S+S REGELTECHNIK

# **RYM**ASKON® **200-Modbus**
# Modbus Slave User Manual

User Manual
for Room Control Units

**RYM**ASKON® **211-Modbus**
**RYM**ASKON® **212-Modbus**

**RYM**ASKON® **221-Modbus**
**RYM**ASKON® **222-Modbus**

**RYM**ASKON® **231-Modbus**
**RYM**ASKON® **232-Modbus**

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**RYM**ASKON® **261-Modbus**
**RYM**ASKON® **262-Modbus**

## Abbreviations

| | |
|---|---|
| ASCII | American Standard Code for Information Interchange |
| IR | Infrarot |
| LCD | Liquid Crystal Display |
| NDEF | NFC Data Exchange Format |
| NFC | Near Field Communication |
| RGB | Red, Green, Blue |
| URI | Uniform Resource Identifier |
| URL | Uniform Resource Locator |
| EU | End User |
| SA | System Administrator |
| DSEU | Display Source for End User |
| DSSA | Display Source for System Administrator |

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# 1. Introduction

## 1.1. Overview

The RYMASKON 200 is a room control unit with a modern, minimalistic look that fits any interior design. It is designed to be directly connected to a controller with a Modbus interface.

Up to 16 RYMASKON 200 devices can be connected to a single Modbus segment. RYMASKON 200 is equipped with a segmented LCD display featuring an RGB backlight with adjustable color, offering a neat way to make the RYMASKON 200 match the interior color concept of an office building. Eight capacitive touch buttons are used to cycle through sensor values, display parameters, and adjust setpoints. Up to four external buttons can be accessed and processed using Modbus interface.

The RYMASKON 200's internal sensors measure temperature, humidity and dew point. Sensor values can be displayed in SI or US units. Additionally, the date and time as well as the current level of eco-friendliness are also displayed on the LCD display. Parameters controlled by the Modbus Masters's logic can be overridden on the RYMASKON 200, such as for occupancy, air conditioning, and ventilation. A direct access mode is available to quickly adjust the most important setpoints e.g. for temperature and ventilation control.

A buzzer provides acoustic feedback for the touch buttons and can also be used to indicate alarms and error states. To prevent unauthorized modifications, two access levels (end user, system integrator) are used, which are secured via 4-digit pin codes. Device replacement and RYMASKON 200's configuration are performed with very little effort through the Modbus controller. The RYMASKON 200 is represented in the controller by a simple data point interface, which can be directly connected to the IEC 61131 or IEC 61499 logic application and offers all common functions for data points such as alarming, scheduling, trending, math functions, etc.

Using an NFC tag, the RYMASKON 200 transmits the URL to mobile devices. Last but not least, the RYMASKON 200 comes with a built-in infrared receiver for comfortable remote control.

## 1.2. Key Features

The different RYMASKON 200 models and their features are documented in Table 1.

| CONTROL | Typ 210 | Typ 220 | Typ 230 | Typ 240 | Typ 250 | Typ 260 |
|---|---|---|---|---|---|---|
| Temperature up/down | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fan speed up/down | – | ✓ | ✓ | – | ✓ | ✓ |
| Light on/off | – | – | ✓ | ✓ | – | ✓ |
| Sun protection up/down | – | – | – | ✓ | ✓ | ✓ |
| Room occupancy | ✓ | ✓ | ✓ | ✓ | ✓ | – |
| Menu | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Table 1: Key Features

Not only the model type but also the enclosure color as well as the touch button layout is defined with the order code. See Table 2 for possible order codes.

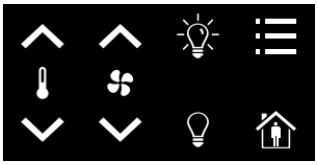
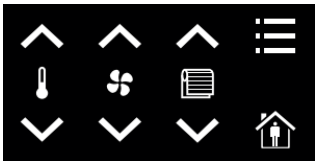
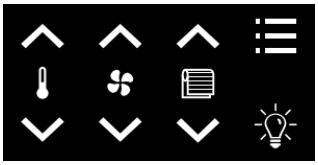
| **Nomenclature of Order Codes** | | |
|---|---|---|
| Enclosure color: | xx**1** = black<br>xx**2** = white | |
| Button layout: | **21**x |  |
| | **22**x |  |
| | **23**x |  |
| | **24**x |  |
| | **25**x |  |
| | **26**x |  |

Table 2: Possible Order Codes

## 1.3. LCD Segments

The following Figure 1 shows the LCD of the device with all possible segments.

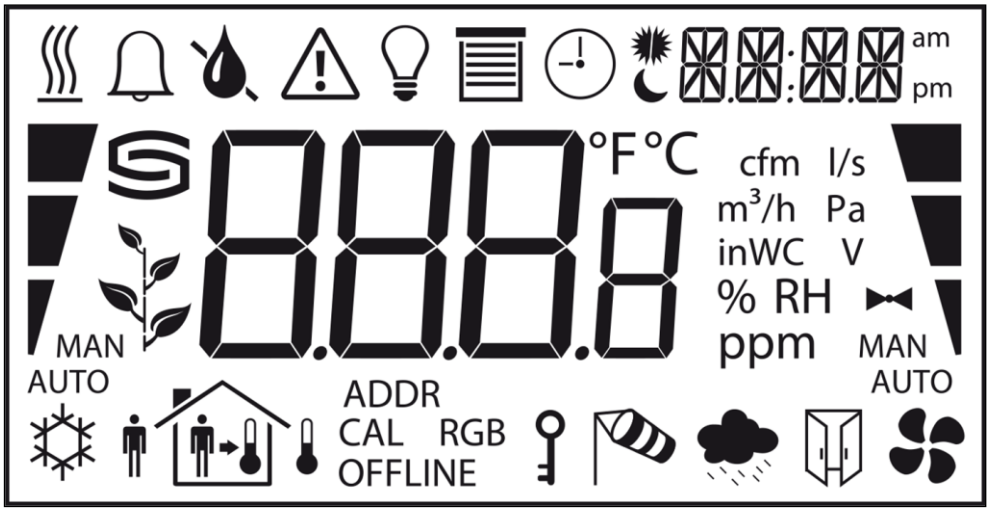



Figure 1: LCD Segments available on RYMASKON 200 displays

The following Table gives an overview of all available segments of the RYMASKON 200 with its defined names. The Table also shows which symbols are directly accessible via Modbus registers (see Table 12 on Page 23).

| Segment | Name | Deskription | Direct Acces |
|---|---|---|---|
|  | heat | Heating symbol | ✓ |
|  | alarm_bell | Alarm bell symbol | ✓ |
|  | drop | Drop symbol | ✓ |
|  | drop_not | Cross out for drop symbol | ✓ |
|  | alarm | Alarm symbol | ✓ |
|  | light | Light bulb symbol | ✓ |
|  | blinds | Sun blinds symbol | ✓ |
|  | clock | Clock symbol | ✓ |

| Segment | Name | Deskription | Direct Acces |
|---|---|---|---|
|  | sun_left | Left half of sun symbol | ✓ |
|  | sun_right | Right half of sun symbol | ✓ |
|  | moon | Moon symbol | ✓ |
|  | colon | The colon symbol of the secondary display will only be available if the secondary_display_direct_access_string register at address 200 (see Table 22 Page 30) is not empty. | ✓ |
|  | secondary_display | The secondary display is used to show time, date and/or a short text depending on the semantic meaning of a display value or set point. It can also be directly accessed via the Modbus register: secondary_display_direct_access_string (see Table 22 on Page 30). | ✓ |
| am<br>pm | am_pm_symbols | These symbols are not directly accessible but are shown along with the time when 12h time format has been selected. | - |
|  | cool | Cooling symbol | ✓ |
|  | man_out | Man outside the house (no occupancy) | ✓ |
|  | man_in | Man inside the house (occupancy) | ✓ |
|  | arrow | Arrow symbol (to represent a set point) | ✓ |
|  | temp_in | Temperature inside | ✓ |
|  | temp_out | Tempareture outside | ✓ |
|  | house | House symbol | ✓ |
| ADDR<br>CAL RGB<br>OFFLINE | text_symbols | The text symbols are not accessible via Modbus but are shown at certain modes or events. | - |
|  | key | The key symbol is primarily used to show that a set point is pincode protected but it can also be accessed via the symbol direct access registers. | ✓ |

| Segment | Name | Deskription | Direct Acces |
|---|---|---|---|
|  | wind | Wind alarm symbol | ✓ |
|  | rain | Rain alarm symbol | ✓ |
|  | window | Window open alarm symbol | ✓ |
|  | fan | Fan symbol | ✓ |
|  | valve | Valve symbol | ✓ |
|  | green_leaf_3 | The green leaf symbols can be used to display the level of eco-friendliness or to visualize environmental conditions. | ✓ |
|  | green_leaf_2 | | ✓ |
|  | green_leaf_1 | | ✓ |
|  | green_leaf_0 | | ✓ |
|  | bar_left_2 | The left bar graph symbols can be used to display a heating or cooling stage in automatic or manual mode. | ✓ |
|  | bar_left_1 | | ✓ |
|  | bar_left_0 | | ✓ |
|  | manual_left | | ✓ |
|  | auto_left | | ✓ |
|  | bar_right_2 | The right bar graph symbols can be used to display a fan stage or valve position in automatic or manual mode. | ✓ |
|  | bar_right_1 | | ✓ |
|  | bar_right_0 | | ✓ |
|  | manual_right | | ✓ |
|  | auto_right | | ✓ |

| Segment | Name | Deskription | Direct Acces |
|---|---|---|---|
| 8.8.8.8 | main_display | The main display is primarily used to show certain values. It is not accessible directly. | - |
| °F | unit_F | All unit symbols are not directly accessible but are displayed along with a display value or set point if the unit is set in the corresponding configuration register. See Table 27 on Page 35 for display value configuration and Table 28 on Page 37 for set point configuration. | - |
| °C | unit_C | | - |
| cfm | unit_cfm | | - |
| l/s | unit_l/s | | - |
| m³/h | unit_m³/h | | - |
| Pa | unit_Pa | | - |
| inWC | unit_inWC | | - |
| V | unit_V | | - |
| % | unit_% | | - |
| %RH | unit_%RH | | - |
| ppm | unit_ppm | | - |

Table 3: LCD Segments Overview

# 2. Quick-Start Guide

## 2.1. Hardware Installation

Please refer to the RYMASKON 200 installation sheet for further information on dimensions, mounting and wiring.

Figure 2 shows the back view of the device with the connection terminals for Modbus, 24 V DC-Supply and external buttons. The four external buttons share a common GND connection which is internally connected to the negative 24 V input terminal.

The external button terminal EB3 is also capable of sensing a NTC-10k temperature sensor. The temperature value of the sensor will be provided on Modbus register address 49 (see Table 10 on Page 21). The cable length for connecting the temperature sensor must not exceed 150m for 0.5mm² or 70m for 0.25mm² to guarantee a temperature error less than 0.1% at 25°C.

