
123	122	**Select preferred differential temperature unit** Affects relative room temperature setpoint (Register No. 37)	0: °C 1: K 2: °F	–	1	R / W

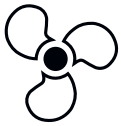
Temperature setpoint

Using the following registers, the temperature setpoint can be configured and read out.

Figure 1: Left: Room temperature setpoint (in °C). Right: Relative room temperature setpoint.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
22	21	**Room/zone temperature setpoint** Set desired room temperature in room/zone in °C.	10...45	°C	0.01	R / W
35	34	**Room/zone temperature setpoint** Set desired room temperature in room/zone in selected unit.	Range depending on the selected unit (calculated)	°C, K, °F	0.01	R / W
36	35	**Relative room/zone temperature setpoint** Set desired room temperature shift in room/zone in °C.	-5...5	°C	0.01	R / W
37	36	**Relative room/zone temperature setpoint** Set desired room temperature shift in room/zone in selected unit.	Range depending on the selected unit (calculated)	°C, K, °F	0.01	R / W
146	145	**Temperature setpoint type** Set the temperature setpoint type between absolute setpoint (e.g. 23°C) and relative setpoint or setpoint shift (e.g. +3°C).	0: Absolute setpoint 1: Relative setpoint	–	1	R / W
147	146	**Default room temperature setpoint** Set the center of the setpoint adjustment range.	15...35	–	0.01	R / W
148	147	**Adjustment range temperature setpoint** Set the permissible setpoint adjustment range (e.g. 3 = +-3°C).	0...5	–	1	R / W

Ventilation setpoint



Using the following registers, the ventilation setpoint can be configured and read out.

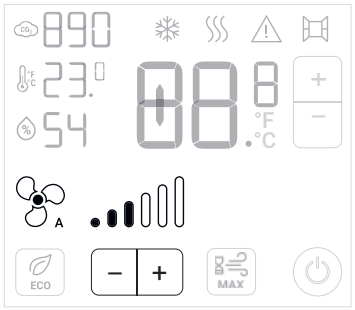


Figure 2: Ventilation setpoint

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
23	22	**Set ventilation stage** Set desired ventilation stage in room/zone in percent.	0...100	%	0.01	R / W
32	31	**Ventilation stage control mode** Set ventilation mode to automatic control or manual control (applies if hybrid control mode is activated in Register No. 150).	0: Manual ventilation stages control 1: Automatic ventilation stages control	–	1	R / W
149	148	**Ventilation stage configuration** Set the number of ventilation stages on the display.	0: – 1: – 2: 3 stages 3: 4 stages 4: 7 stages	–	1	R / W
150	149	**Ventilation control mode** Set the ventilation control functionality to manual mode only or automatic and manual mode combined.	0: Manual mode only 1: Hybrid control mode, setpoint invisible in automatic mode	–	1	R / W

Display configuration

The display content and the options for interaction are fully customisable according to the needs of the HVAC application and the building owner. The following registers describe how to configure the display layout.

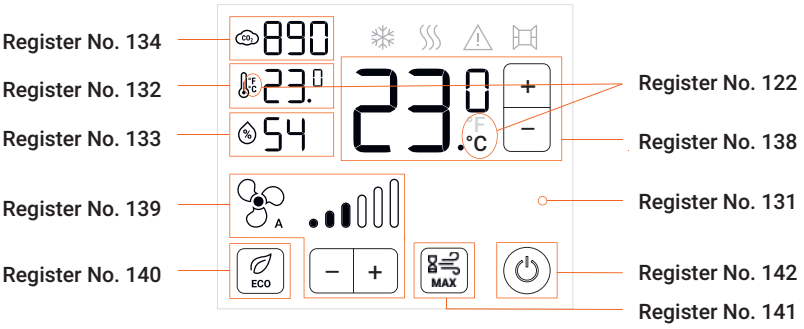
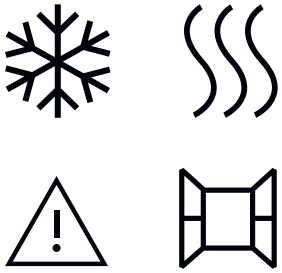


Figure 3: Display configuration options

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
34	33	**Enable local adjustment** Allow or prohibit the room occupant to make adjustments on the room operating unit.	0: Disabled 1: Enabled	–	1	–
131	130	**Light/dark color scheme** Set the display background color.	0: White 1: Black	–	1	R / W
132	131	**Display room/zone temperature** Set the display of the room temperature value.	0: Invisible 1: Visible	–	1	R / W
133	132	**Display relative humidity** Set the display of the relative humidity value.	0: Invisible 1: Visible	–	1	R / W
134	133	**Display CO_2 value** Set the display of the CO_2 concentration value.	0: Invisible 1: Visible	–	1	R / W
138	137	**Mode temperature on display** Set the functionality of the large temperature indicator on the display.	0: Invisible 1: Display actual room temperature 2: Room temperature setpoint	–	1	R / W
139	138	**Display ventilation stages** Set the display of the ventilation stages.	0: Invisible 1: Visible	–	1	R / W
140	139	**Eco button mode** Set the functionality of the Eco mode icon on the display.	0: Invisible 1: Value 2: Setpoint	–	1	R / W
141	140	**Display boost button** Set boost/max icon on the display.	0: Invisible 1: Visible	–	1	R / W
142	141	**On/off button mode** Set the functionality of the on/off icon on the display.	0: Invisible 1: Status 2: Setpoint	–	1	R / W

Status icons on display

The display offers additional icons which can be used to give additional status information to a facility manager or room occupant. The following registers describe how to configure the status icons.