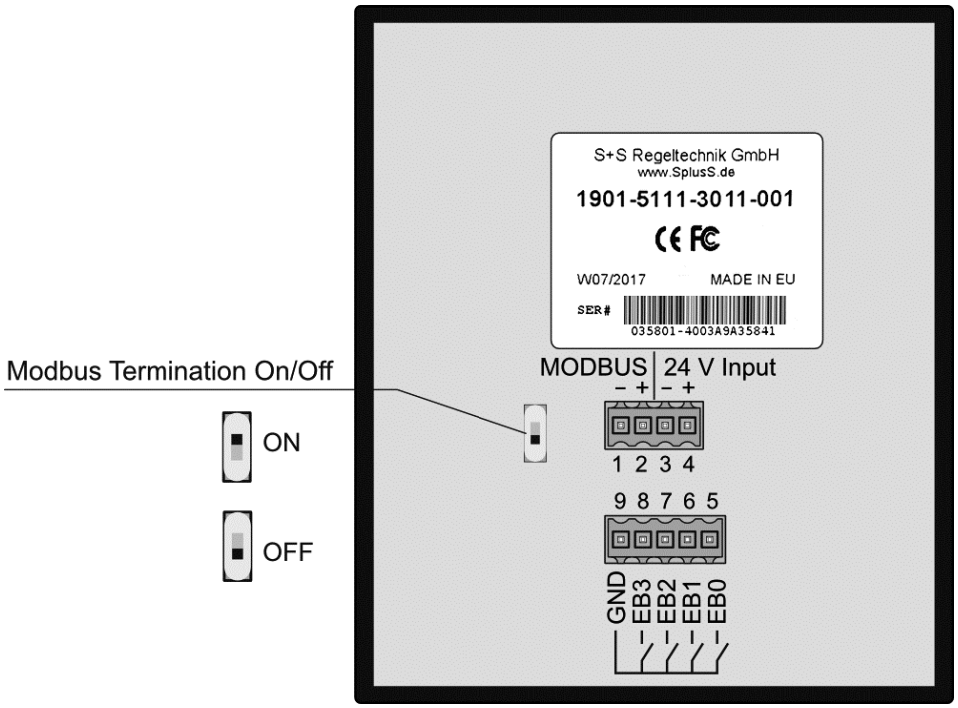



Figure 2: Back View RYMASKON 200

## 2.2. User Interface

### 2.2.1. General Description

The user interface consists of the LCD for displaying any desired value and up to eight touch buttons which are used to adjust set points and change settings. Additionally up to four external push-buttons can be connected to the device.

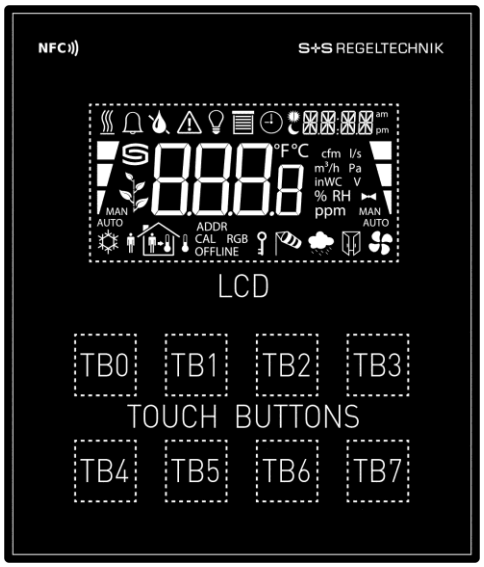



Figure 3: Front View RYMASKON 200

Each button can be configured individually via a Modbus register for its function (see Table 23 on Page 31). The following listing gives you an overview which functionality can be associated with the buttons.

**UP** **DOWN**

change set point or device setting in EDIT-mode
directly access a set point in DISPLAY-mode

**ON** **OFF**

no specific function, the button state can be requested to control lighting

**OCCUPANCY**

no specific function, the button state can be requested to set occupancy state

**MENU**

short press <3s: cycle through display values, set points or device settings
long press ~3s: switch between DISPLAY-mode and EDIT-mode
long press >6s: switch to CLEANING-mode

### 2.2.2 Operating Modes

In Figure 4 the operating modes of RYMASKON 200 are depicted. Each operating mode gives access to certain Modbus registers that can either be viewed or edited depending on the mode. The following data is available:

| | |
|---|---|
| display values: | Are used to visualize data provided by the Modbus master or values of internal sensors. It is viewed in DISPLAY-mode. For the display value registers see Table 11 on Page 22 and Table 27 on Page 35 for the corresponding display value configuration. |
| set points: | Are used to visualize data that is provided by the Modbus master and that can be edited by the user. It is shown in DISPLAY-mode and it can be edited in EDIT-mode. For the set point registers see Table 31 on Page 42 and Table 28 on Page 37 for set point configuration.<br>The range in which a set point can be altered is defined by minimum and maximum values that have to be written by the Modbus master. Please refer to Table 32 on Page 43 and Table 33 on Page 44. |
| device settings: | These values define some basic settings of the device itself. Please refer to Table 4 on Page 15 for a listing of all device settings and to Table 18, Table 19 and Table 20 on Page 27 f. for the corresponding Modbus registers. Device Settings can only be edited by the system administrator in administration-mode. |
| offset values: | Are used to add a certain offset to a display value. This functionality can be used to calibrate sensor values. Offset values can be editet by the system administrator in CALIBRATION-mode directly at the device or over Modbus. Please see Table 34 on Page 45 for the offset value register. |

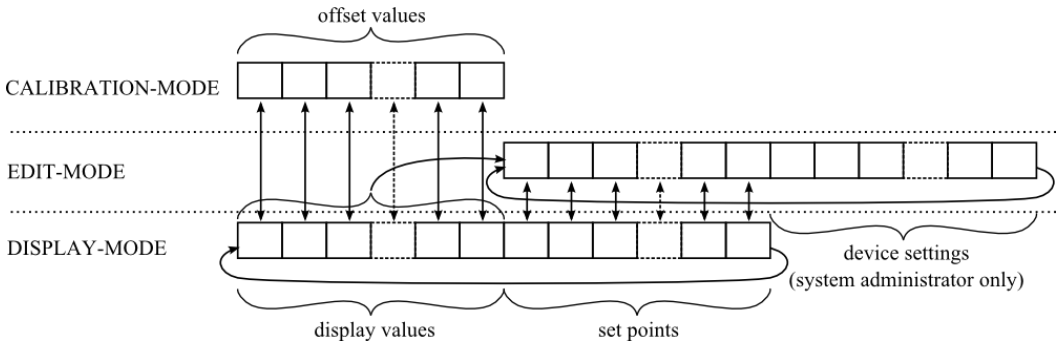



Figure 4: RYMASKON 200 Operating Modes

When the device powers up, it enters DISPLAY-mode and it will display the first display value. When pressing the MENU-button the next value will be shown. First all active display values and then all active set points are displayed. After the last set point, the display will show the first display value again.

EDIT-mode is entered by pressing the MENU-button for more than 3 seconds. To enter the administration-mode as system administrator two additionally defined buttons (TB0 and TB4) need to be pressed along with the MENU-button for more than 3 seconds. Also in EDIT-Mode a short press on the MENU-button is used to go to the next value. Any other button that has no specific function can be used in EDIT-mode to cycle the values in the opposite direction. EDIT-mode is left when pressing the MENU-button for more than 3 seconds.
It is possible to edit the device settings in administration-mode.

CALIBRATION-mode will be entered for any display value when pressing one UP- and one DOWN-button simultaneously for more than 3 seconds to adjust the offset. This mode is secured by the system administrator password. CALIBRATION-mode is left when pressing the MENU-button for more than 3 second or after a timeout of 1 minute.

An overview of all possible operating modes is given in Table 4 below. The operating mode can also be defined by the Modbus master by writing the user interface direct access register (see Table 13 on page 23).

| Order of Operating Modes | Description |
|---|---|
| 0 DISPLAY-Mode / display values | Display values are shown. |
| 1 DISPLAY-Mode / set points | Set points are shown. |
| 2 EDIT-Mode / set points | Set points can be edited. |
| 3 administration-Mode / device settings | Device settings can be edited. This mode is only accessible for the system admi-nistrator. |
| 4 CALIBRATION-Mode / offset values | Offset values can be edited |
| 5 PINCODE-ENTRY / end user | The pincode for the end user has to be entered to show and/or edit the requested value. |
| 6 PINCODE-ENTRY / system administrator | The pincode for the system administator has to be entered to show and/or edit the requested value. |
| 7 DIRECT_ACCESS-Mode / set points | A defined set point can be accessed and edited without entering EDIT-mode. It can be entered by pressing a defined button (see Table 23 on page 31). In contrast to EDIT-mode only predefined set points can be edited.<br>The DIRECT_ACCESS-mode can be left by pressing any button that has no direct access capability. |
| 10 CLEANING-Mode | This mode is used to clean the surface of the device without any response of the touch buttons and hence any unwanted changes. This mode is entered by pressing the MENU-button for at least 6 seconds. After 10 seconds with no interaction the device will switch back to DISPLAY-mode automatically. |

Table 4: Operating Modes

### 2.2.3 Access Levels

There are two access levels (end user & system administrator) with configurable rights to display and edit values. Each access level is secured by a four digit pincode that will be requested if EDIT-mode or DIRECT_ACCESS-mode is entered and the desired value is pincode protected.

Per default the pincode for end user and system administrator access level is disabled (0000). Otherwise the pincode can be entered as described in Figure 5.

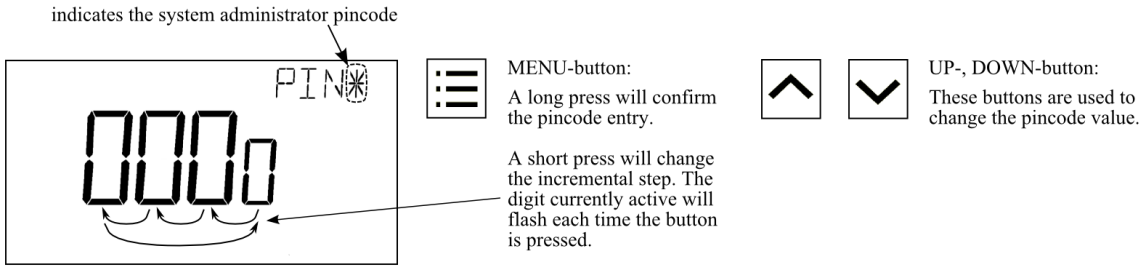



Figure 5: Pincode Entry

### 2.2.4 Device Settings

The following Table gives an overview of the device settings accessible through the button interface as well as via Modbus. For the corresponding Modbus registers please refer to Table 18, Table 19 and Table 20 on Page 27 and following.

| Parameter | Value | Default | Your Setting |
|---|---|---|---|
| Modbus Parity | Odd / Even / None | None | |
| Modbus Baudrate | 1.2kB / 2.4kB / 4.8kB / 9.6kB / 19.2kB / 38.4kB / 57.6kB / 115.2kB | 57,6kB | |
| Modbus Address | 1 - 247 | 1 | |
| Pincode System Administrator | 0000 – 9999<br>(if 0000 the pincode is disabled) | 0000 | |
| Pincode End User | 0000 – 9999<br>(if 0000 the pincode is disabled) | 0000 | |
| Color Setting LCD Backlight Red | 0% - 100% | 100% | |
| Color Setting LCD Backlight Green | 0% - 100% | 100% | |
| Color Setting LCD Backlight Blue | 0% - 100% | 100% | |
| Brightness LCD Backlight | 0% - 100% | 100% | |
| LCD Contrast | 0% - 100% | 100% | |
| LCD Color Scheme | 0 – user (as defined above)<br>1 – white<br>2 – red<br>3 – green<br>4 – blue<br>5 – orange<br>6 – magenta<br>7 – cyan | 0 | |
| Time Format | 24h / 12h | 24h | |
| Show Date | on / off | off | |
| Show Time | on / off | off | |
| Acoustic Feedback (for Touch Buttons) | on / off | on | |
| Goto First Display Value (the first display value will be displayed after 1 minute without inter-action) | on / off | on | |
| Display Auto Shuffle | on / off | off | |
| Display Auto Dim<br>(lcd brightness will be dimmed after 2 minutes with no interaction) | off / 50% / 10% / 0% | off | |
| Unit System | SI / US | SI | |
| Device Restart | off – if a DOWN-button is pressed the device will be rebooted manually | - | |

Table 5: Device settings

### 2.2.5 Factory Default

The factory default configuration for display values and set points depends on the specific RYMASKON 200 model. The following Table shows the factory default values for each model. See Table 27 on page 35 for display value configuration and Table 28 on Page 37 for set point configuration.

| Register Name | Inhalt |
|---|---|
| display_value_0 | Internal Temperature |
| display_value_1 | Relative Humidity |
| display_value_2 | Dew Point |
| display_value_3 | - |
| display_value_4 | Supply Voltage |
| display_value_5 | External Temperature |
| display_value_6 to display_value_15 | - |
| set_point_0 | Internal Temperature Set Point |
| set_point_1 | Fan Stage |
| set_point_2 to set_point_15 | - |

Table 6: Factory Default for RYMASKON 200

# 3. Modbus

## 3.1. Introduction

The device operates as a Modbus slave in Modbus RTU mode. The default baudrate is set to 57600, the default parity is set to 'none' and the default address is set to 1. The communication with a Modbus master device will work with Modbus function code 0x03 (Read Holding Registers) and Modbus function code 0x06 (Preset Single Register). Section 3.4 shows all available Modbus registers.

## 3.2. Modbus Network

Figure 6 illustrates a typical Modbus network setup with a linear bus topology used to connect several slave devices to a master device. The transmission line has to be terminated at both ends. At the master device this can be done by connecting a termination resistor.
Each RYMASKON 200 is equipped with a built-in 120Ω termination resistor. Set the termination switch to OFF except on the last device on the bus where the termination switch must be turned ON. Per default each device has the Modbus address set to 1. Because each address can only be used once it has to be configured at the device settings in administration-mode.
For further information please see Section 2.2.

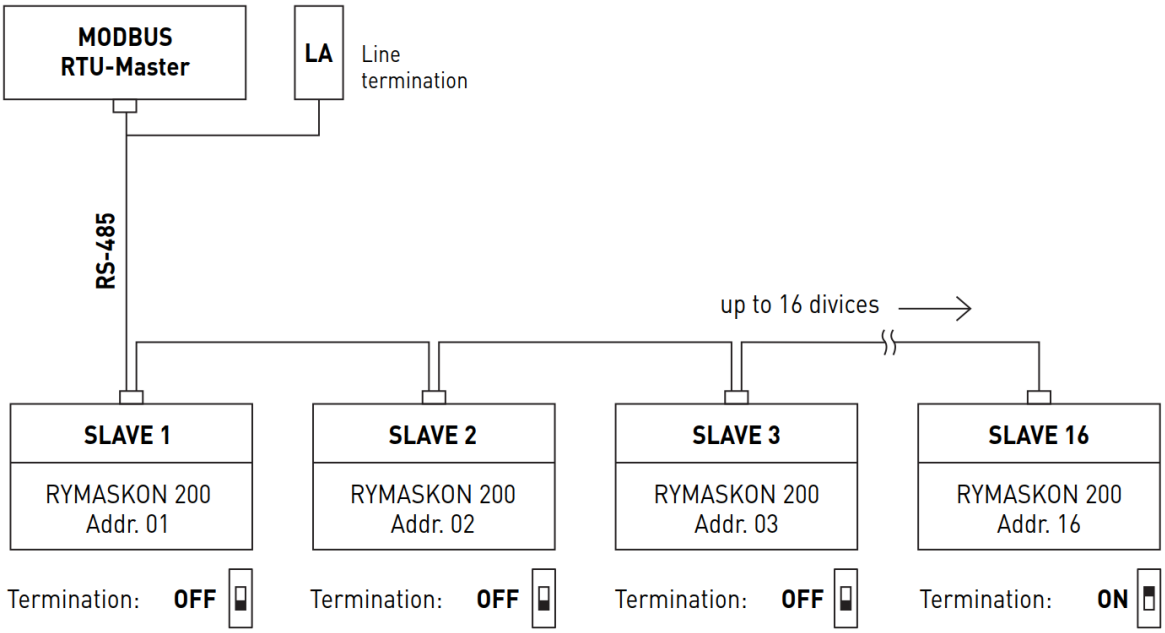



Figure 6: Modbus Network

## 3.3. Modbus Register Usage for Value Display

The following Figure 7 shows, which Modbus registers have influence on a displayed value, unit, text on the secondary display or symbols.
Depending on settings in configuration registers different combinations are possible to achieve the desired result.

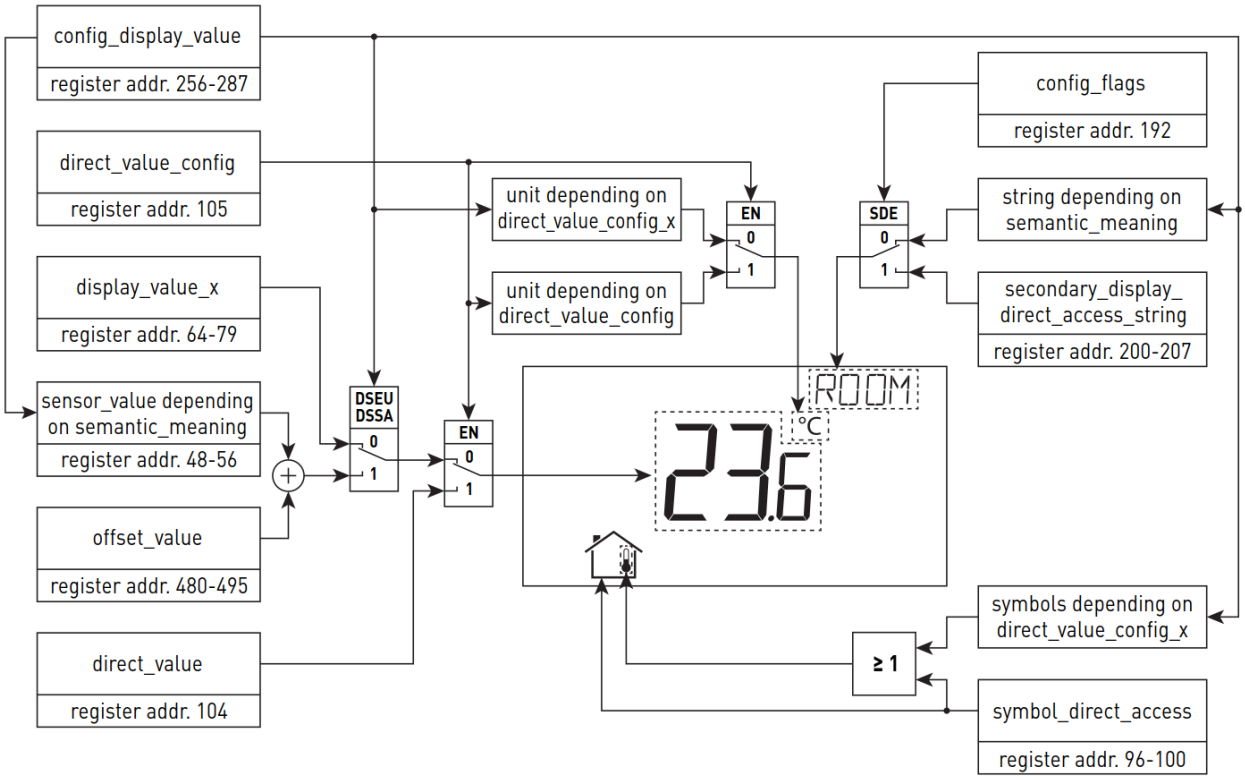



Figure 7: Modbus Register Usage for Value Display

## 3.4. Modbusregister Description

In the following sections the RYMASKON 200 Modbusregister.
Modbus registers are described. Abbrevations are explained at the end of each table. 'R' indicates that this value is not used by now and that it is reserved for future use. Square brackets '[]' indicate that this is the initial value. Numbers with the prefix '0x' are hexadecimal values. Values with no prefix indicate decimal values.

### 3.4.1 Data Registers

These registers contain data that is changing frequently. This data is not stored persistent in the device and will be lost after a reboot.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| present_state | 0<br>0x0000 | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0]] | EB3 [0] | EB2 [0] | EB1 [0] | EB0 [0] | TB7 [0] | TB6 [0] | TB5 [0] | TB4 [0] | TB3 [0] | TB2 [0] | TB1 [0] | TB0 [0] |
| short_pressed | 1<br>0x0001 | IRC<br>[0] | NFC<br>[0] | R<br>[0] | R<br>[0] | | | | | | | | | | | | |
| long_pressed | 2<br>0x0002 | R<br>[0] | ERR<br>[0] | DOC<br>[0] | SPC<br>[0] | | | | | | | | | | | | |

The present_state register always represents the actual state of the buttons.
The short_pressed and long_pressed states will remain set until the flags are cleared by the Modbus master by writing a logical '1' to the specific flag, except the occupancy flag that is cleared automatically after the occupancy_timeout has expired. The long_pressed state of a button will remain set as long as the button is pressed.

Bits 0-11 indicate the states of the buttons (**TBx**-touch button, **EBx**-external button)

**NFC**: NFC flag, is set if an NFC field was detected. This gives the information that a user is reading the NFC tag memory with an NFC enabled mobile device. For more information see Chapter 4.

**IRC**: infrared remote control flag, is set when an infrared remote control code was received. The received code can be read via the ir_remote_control_command register at register address 32 (see Table 9 on page 20).

**SPC**: Set point changed flag, is set when a set point was changed.
Each set point has an individual change flag at register address 3 (see Table 8 on page 20).

**DOC**: device setting or offset value changed flag, is set when a device setting or offset value was changed. he specific change flags can be read via the registers at address 4 and 5 (see Table 8 on page 20).

**ERR**: error flag, is set when an internal error has occurred.

**!!!** Button states and flags can have the following binary values:
1 – pressed, set
0 – released, cleared

**!!!** The present_state register is only updated in DISPLAY- and DIRECT_ACCESS-mode!
(For a list of possible modes see Table 4 on page 13)

Table 7: Button States and Flags

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| change_flags_ set_points | 3 0x0003 | SP15 [0] | SP14 [0] | SP13 [0] | SP12 [0] | SP11 [0] | SP10 [0] | SP9 [0] | SP8 [0] | SP7 [0] | SP6 [0] | SP5 [0] | SP4 [0] | SP3 [0] | SP2 [0] | SP1 [0] | SP0 [0] |
| change_flags_ device_settings | 4 0x0004 | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | DS8 [0] | DS7 [0] | DS6 [0] | DS5 [0] | DS4 [0] | DS3 [0] | DS2 [0] | DS1 [0] | DS0 [0] |
| change_flags_ offset_values | 5 0x0005 | OV15 [0] | OV14 [0] | OV13 [0] | OV12 [0] | OV11 [0] | OV10 [0] | OV9 [0] | OV8 [0] | OV7 [0] | OV6 [0] | OV5 [0] | OV4 [0] | OV3 [0] | OV2 [0] | OV1 [0] | OV0 [0] |

The change flag register states will remain true until the flags are cleared by the Modbus master by writing a logical '1' to the specific flag.