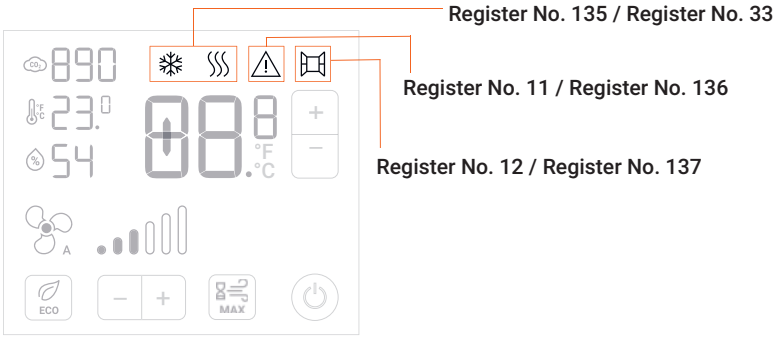


Figure 4: Status icons configuration options

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
11	10	**Display warning icon** Set warning icon on the display. (Applies if Register No.136 is set to 1: According to display warning icon.)	0: Invisible 1: Visible	–	1	–
12	11	**Display window icon** Set window icon on the display. (Applies if Register No.137 is set to: 1: According to display window icon.)	0: Invisible 1: Visible	–	1	R / W
33	32	**Heating and cooling application status** Set heating or cooling icons on the display.	0: None 1: Heating 2: Cooling	–	1	R / W
135	134	**Display heating/cooling icon** Set the display of the heating and cooling icons.	0: Invisible 1: Visible	–	1	R / W
136	135	**Warning icon function** Set the functionality of the warning icon on the display.	0: Invisible 1: According to parameter display warning icon 2: According to device error status	–	1	R / W
137	136	**Window icon function** Set the functionality of the window icon on the display.	0: Invisible 1: According to display window icon setting 2: According to digital input	–	1	R / W

Building operation mode

The display offers the possibility to switch between different building operation modes, but only when the dedicated button has been activated.

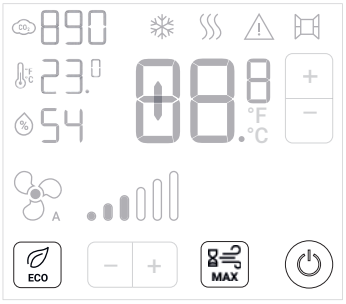


Figure 5: Using the "ECO", "MAX" and "On/Off" buttons, the user can switch between different building operation modes.

Using the Register No. 30, the building operation mode can be chosen.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
31	30	**System operation mode** Set HVAC building operation mode.	0: Off/protection 1: On/comfort 2: Eco mode 3: Boost mode	–	1	R / W
143	142	**Boost mode duration** Set the time the boost mode shall be activated.	60...3'600	s	1	R / W

Digital input

The status of the contact can be read out via the digital input of the device.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
8	7	**Digital input** Feedback of logical level at digital input	0: False (contact open) 1: True (contact closed)	–	1	R

Air quality traffic light

The devices that feature a CO_2 sensor have a built-in traffic light that indicates the status of the CO_2 concentration in the room. The following registers describe how to configure the CO_2 traffic light.

Figure 6: CO_2 traffic light for different models.

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
7	6	**Air quality status** Status of measured air quality in the room/zone Corresponds to EN 16798-3 notation: 1: Good IAQ (green) 2: Moderate IAQ (yellow) 3: Poor IAQ (red)	0: Deactivated 1: Ok 2: Warning 3: Alarm	–	1	R
118	117	**Air quality indication** Enable/disable CO_2 traffic light	0: Disabled 1: Enabled	–	1	R / W
116	115	**CO_2 limit for good air quality** Set threshold value of CO_2 concentration to switch between “good” (green LED) and “moderate” (yellow LED) state.	600...1'249	ppm	1	R / W
117	116	**CO_2 limit for moderate air quality** Set threshold value of CO_2 concentration to switch between “moderate” (yellow LED) and “poor” (red LED) state.	1'250...2'000	ppm	1	R / W

Serial number and firmware version

No.	Address	Description	Range, enumeration	Unit	Scaling	Access
100	99	**Bus Termination** Indicates if bus termination (120 Ω) is enabled. Bus termination can be set with the Belimo Assistant App.	0: Disabled 1: Enabled Default: Disabled (0)	–	1	R
101	100	**Serial number device – 1st part**		–	1	R
102	101	**Serial number device – 2nd part**		–	1	R
103	102	**Serial number device – 4th part**		–	1	R
104	103	**Firmware version**		–	1	R

All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Damper actuators, control valves, sensors and meters represent our core business.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.

- 5-year warranty
- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

EN – 2023-04/A – Subject to technical modifications

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