**SP0** to **SP15:** change flags for set_point_0 to set_point_15 (see Table 31 on page 42)

**DS0:** change flag for modbus_parameter on register address 176 (see Table 18 on page 27)

**DS1:** change flag for pincode_system_administrator on register address 177 (see Table 19 on page 27)

**DS2:** change flag for pincode_end_user on register address 178 (see Table 19 on page 27)

**DS3:** change flag for lcd_color_red on register address 179 (see Table 20 on page 28)

**DS4:** change flag for lcd_color_green on register address 180 (see Table 20 on page 28)

**DS5:** change flag for lcd_color_blue on register address 181 (see Table 20 on page 28)

**DS6:** change flag for lcd_brightness_contrast on register address 182 (see Table 20 on page 28)

**DS7:** change flag for user_interface_settings on register address 183 (see Table 20 on page 28)

**DS8:** change flag for display_unit on register address 192 (see Table 21 on page 29)

**OV0** to **OV15:** change flags for offset_value_0 to offset_value_15 (see Table 34 on page 45)

**!!!** Change flags can have the following binary values:
1 – true / 0 – false

**!!!** If a set point, device setting or offset value is changed by the user the corresponding flag will be set and it has to be cleared by the Modbus master.

Table 8: Change Flags

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ir_remote_control_ command | 32 0x0020 | button_code [0x00] | | | | | | | | remote_id [0x00] | | | | | | | |

This register provides the button_code and remote_id of a valid command received via the infrared receiver. See Chapter 5 for detailed information.

**!!!** Whenever a command was received the ir_remote_control_command register is updated and the IRC flag of the short_pressed register at address 1 is set (see Table 7 on Page 19).

Table 9: IR Remote Control Command

The following Table gives an overview of the internal sensor values. These registers can be read over Modbus and can be used as source for a display value if configured. As described in Section 2.2.2 on page 11 there are up to 16 display values used to visualize data.

Each display value has two 16 bit configuration registers to specify the values displayed. Display values (register address 64 to 79) are read- and writable over Modbus.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| sensor_value_0 | 48 0x0030 | internal temperature | | | | | | | | | | | | | | | |
| sensor_value_1 | 49 0x0031 | external temperature | | | | | | | | | | | | | | | |
| sensor_value_2 | 50 0x0032 | relative humidity | | | | | | | | | | | | | | | |
| sensor_value_3 | 51 0x0033 | dew point | | | | | | | | | | | | | | | |
| sensor_value_4 | 52 0x0034 | reserved | | | | | | | | | | | | | | | |
| sensor_value_5 | 53 0x0035 | reserved | | | | | | | | | | | | | | | |
| sensor_value_6 | 54 0x0036 | supply voltage | | | | | | | | | | | | | | | |
| sensor_value_7 | 55 0x0037 | CPU temperature | | | | | | | | | | | | | | | |
| sensor_value_8 | 56 0x0038 | CPU voltage | | | | | | | | | | | | | | | |

!!! A sensor value can be used as source for a display value. Therefor the DSSA or DSEU bit as well as the semantic meaning at the corresponding display value configuration at address 256 to 286 has to be set (see Table 27 on page 35). If the DSSA or DSEU bit is set this specifies that a sensor value is used instead of a display value. The semantic meaning specifies which sensor value is used as source for displaying. For an overview on this topic please see Figure 7 on page 18.

!!! Sensor_value_0, sensor_value_1 and sensor_value_3 are 16 Bit signed values. All other sensor values are defined as 16 Bit unsigned since there are no negative values to expect. The values are scaled as described in Table 38 on page 49.

Table 10: Sensor Values

If an external temperature sensor is connected to the EB3 terminal and GND the value of this sensor will be provided as sensor_value_1. It is advised to disable the button function at the button configuration register at address 227 (Table 24 on page 32) when used as temperature sensor input.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| display_value_0 | 64<br>0x0040 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_1 | 65<br>0x0041 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_2 | 66<br>0x0042 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_3 | 67<br>0x0043 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_4 | 68<br>0x0044 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_5 | 69<br>0x0045 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_6 | 70<br>0x0046 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_7 | 71<br>0x0047 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_8 | 72<br>0x0048 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_9 | 73<br>0x0049 | [0x0000] | | | | | | | | | | | | | | | |
| display_value_10 | 74<br>0x004A | [0x0000] | | | | | | | | | | | | | | | |
| display_value_11 | 75<br>0x004B | [0x0000] | | | | | | | | | | | | | | | |
| display_value_12 | 76<br>0x004C | [0x0000] | | | | | | | | | | | | | | | |
| display_value_13 | 77<br>0x004D | [0x0000] | | | | | | | | | | | | | | | |
| display_value_14 | 78<br>0x004E | [0x0000] | | | | | | | | | | | | | | | |
| display_value_15 | 79<br>0x004F | [0x0000] | | | | | | | | | | | | | | | |

**!!!** The DSSA or DSEU bit at the corresponding display value configuration at address 256 to 286 has to be cleared to display the content of a display value register (see Table 27 on Page 35). If the DSSA or DSEU bit is cleared this specifies that a display value is used instead of a sensor value. The semantic meaning specifies which text is displayed along with the specific display value. For an overview on this topic please see Figure 7 on Page 18.

**!!!** All registers are 16 Bit signed values. Depending on the modbus_unit specified with the corresponding display value configuration register at address 256 to 287 (Table 27 at Page 35) the value needs to be scaled as described in Table 38 at Page 49 to achieve the desired result.

Table 11: Display Values

| Register Name | Register Address | Bit Position 15 14 | 13 12 | 11 10 | 9 8 | 7 6 | 5 4 | 3 2 | 1 0 |
|---|---|---|---|---|---|---|---|---|---|
| symbol_direct_access_0 | 96 0x0060 | R [00] | | | | | | | |
| symbol_direct_access_1 | 97 0x0061 | | | | | | | | |
| symbol_direct_access_2 | 98 0x0062 | | | | | | | | |
| symbol_direct_access_3 | 99 0x0063 | | | | | | | | |
| symbol_direct_access_4 | 100 0x0064 | MAN AUTO | MAN AUTO | MAN AUTO | MAN AUTO | | | | |

Symbols of the LCD can be directly set by writing these registers. For an overview of all LCD segments please see Table 3 on Page 9.

2 bits are reserved per symbol indicating the state that can have the following values:

**00** – disabled, symbol is not visible

**01** – enabled, symbol is visible

**10** – blinking slow (1Hz)

**11** – blinking fast (2Hz)

**!!!** For the house symbol the initial value is set to '01' per default.
The initial value of the other symbols is '00'.

**!!!** The colon symbol of the secondary display will only be available if the secondary_display_direct_access_string register at address 200 (see Table 22 Page 30) is not empty.

Table 12: Symbol-Direct Access

| Register Name | Register Address | Bit Position 15 | 14 13 12 11 10 9 8 | 7 6 5 4 3 2 1 0 |
|---|---|---|---|---|
| user_interface_direct_access | 101 0x0065 | EU/SA [0] | ui_mode [0x00] | ui_index [0x00] |

This register can be read to get information of which value is currently displayed. It can also be written to determine the displayed value.

**EU/SA**: defines the current access level (0 – end user, 1 – system administrator)

**ui_mode**: defines the user interface mode the device is currently operating in.
For a listing of all RYMASKON 200 operating modes see 2.2.2 on Page 12.

**ui_index**: defines the index within each mode of the value currently displayed

Please see the following examples:

0x0001 – This means that display_value_1 is currently displayed in DISPLAY-mode for the end user.

0x8200 – This means that set_point_0 is currently edited in administration-mode

Table 13: User Interface Direct Access

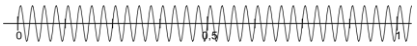
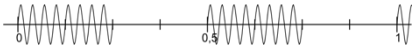
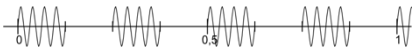
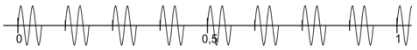
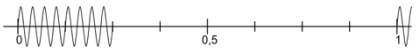
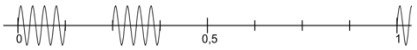
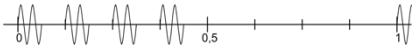
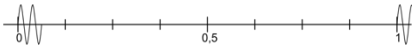
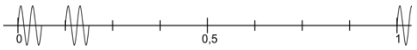
| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| buzzer_direct_access_0 | 102<br>0x0066 | BE<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | buzzer_duration<br>[0x00] | | | | | | | |
| buzzer_direct_access_1 | 103<br>0x0067 | buzzer_mode<br>[0x00] | | | | | | | | buzzer_tone<br>[0x00] | | | | | | | |

These registers are used to provide direct access of the piezo buzzer primarily used to give acoustic feedback for the touch buttons.

**BE**: Buzzer Enable Bit (1 – enabled/ 0 – disabled)

**buzzer_duration**: 0x00 infinite, 0x01 - 0xFF duration in seconds

**buzzer_mode**: defines specific alarm sound patterns

| mode: | description: | < 1s pattern > |
|---|---|---|
| 0 | continuous |  |
| 1 | alarm 1 |  |
| 2 | alarm 2 |  |
| 3 | alarm 3 |  |
| 4 | alarm 4 |  |
| 5 | alarm 5 |  |
| 6 | alarm 6 |  |
| 7 | alarm 7 |  |
| 8 | alarm 8 |  |

**buzzer_tone**: 0x00 - 100 Hz, 0xFF - 1375 Hz (step-width = 5 Hz)

Table 14: Buzzer Direct Access

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| direct_value | 104<br>0x0068 | [0x0000] | | | | | | | | | | | | | | | |
| direct_value_config | 105<br>0x0069 | EN<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | R<br>[0] | unit<br>[0x0] | | | | exp<br>[00] | |

These registers are used to display specific values instead of display_values or set_points. For an overview on how to setup the configuration please refer to Figure 7 on Page 18.

**direct_value:** 16 bit signed integer to be displayed

**EN:** direct value enable bit (1 – enabled, 0 – disabled)

**unit:** defines a unit symbol to be displayed, following values are possible:

| 0x0 | 0x1 | 0x2 | 0x3 | 0x4 | 0x5 | 0x6 | 0x7 | 0x8 | 0x9 | 0xA | 0xB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| no unit | °C | °F | cfm | l/s | $m^3/h$ | Pa | inWC | V | % | %RH | ppm |

**exp:** exponent, defines the number of decimal places:

00 – no decimal point 

01 – one decimal place 

10 – two decimal places 

11 – three deciml places 

!!! If disabled, the last viewed value will be visible again as defined with the user_interface_direct_access register at adderss 101 (Table 13 on Page 23).

Table 15: Direct Value

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| system_time | 112<br>0x0070 | system_time_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 113<br>0x0071 | system_time_1<br>[0x0000] | | | | | | | | | | | | | | | |

**system_time** represent a 32 bit timestamp in seconds since JAN-01-1970. The timestamp has to be initially set by the Modbus master because the device has no back-up battery and so it would start at 0 (00:00:00 JAN-01-1970) after a reboot.
The timestamp is incremented by the device but anyway it has to be set by the master at defined intervals to prevent time offsets.

Table 16: System Time

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| modbus_time_cleared | 128<br>0x0080 | modbus_time_cleared_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 129<br>0x0081 | modbus_time_cleared_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_rx_packets | 130<br>0x0082 | modbus_rx_packets_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 131<br>0x0083 | modbus_rx_packets_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_rx_bytes | 132<br>0x0084 | modbus_rx_bytes_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 133<br>0x0085 | modbus_rx_bytes_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_tx_packets | 134<br>0x0086 | modbus_tx_packets_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 135<br>0x0087 | modbus_tx_packets_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_tx_bytes | 136<br>0x0088 | modbus_tx_bytes_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 137<br>0x0089 | modbus_tx_bytes_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_timeout_errors | 138<br>0x008A | modbus_timeout_errors_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 139<br>0x008B | modbus_timeout_errors_1<br>[0x0000] | | | | | | | | | | | | | | | |
| modbus_checksum_errors | 140<br>0x008C | modbus_checksum_errors_0<br>[0x0000] | | | | | | | | | | | | | | | |
| | 141<br>0x008D | modbus_checksum_errors_1<br>[0x0000] | | | | | | | | | | | | | | | |

**Modbus_time_cleared_0** and **modbus_time_cleared_1** represent a 32 bit timestamp in seconds since JAN-01-1970 that is set by the RYMASKON 200 after the statistics have been cleared by the master device.

All other values are 32 bit counters incremented by the device.
These values are not permanently stored and will be lost after a reboot.

**!!!** The statistics can be cleared by setting the MSC bit at the config_flags register at address 192 (see Table 21 on Page 29).

Table 17: Modbus Statistics

### 3.4.2 Device Settings

The device settings contain data to configure the device and the user interface. This registers are also accessible through the button interface in administration-mode. The data is stored persistently and will be preserved during power loss.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| modbus_parameter | 176<br>0x00B0 | R<br>[0] | R<br>[0] | PAR<br>[0x2] | | modbus_baud<br>[0x6] | | | | device_addr<br>[0x01] | | | | | | | |

This register contains the configuration for the Modbus port of the Rymaskon 200.

**PAR**: defines the parity bit used for Modbus communication. Valid are:
0x0 – odd (odd parity bit, 1 stop bit)
0x1 – even (even parity bit, 1 stop bit)
0x2 – none (no parity bit, 2 stop bits)

**modbus_baud**: defines the Modbus baudrate, following values are valid:
0x0 – 1200
0x1 – 2400
0x2 – 4800
0x3 – 9600
0x4 – 19200
0x5 – 38400
0x6 – 57600
0x7 – 115200

**device_addr**: defines the Modbus slave address.
Valid addresses are 1(0x01) to 247 (0xF7).

**!!!** Compare Table 4 on Page 15 for device settings editable via the user interface.

Table 18: Modbus Parameter

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| pincode_<br>system_administrator | 177<br>0x00B1 | R<br>[0] | R<br>[0] | [0x0000] | | | | | | | | | | | | | |
| pincode_<br>end_user | 178<br>0x00B2 | R<br>[0] | R<br>[0] | [0x0000] | | | | | | | | | | | | | |

pincode_system_administrator defines the pincode for the system administrator.
If set to 0000 the pincode is disabled. Possible values are 0000 (0x0000) to 9999 (0x270F).

pincode_end_user defines the pincode for the end user.
If set to 0000 the pincode is disabled. Possible values are 0000 (0x0000) to 9999 (0x270F).

**!!!** Compare Table 4 on Page 15 for device settings editable via the user interface.

Table 19: Pincodes

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| lcd_color_red | 179<br>0x00B3 | reserved<br>[0x00] | | | | | | | | color_brightness<br>[0x64] | | | | | | | |
| lcd_color_green | 180<br>0x00B4 | reserved<br>[0x00] | | | | | | | | color_brightness<br>[0x64] | | | | | | | |
| lcd_color_blue | 181<br>0x00B5 | reserved<br>[0x00] | | | | | | | | color_brightness<br>[0x64] | | | | | | | |
| lcd_brightness_contrast | 182<br>0x00B6 | lcd_contrast<br>[0x64] | | | | | | | | lcd_brightness<br>[0x64] | | | | | | | |
| user_interface_settings | 183<br>0x00B7 | DAD<br>[0x0] | | | GFV<br>[1] | AF<br>[1] | Time<br>[1] | Date<br>[0] | TF<br>[1] | DAS<br>[0] | R<br>[0] | lcd_color_scheme<br>[0x0] | | | | | |

These registers are used to configure basic features of the display and the button interface.

**color_brightness**: defines the brightness of a specific backlight color.
Values from 0x00 – 0% to 0x64 – 100% are valid.

**lcd_brightness**: defines the overall brightness of the LCD backlight.
Values from 0x00 – 0% to 0x64 – 100% are valid.

**lcd_contrast**: defines the contrast setting of the LCD.
Values from 0x00 – 0% to 0x64 – 100% are valid.

**lcd_color_scheme**: sets a predefined color setting, possible values are:
0x0 – user (as defined with the above values)
0x1 – white
0x2 – red
0x3 – green
0x4 – blue
0x5 – orange
0x6 – magenta
0x7 – cyan

**DAS**: display auto shuffle mode (0 – off, 1 – on), display values and set points will be shuffled after a defined timeout of 1 minute, each value is shown for 5 seconds

**TF**: time format (0 – 12h, 1 – 24h), if TF is set to 12h the date format will also be set to MM/DD instead of DD/MM

**Date**: show date in secondary display (0 – off, 1 – on)

**Time**: show time in secondary display (0 – off, 1 – on)

**AF**: acoustic feedback for touch buttons (0 – off, 1 – on)

**GFV**: goto first value after a defined timeout of 1 minute (0 – off, 1 – on)

**DAD**: display auto dim, dim display brightness after 2 minutes to following defined values:
0x0 – off (disabled)
0x1 – 50% lcd_brightness
0x2 – 10% lcd_brightness
0x3 – 0% lcd_brightness
0x4 – 0% lcd_brightness

**!!!** Compare Table 4 on Page 15 for device settings editable via the user interface**.**

Table 20: User Interface Settings

### 3.4.3 Configuration Registers

The configuration registers contain data for configuring fundamental functions of the device as well as configurations for display values and set points. The data is stored persistent and will be preserved after reboot

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_flags | 192<br>0x00C0 | R<br>[0] | SDSV<br>[0] | MSC<br>[0] | IRCP<br>[0] | DU<br>[0x1] | | MU<br>[0x1] | | VIE<br>[0] | VOL<br>[1] | AIE<br>[0] | AOL<br>[0] | PESA<br>[1] | PEEU<br>[1] | SDE<br>[0] | RST<br>[0] |

**RST:** reset_device flag, set to '1' the device will reboot.

**SDE:** secondary_display_direct_access_enabled flag, set to '1' the device displays the content of the secondary_display_direct_access_string register at address 200 (see Table 22 on Page 30)

**PEEU:** pincode_enabled_for_end_user flag, if set to '1' the pincode for the end user can be edited by the end user

**PESA:** pincode_enabled_for_system_administrator flag, if set to '1' the pincode for the end user and the system administrator can be edited by the system administrator

**AOL:** acoustic_alarm_when_offline flag, if set to '1' a buzzer tone will be generated while the device is offline

**AIE:** acoustic_alarm_on_internal_error flag, if set to '1' a buzzer tone will be generated if an internal error occurred

**VOL:** visual_alarm_when_offline flag, if set to '1' the offline text symbol ( OFFLINE ) will be displayed while the device is offline

**VIE:** visual_alarm_on_internal_error flag, if set to '1' the alarm symbol (⚠) will be displayed if an internal error occurred

**MU:** modbus_unit, defines which unit system is used for values on Modbus. The following values are possible:

0x0 – K
0x1 – °C (SI)
0x2 – °F (US)

**DU:** display_unit, defines which unit system is used to display values on the Rymaskon 200. The following values are possible:

0x0 – access prohibited via the user interface
0x1 – °C (SI)
0x2 – °F (US)

The display_unit can also be changed via the user interface in the device settings (see Table 4 an Page 15). If the value is set to '00' the access to this device setting via the user interface is prohibited.

**IRCP:** ir_remote_control_pairing flag. This flag is set when a remote control is paired with the Rymaskon 200. Clear this flag to remove the pairing.

**MSC:** modbus_statistics_clear flag. When set to '1' all Modbus statistics will be reseted.

**SDSV:** secondary_display_direct_access_string_volatile flag, if set to '1' the content of secondary_display_direct_access_string (Table 22 on Page 30) is not kept persistent. This should be considered when the content of this register is changed frequently because of the limited write cycles of persistent memory.

Table 21: Configuration Flags

Please note that a change of display_unit or modbus_unit at the config_flags register will change the configuration registers for display values at address 256 to 289 and set points at address 320 to 351 to match the selected units system. Please see Table 27 on Page 35 for display value configuration and Table 28 on Page 37 for set point configuration.

If the direct value registers at adderss 104 and 105 (see Table 15 on Page 25) are used to display certain values there is no need to set the SDE flag at the config_flags register (see Table 21 on Page 29) to show a text along with the value. If the direct value enable bit is set to '**1**' the content of sec_display_direct_access_string will be checked by the device. If the string is empty time and/or date will be displayed if enabled at user_interface_settings at addresse 183 (Table 20 on Page 28). Otherwise the content of the string will be displayed automatically.
If it is desired to don´t show anything at the secondary display a space character (0x20) needs to be inserted.

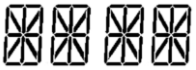
| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| secondary_display_ direct_access_string | 200 0x00C8 – 207 0x00CF | sec_display_direct_access_string | | | | | | | | | | | | | | | |
| | The string will be displayed with the 4x16 segment digits of the secondary display.  The string will be updated if the secondary_display_direct_access_enabled flag at the config_flags register at address 192 (Table 21 on Page 29) is set. **!!!** Up to 16 ASCII character (limited to characters from 0x20 to 0x5F) can be displayed. A string terminator (0x00) will determine the length of the string. If a string is longer than 4 characters the secondary display will work as a ticker. | | | | | | | | | | | | | | | | |

Table 22: Secondary Display Direct Access String

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_touch_button_0 | 208 0x00D0 | DA [1] | ED [0] | EU [1] | DAD [0] | DAU [1] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_touch_button_1 | 209 0x00D1 | DA [1] | ED [0] | EU [1] | DAD [0] | DAU [1] | MF [0] | R [0] | EN [1] | set_point_index [0x01] | | | | | | | |
| config_touch_button_2 | 210 0x00D2 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_touch_button_3 | 211 0x00D3 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [1] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_touch_button_4 | 212 0x00D4 | DA [1] | ED [1] | EU [0] | DAD [1] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_touch_button_5 | 213 0x00D5 | DA [1] | ED [1] | EU [0] | DAD [1] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x01] | | | | | | | |
| config_touch_button_6 | 214 0x00D6 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_touch_button_7 | 215 0x00D7 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |

With these registers the functionality of the touch buttons is defined.

**set_point_index:** defines a set point register that can be edited in DIRECT_ACCESS-mode if the DA bit is set

**EN:** if set to '1' the defined button is enabled and its state will be updated in the present state, short pressed and long pressed register at Table 7 on Page 19

**MF:** if set to '1' the button is defined as MENU-button

**DAU:** if set to '1' the button is defined as UP-button in DIRECT_ACCESS-mode

**DAD:** if set to '1' the button is defined as DOWN-button in DIRECT_ACCESS-mode

**EU:** if set to '1' the button is defined as UP-button in EDIT-mode

**ED:** if set to '1' the button is defined as DOWN-button in EDIT-mode

**DA:** if set to '1' and the button gets pressed a set point defined by the set_point_index will be displayed in DIRECT_ACCESS-mode

**!!!** See Table 25 on Page 33 for example configurations.

Table 23: Touch Button Configuration

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_external_button_0 | 224 0x00E0 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_external_button_1 | 225 0x00E1 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_external_button_2 | 226 0x00E2 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |
| config_external_button_3 | 227 0x00E3 | DA [0] | ED [0] | EU [0] | DAD [0] | DAU [0] | MF [0] | R [0] | EN [1] | set_point_index [0x00] | | | | | | | |

With these registers the functionality of the external buttons is defined.

**set_point_index:** defines a set point register that can be edited in DIRECT_ACCESS-mode if the DA bit is set.

**EN:** if set to '1' the defined button is enabled and its state will be updated in the present state, short pressed and long pressed register at Table 7 on Page 19.

**MF:** if set to '1' the button is defined as MENU-button

**DAU:** if set to '1' the button is defined as UP-button in DIRECT_ACCESS-mode

**DAD:** if set to '1' the button is defined as DOWN-button in DIRECT_ACCESS-mode

**EU:** if set to '1' the button is defined as UP-button in EDIT-mode

**ED:** if set to '1' the button is defined as DOWN-button in EDIT-mode

**DA:** if set to '1' and the button gets pressed a set point defined by the set_point_index will be displayed in DIRECT_ACCESS-mode

**!!!** See Table 25 on Page 33 for example configurations.

Table 24: External Button Configuration

| Description | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| no special function | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | | | | | | |
| ➔ The button is enabled but has no special function (e.g. OCCUPANCY-button). The set point index has no influence in this case. | | | | | | | | | | | | | | | | |
| MENU-button | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | | | | | | | |
| ➔ This combination can be used to determine the MENU-button. The set point index has no influence in this case. | | | | | | | | | | | | | | | | |
| UP-button | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | | | | | | | |
| ➔ This button will increment a set point in EDIT- or DIRECT_ACCESS-mode when pressed. The set point index has no influence in this case. | | | | | | | | | | | | | | | | |
| DOWN-button with direct access | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | | | | | | | |
| ➔ This button will decrement a set point in EDIT- or DIRECT_ACCESS-mode when pressed. Additionally a setpoint defined with the set_point_index is displayed when pressed and can be edited in DIRECT_ACCESS-mode. | | | | | | | | | | | | | | | | |

Table 25: Button Example Configuration

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_bar_graph_left | 240 0x00F0 | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | EN [0] | set_point_index [0x00] | | | | | | | |
| config_bar_graph_right | 241 0x00F1 | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | R [0] | EN [1] | set_point_index [0x01] | | | | | | | |
| These registers are used to associate a set point as source for the bar graph on the left and on the right side of the LCD. If enabled the bar graph is updated corresponding to the value of the set point defined with the set_point_index.<br>The bar graph segments can also be set manually by writing the symbol_direct_access registers at address 99 and 100 ( Table 12 on Page 23)<br><br>**set_point_index**: defines a set point register that is used as source for the bar graph.<br>**EN**: if set to '1' the corresponding bar-graph will be updated to visualize the value of a set point with the defined set_point_index. | | | | | | | | | | | | | | | | | |

Table 26: Bar Graph Configuration

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_display_value_0 | 256 0x0100 | unit_modbus [0x1] | | | | unit [0x1] | | | | CAL [1] | semantic_meaning [0x01] | | | | | | |
| | 257 0x0101 | VSA [1] | VEU [1] | DSSA [1] | DSEU [1] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [1] | [0] |
| config_display_value_1 | 258 0x0102 | unit_modbus [0xA] | | | | unit [0xA] | | | | CAL [1] | semantic_meaning [0x04] | | | | | | |
| | 259 0x0103 | VSA [1] | VEU [1] | DSSA [1] | DSEU [1] | [0] | [0] | [0] | [0] | [1] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_2 | 260 0x0104 | unit_modbus [0x1] | | | | unit [0x1] | | | | CAL [1] | semantic_meaning [0x05] | | | | | | |
| | 261 0x0105 | VSA [1] | VEU [1] | DSSA [1] | DSEU [1] | [0] | [0] | [0] | [0] | [1] | [0] | [0] | [0] | [0] | [0] | [1] | [0] |
| config_display_value_3 | 262 0x0106 | unit_modbus [0xB] | | | | unit [0xB] | | | | CAL [1] | semantic_meaning [0x07] | | | | | | |
| | 263 0x0107 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_4 | 264 0x0108 | unit_modbus [0x8] | | | | unit [0x8] | | | | CAL [1] | semantic_meaning [0x0E] | | | | | | |
| | 265 0x0109 | VSA [1] | VEU [1] | DSSA [1] | DSEU [1] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_5 | 266 0x010A | unit_modbus [0x1] | | | | unit [0x1] | | | | CAL [1] | semantic_meaning [0x03] | | | | | | |
| | 267 0x010B | VSA [1] | VEU [1] | DSSA [1] | DSEU [1] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [1] | [0] | [0] |
| config_display_value_6 | 268 0x010C | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 269 0x010D | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_7 | 270 0x010E | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 271 0x010F | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_8 | 272 0x0110 | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 273 0x0111 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_9 | 274 0x0112 | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 275 0x0113 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_10 | 276 0x0114 | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 277 0x0115 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_11 | 278 0x0116 | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 279 0x0117 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_12 | 280 0x0118 | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 281 0x0119 | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| config_display_value_13 | 282 0x011A | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 283 0x011B | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_14 | 284 0x011C | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 285 0x011D | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_display_value_15 | 286 0x011E | unit_modbus [0x0] | | | | unit [0x0] | | | | CAL [0] | semantic_meaning [0x00] | | | | | | |
| | 287 0x011F | VSA [0] | VEU [0] | DSSA [0] | DSEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |

These registers hold the configuration of the 16 display values.

**semantic_meaning:** is used to provide information about the semantic meaning and the source of the value. For further information please see Table 29 on Page 39.

**CAL:** if set to '1' the corresponding offset_value can be edited in CALIBRATION-mode (only capable if DSEU or DSSA is set to '1')

**unit:** defines a unit with which the corresponding display value appears on the LCD

**unit_modbus:** defines a unit that the corresponding display value register appeare on Modbus

**!!!** For both, unit and unit_modbus the following values are possible:

| 0x0 | 0x1 | 0x2 | 0x3 | 0x4 | 0x5 | 0x6 | 0x7 | 0x8 | 0x9 | 0xA | 0xB | 0xC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| no unit | °C | °F | cfm | l/s | $m^3/h$ | Pa | inWC | V | % | %RH | ppm | °F dec. |

Bits 0-11 of the higher address of each configuration register indicate the symbols that are displayed along with the corresponding display value.

**DSEU:** Display Source for End User

**DSSA:** Diplay Source for System Administrator

These two bits define if the value displayed is taken from a display_value register at address 64 to 79 (see Table 11 on Page 22) or from a sensor_value register at address 48 to 56 (see Table 10 on Page 21). The following states are valid:

0 – defines that the value is taken from a display_value register that has to be set via modbus.

1 – defines that the value is taken from a sensor_value (+ offset_value) register that is automatically updated with the current sensor value.

**VEU:** Visible for End User

**VSA:** Visible for System Administrator

These two bits define if the display value is visible for the end user and/or the system administrator. If set to '1' the value will be visible.

**!!!** See Table 30 on Page 41 for example configurations of display values or set points.

Table 27: Display Value Configuration

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_set_ point_0 | 320 0x0140 | unit_modbus [0x1] | | | | unit [0x1] | | | | PIN [0] | semantic_meaning [0x01] | | | | | | |
| | 321 0x0141 | VSA [1] | VEU [1] | ESA [1] | EEU [1] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [1] | [1] |
| config_set_ point _1 | 322 0x0142 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x0B] | | | | | | |
| | 323 0x0143 | VSA [1] | VEU [1] | ESA [1] | EEU [1] | [0] | [0] | [0] | [0] | [0] | [0] | [1] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _2 | 324 0x0144 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 325 0x0145 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _3 | 326 0x0146 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 327 0x0147 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _4 | 328 0x0148 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 329 0x0149 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _5 | 330 0x014A | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 331 0x014B | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _6 | 332 0x014C | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 333 0x014D | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _7 | 334 0x014E | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 335 0x014F | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _8 | 336 0x0150 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 337 0x0151 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _9 | 338 0x0152 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 339 0x0153 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _10 | 340 0x0154 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 341 0x0155 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _11 | 342 0x0156 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 343 0x0157 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |

| Register Name | Register Adresse | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_set_ point _12 | 344 0x0158 | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 345 0x0159 | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _13 | 346 0x015A | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 347 0x015B | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _14 | 348 0x015C | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 349 0x015D | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |
| config_set_ point _15 | 350 0x015E | unit_modbus [0x0] | | | | unit [0x0] | | | | PIN [0] | semantic_meaning [0x00] | | | | | | |
| | 351 0x015F | VSA [0] | VEU [0] | ESA [0] | EEU [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |

These registers hold the configuration for the 16 set point.

**semantic_meaning:** is used to provide information about the semantic meaning of the set point. For further information please see Table 29 on Page 39.

**PIN:** if set to '1' the the corresponding set point is pincode protected and can only be changed in EDIT-mode if the correct pincode has been entered before.

**unit:** defines a unit with which the corresponding set point appears on the LCD

**unit_modbus:** defines a unit that the corresponding set point register appears on Modbus

!!! For both, unit and unit_modbus the following values are possible:

| 0x0 | 0x1 | 0x2 | 0x3 | 0x4 | 0x5 | 0x6 | 0x7 | 0x8 | 0x9 | 0xA | 0xB | 0xC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| no unit | °C | °F | cfm | l/s | $m^3/h$ | Pa | inWC | V | % | %RH | ppm | °F dec. |

Bits 0-11 of the higher address of each configuration register indicate the symbols that are displayed

**EEU:** Editable for End User

**ESA:** Editable for Aystem Administrator

along with the corresponding display value.

0 – defines that the set point is not editable.

1 – editable for system administrator.

**VEU**: Visible for End User

**VSA**: Visible for System Administrator

These two bits define if the set point is editable for the end user and/or the system administrator. The following states are valid:

These two bits define if the set point is visible for the end user and/or the system administrator. If set to '1' the set point will be visible.

**!!!** See Table 30 on Page 41 for example configurations of display values or set points.

Table 28: Set Point Configuration

Table 29 below shows possible values for the semantic meaning used in the configuration for display values (Table 27 on Page 35) and set points (Table 28 on Page 37).

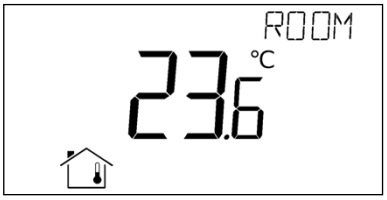
Primarily the semantic meaning field defines a text that is displayed along with a display value or a set point. Additionally for display values it defines the internal sensor_value that is displayed when the DSEU or DSSA bit is set. For examples on how to use the semantic meaning field in the configuration registers please see Table 30 on Page 41.

| semantic_meaning | Beschreibung | Text im Zweitdisplay |
|---|---|---|
| 0x00 | None (unconfigured) | |
| 0x01 | Internal Temperature abs. | R O O M |
| 0x02 | Internal Temperature rel. | Δ S P T |
| 0x03 | External Temperature | O U T |
| 0x04 | Relative Humidity | H U M |
| 0x05 | Dew Point | D E W |
| 0x06 | Luminance (lx) | L U X |
| 0x07 | Amount $CO_2$ | C O 2 |
| 0x08 | Differential Pressure | P R E S |
| 0x09 | Flow | F L O W |
| 0x0A | Valve Position | V A L V |
| 0x0B | Fan Stage | F A N |
| 0x0C | Heat/Cool Stage | H & C |
| 0x0D | Brightness (%) | B R % |
| 0x0E | Supply Voltage | 2 4 V |
| 0x0F | CPU voltage | C P U |
| 0x10 | CPU temperature | C P U |
| 0x11 | Room ID | R O O M |
| 0x12 | Damper Position (%) | D A M P |
| 0x13 | Reheat (%) | H E A T |
| 0x14 | Discharge Temperature | D I S |

Table 29: Semantic Meaning

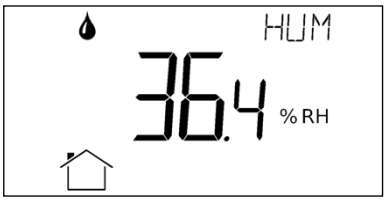
| Description | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| config_display_value_x<br>internal temperature<br>(from built in sensor) | 0x1 | | | | 0x1 | | | | 1 | 0x01 | | | | | | |
| | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

The value of the built in temperature sensor will be displayed with the internal temperature symbol in °C. It will be visible for the end user and system administrator. See the following example for how the display would look like:



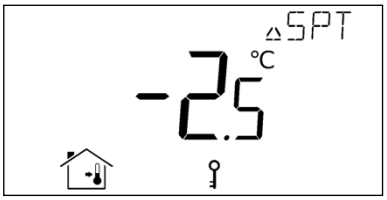

| config_display_value_x<br>relative humidity<br>(value supplied over Modbus) | 0xA | | | | 0xA | | | | 0 | 0x04 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

This is an example of a relative humidity display value. Because the DSEU and DSSA bit is set to '0' the content of the corresponding display_value_register will be displayed. It will be visible for the end user and system administrator. See the following example for how the display would look like:




| config_set_point_x<br>relative temperature | 0x1 | | | | 0x1 | | | | 1 | 0x02 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

This is an example of a relative temperature set point in °C. The internal temperature symbol as well as the arrow symbol will be displayed. Since the set point is pincode protected also the key symbol will be displayed. See the following example for how the display would look like:



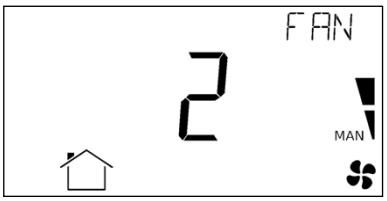
<table>
<tr><th>Description</th><th colspan="16">Bit Position</th></tr>
<tr><td rowspan="2">config_set_point_x<br>fan stage</td><td colspan="4">0x0</td><td colspan="4">0x0</td><td>0</td><td colspan="8">0x0B</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td></td><td colspan="16">This is an example of a fan stage set point. The fan symbol and the actual stage will be displayed. The bar graph showing the actual stage of the fan is not displayed automatically but can be enabled via the corresponding bar graph configuration register at address 240-241 (see Table 26 on Page 33).<br>See the following example for how the display would look like:<br>  <br><br>For a stage set point the following semantic meanings are possible:<br>0x0A ...Valve Position<br>0x0B ...Fan Stage<br>0x0C ...Heat/Cool Stage<br>The user can adjust the set point in manual mode within the limits defined by the set point max and min values (see Table 32 and Table 33). The automatic mode can be displayed by writing defined values to the specific set point register (see Table 31).<br>The following values are possible:<br>0x0000 ... Stufe 0 Manual<br>0x0001 ... Stufe 1 Manual<br>0x0002 ... Stufe 2 Manual<br>0x0003 ... Stufe 3 Manual<br>0x8000 ... Stufe 0 Auto<br>0x8001 ... Stufe 1 Auto<br>0x8002 ... Stufe 2 Auto<br>0x8003 ... Stufe 3 Auto<br>If the set point min value is set to any automatic stage the user will have the opportunity to switch between manual and automatic mode. In this case, if the set point max value is set to “Stage 3 Manual” for example, the user can select the following values:<br>Stage 3 Manual<br>Stage 2 Manual<br>Stage 1 Manual<br>Stage 0 Manual<br>Stage 0 Auto</td></tr>
</table>

Table 30: Display Value and Set Point Example Configuration

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| set_point_0 | 384<br>0x0180 | [0x00DC] | | | | | | | | | | | | | | | |
| set_point_1 | 385<br>0x0181 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_2 | 386<br>0x0182 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_3 | 387<br>0x0183 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_4 | 388<br>0x0184 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_5 | 389<br>0x0185 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_6 | 390<br>0x0186 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_7 | 391<br>0x0187 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_8 | 392<br>0x0188 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_9 | 393<br>0x0189 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_10 | 394<br>0x018A | [0x0000] | | | | | | | | | | | | | | | |
| set_point_11 | 395<br>0x018B | [0x0000] | | | | | | | | | | | | | | | |
| set_point_12 | 396<br>0x018C | [0x0000] | | | | | | | | | | | | | | | |
| set_point_13 | 397<br>0x018D | [0x0000] | | | | | | | | | | | | | | | |
| set_point_14 | 398<br>0x018E | [0x0000] | | | | | | | | | | | | | | | |
| set_point_15 | 399<br>0x018F | [0x0000] | | | | | | | | | | | | | | | |
| | These registers contain the values of up to 16 set points.<br>All registers are 16 Bit signed values. Depending on the modbus_unit specified with the corresponding set point configuration register at address 320 to 351 (Table 28 on Page 37) the value needs to be scaled as described in Table 38 on Page 49 to achieve the desired result.. | | | | | | | | | | | | | | | | |

Table 31: Set Points

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| set_point_max_0 | 416<br>0x01A0 | [0x012C] | | | | | | | | | | | | | | | |
| set_point_max_1 | 417<br>0x01A1 | [0x0003] | | | | | | | | | | | | | | | |
| set_point_max_2 | 418<br>0x01A2 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_3 | 419<br>0x01A3 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_4 | 420<br>0x01A4 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_5 | 421<br>0x01A5 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_6 | 422<br>0x01A6 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_7 | 423<br>0x01A7 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_8 | 424<br>0x01A8 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_9 | 425<br>0x01A9 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_10 | 426<br>0x01AA | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_11 | 427<br>0x01AB | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_12 | 428<br>0x01AC | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_13 | 429<br>0x01AD | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_14 | 430<br>0x01AE | [0x0000] | | | | | | | | | | | | | | | |
| set_point_max_15 | 431<br>0x01AF | [0x0000] | | | | | | | | | | | | | | | |

These registers are used to allow set point changes for the end user or system administrator only within limits defined with a set_point_max value of this Table and a set_point_min value of Table 33.

All registers are 16 Bit signed values. Depending on the modbus_unit specified with the corresponding set point configuration register at address 320 to 351 (Table 28 at Page 37) the value needs to be scaled as described in Table 38 at Page 49 to achieve the desired result..

Table 32: Set Point max. Values

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| set_point_min_0 | 448<br>0x01C0 | [0x0096] | | | | | | | | | | | | | | | |
| set_point_min_1 | 449<br>0x01C1 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_2 | 450<br>0x01C2 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_3 | 451<br>0x01C3 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_4 | 452<br>0x01C4 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_5 | 453<br>0x01C5 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_6 | 454<br>0x01C6 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_7 | 455<br>0x01C7 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_8 | 456<br>0x01C8 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_9 | 457<br>0x01C9 | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_10 | 458<br>0x01CA | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_11 | 459<br>0x01CB | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_12 | 460<br>0x01CC | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_13 | 461<br>0x01CD | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_14 | 462<br>0x01CE | [0x0000] | | | | | | | | | | | | | | | |
| set_point_min_15 | 463<br>0x01CF | [0x0000] | | | | | | | | | | | | | | | |

These registers are used to allow set point changes for the end user or system administrator only within limits defined with a set_point_max value of Table 32 and a set_point_min value of this Table.

All registers are 16 Bit signed values. Depending on the modbus_unit specified with the corresponding set point configuration register at address 320 to 351 (Table 28 at Page 37) the value needs to be scaled as described in Table 38 at Page 49 to achieve the desired result..

Table 33: Set Point min. Values

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| offset_value_0 | 480<br>0x01E0 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_1 | 481<br>0x01E1 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_2 | 482<br>0x01E2 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_3 | 483<br>0x01E3 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_4 | 484<br>0x01E4 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_5 | 485<br>0x01E5 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_6 | 486<br>0x01E6 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_7 | 487<br>0x01E7 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_8 | 488<br>0x01E8 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_9 | 489<br>0x01E9 | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_10 | 490<br>0x01EA | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_11 | 491<br>0x01EB | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_12 | 492<br>0x01EC | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_13 | 493<br>0x01ED | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_14 | 494<br>0x01EE | [0x0000] | | | | | | | | | | | | | | | |
| offset_value_15 | 495<br>0x01EF | [0x0000] | | | | | | | | | | | | | | | |
| | These registers are used to define offsets for display values when displaying a value from a built in sensor. These registers can either be written via Modbus or can be edited in CALIBRATION-mode by the system administrator.<br><br>All registers are 16 Bit signed values. Depending on the modbus_unit specified with the corresponding display value configuration register at address 256 to 287 (Table 27 on Page 35) the value needs to be scaled the same as the corresponding display value as described in Table 38 on Page 49. | | | | | | | | | | | | | | | | |

Table 34: Offset Values

### 3.4.4 Model Information Registers (read only)

These registers are set at production time and contain specific information about the specific model and the default button print layout.

| | | **Buttonlayout** / Default Values | | | | | |
|---|---|---|---|---|---|---|---|
| **Register Name** | **Register Address** | **Type 210** | **Type 220** | **Type 230** | **Type 240** | **Type 250** | **Type 260** |
| default_print_touch_button_0 | 528 0x0210 | [0x0004] | [0x0004] | [0x0004] | [0x0004] | [0x0004] | [0x0004] |
| default_print_touch_button_1 | 529 0x0211 | [0x0000] | [0x0006] | [0x0006] | [0x000A] | [0x0006] | [0x0006] |
| default_print_touch_button_2 | 530 0x0212 | [0x0000] | [0x0000] | [0x0008] | [0x0008] | [0x000A] | [0x000A] |
| default_print_touch_button_3 | 531 0x0213 | [0x0001] | [0x0001] | [0x0001] | [0x0001] | [0x0001] | [0x0001] |
| default_print_touch_button_4 | 532 0x0214 | [0x0005] | [0x0005] | [0x0005] | [0x0005] | [0x0005] | [0x0005] |
| default_print_touch_button_5 | 533 0x0215 | [0x0000] | [0x0007] | [0x0007] | [0x000B] | [0x0007] | [0x0007] |
| default_print_touch_button_6 | 534 0x0216 | [0x0000] | [0x0000] | [0x0009] | [0x0009] | [0x000B] | [0x000B] |
| default_print_touch_button_7 | 535 0x0217 | [0x0002] | [0x0002] | [0x0002] | [0x0002] | [0x0002] | [0x0008] |
| default_print_external_button_0 | 539 0x0218 | [0x0000] | | | | | |
| default_print_external_button_1 | 539 0x0219 | [0x0000] | | | | | |
| default_print_external_button_2 | 539 0x021A | [0x0000] | | | | | |
| default_print_external_button_3 | 539 0x021B | [0x0000] | | | | | |

Button Print Layout – describes which symbols are printed on the front panel and on the external buttons by default. The following symbols are defined:

0x0000 – none 

0x0001 – menu 

0x0002 – occupancy 

0x0003 – reserviert

0x0004 – temp_up 

| | | **Buttonlayout** / Default Values | | | | | |
|---|---|---|---|---|---|---|---|
| **Register Name** | **Register Address** | **Type 210** | **Type 220** | **Type 230** | **Type 240** | **Type 250** | **Type 260** |
| | | 0x0005 – temp_down | | |  | | |
| | | 0x0006 – fan_up | | |  | | |
| | | 0x0007 – fan_down | | |  | | |
| | | 0x0008 – light_on | | |  | | |
| | | 0x0009 – light_off | | |  | | |
| | | 0x000A – blinds_up | | |  | | |
| | | 0x000B – blinds_down | | |  | | |
| | | 0x000C – light_up | | |  | | |
| | | 0x000D – light_down | | |  | | |

Table 35: Model Information Registers

### 3.4.5 Device Information Registers (read only)

The registers shown in Table 36 are set at production and contain specific information about the device.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| product_code_string | 560 0x0230 – 569 0x0239 | product_code_string | | | | | | | | | | | | | | | |
| serial_number_ string | 576 0x0240 – 585 0x0249 | serial_number_string | | | | | | | | | | | | | | | |
| firmware_version_ string | 592 0x0250 – 595 0x0253 | firmware_version_string | | | | | | | | | | | | | | | |

| Register Name | Register Address | Bit Position |
|---|---|---|
| firmware_date | 596 0x0254 | firmware_date_0 |
| | 597 0x0255 | firmware_date_1 |
| bootloader_version_ string | 608 0x0260 – 611 0x0263 | bootloader_version_string |
| bootloader_date | 612 0x0264 | bootloader_date_0 |
| | 613 0x0265 | bootloader_date_1 |
| !!! firmware_date_0 and firmware_date_1 as well as bootloader_date_0 and bootloader_date_1 represent a 32 bit timestamp in seconds since JAN-01-1970 indicating the build time. | | |

Table 36: Device Information Registers

### 3.4.6 NFC Registers

These registers provide an URL that can be accessed by NFC enabled devices such as smart phones to get additional information and control of the room automation.

| Register Name | Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| url_string | 1024 0x0400 – 1148 0x047C | [https://spluss.de] | | | | | | | | | | | | | | | |
| !!! Up to 248 ASCII character including a string terminator (0x00) can be used. The string will be converted to a NDEF URI record that is saved on the NFC tag. For further information on the NFC interface see Chapter 4. | | | | | | | | | | | | | | | | | |

Table 37: NFC Registers

### 3.4.7 Value Scaling and Stepwidth

The following Table 38 gives an overview of how Modbus register datapoints (display values, set points, min., max. and offset values) need to be scaled to achieve the desired result at the display. It also shows which stepwidth is defined for set points.

| Physical Value | Unit | Modbus Scaling A*10^B*(raw + C) | | | Set Point Stepwidth | Example | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | | raw value | displayed value |
| No Unit | - | 1 | 0 | 0 | 1 | 100 | 100.0 |
| Temperature | (K) | 1 | -1 | -2740 | 0,5 | 2975 | 023.5 °C |
| | °C | 1 | -1 | 0 | 0,5 | 235 | 023.5 °C |
| | °F | 1 | -1 | 0 | 1,0 | 743 | 074.0 °F |
| | °F dec. | 1 | -1 | 0 | 0,5 | 743 | 074.5 °F |
| Flow | m³/h | 1 | 0 | 0 | 1 | 150 | 150.0 m³/h |
| | l/s | 1 | -1 | 0 | 0,1 | 417 | 041.7 l/s |
| | cfm | 1 | 0 | 0 | 1 | 88 | 088.0 cfm |
| Pressure | Pa | 1 | 0 | 0 | 1 | 200 | 200.0 Pa |
| | inWC | 1 | -3 | 0 | 0,01 | 803 | 0.803 inWC |
| Voltage | V | 1 | -1 | 0 | 0,1 | 240 | 024.0 V |
| Percentage | % | 5 | -3 | 0 | 1 | 9000 | 045.0 % |
| Humidity | %RH | 5 | -3 | 0 | 1 | 9000 | 045.0 %RH |
| Amount $CO_2$ | ppm | 1 | 0 | 0 | 1 | 550 | 550.0 ppm |

Note that though a display value or a set point would accept values from 0 to 65535 if unsigned or -32768 to 32767 if signed the value that is displayed is limited to a range from -999 to 9999 because of the 4 digit display.

**!!!** When a fixed-point number reaches a certain limit where an overflow occurs the decimal point is shifted rightwards (e.g. 999.9 → 1000).

**!!!** Whole number values are preferably displayed with the bigger digits. If an overflow occurs the number is shifted rightwards (e.g. 999 → 1000).

Table 38: Value Scaling and Stepwidth

# 4. NFC

The NFC interface of the RYMASKON 200 device can be used to get additional information and configuration options for room automation. The RYMASKON 200 will behave like an NFC tag that can be read by an NFC enabled device. The antenna is located behind the LCD and best performance is achieved by putting the NFC enabled device right on the front panel glass. Depending on where the antenna of the mobile device is located the optimal position will be found by moving the device slowly over the front panel. Best performance can be achieved by positioning the device in a more or less horizontal position covering the LCD as shown in Figure 8.

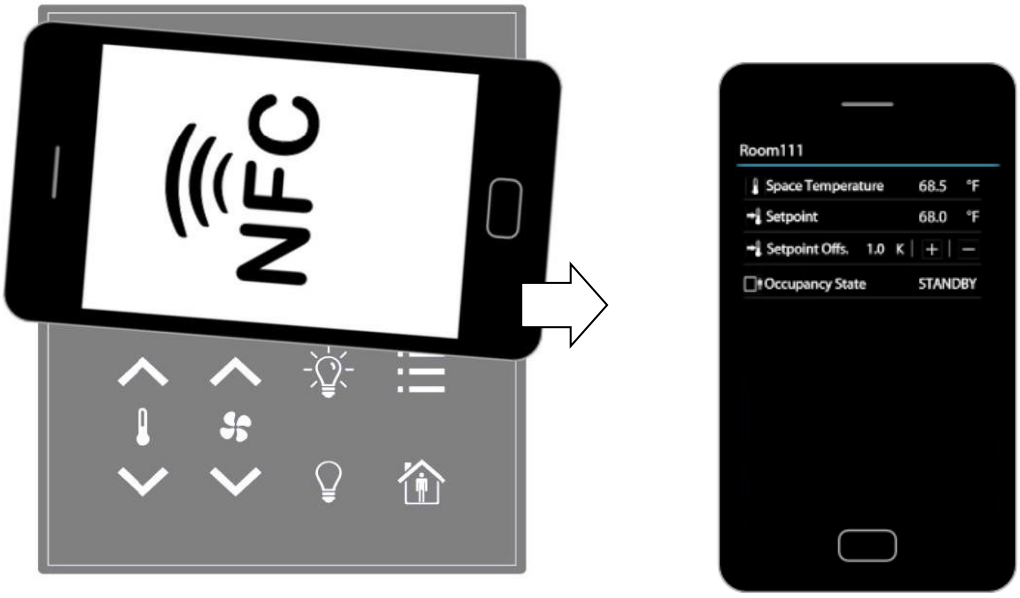



Figure 8: NFC Device Positioning

If the connection is established the NFC field detection bit at the short_pressed Modbus register at address 1 (Table 7 on Page 19) will be set. In the meantime the NFC enabled device will read the memory of the tag and will perform an appropriate action.

Since a NDEF URI record is saved at the tags memory the device will ask to open the defined URL in the browser of the NFC enabled device.

# 5. IR-Remote Control Operation

## 5.1. General Description

The IR receiver is located behind the front panel glass above the LCD.
The RYMASKON 200 device implements the NEC IR protocol compatible with the Apple remote control as displayed in Figure 9.

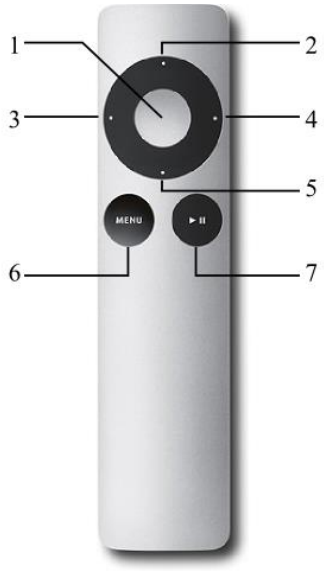



Figure 9: Apple Remote Control

Whenever a command gets received the IRC bit at the short_pressed Modbus register at address 1 (Table 7 on Page 19) is set.
The received button code as well as the remote ID can be read from the ir_remote_control_command register at address 32 (Table 9 on Page 20).

| Button Number | Description | Button Code |
|---|---|---|
| 1 | Center | 46 |
| 2 | Up | 5 |
| 3 | Left | 4 |
| 4 | Right | 3 |
| 5 | Down | 6 |
| 6 | Menu | 1 |
| 7 | Play/Pause | 47 |

Table 39: Apple Remote Button Codes

## 5.2. Remote Control Pairing

Each remote control has an ID that is transmitted along with the button code. This ID can be used to pair a certain remote control with a certain RYMASKON 200 - device. The ID of the Apple remote control can be changed by pressing Menu and Center button for at least 6s. This will increment the ID by one.

The ID of your remote control can be checked by pressing any button while watching the ir_remote_control_command register.

If a RYMASKON 200 device gets paired with a certain remote control it will only update the ir_remote_control_command register and the IRC bit at the short_pressed register when receiving a command from this remote control.

Pairing can be achieved by pressing Menu and Right button at the remote control for at least 6s while pointing towards the RYMASKON 200 device. If pairing worked the secondary display will shortly show 'IRP' (IR pairing). The remote ID will be saved internally and the IRCP flag of the config_flags register at address 192 (Table 21 on Page 29) will be set.

The pairing can be canceled by either clearing the IRCP flag or by pressing Menu and Left button for at least 6s. If the secondary display shows 'IRUP' (IR unpairing) shortly the pairing is suspended.

# 6. Troubleshooting

## 6.1. Technical Support

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# 7. Specifications

## 7.1. Physical Specifications

| | |
|---|---|
| Operating Voltage | 24 V DC (±10 %) |
| Power Consumption | max. 0.8 W |
| In rush current | up to 4A (at 24 V DC) |
| Operating range, temperature | 0....+50°C |
| Operating range, humidity | 10... 90 % r.H. (without dew formation) |
| Dimensions | 94.5 x 110 x 19.5mm |
| Protection type | IP 30 (according to EN 60529) |
| Installation | using a plastic mounting plate, on in-wall flush box, Ø 55 mm |

Following Table 40 should provide support for dimensioning of an installation and the power supply. For each device type there is a listing for up to 16 devices of the maximum possible cable length and the resulting power loss on the cable for different supply voltage levels. Together with the power consumption of the devices one can calculate the required power of the power supply.

| Conditions of the Installation | | | | Number of Devices | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
| RYMASKON200 | | maximum power consumption of devices | [W] | 0,8 | 1,6 | 2,4 | 3,2 | 4,0 | 4,8 | 5,6 | 6,4 | 7,2 | 8,0 | 8,8 | 9,6 | 10,4 | 11,2 | 12,0 | 12,8 |
| | 24V DC | max. Cable length [m] | for 0,5mm² | 1.620 | 810 | 540 | 400 | 320 | 270 | 230 | 200 | 180 | 160 | 140 | 130 | 120 | 110 | 100 | 100 |
| | | | for 1,0mm² | 3.250 | 1.620 | 1.080 | 810 | 650 | 540 | 460 | 400 | 360 | 320 | 290 | 270 | 250 | 230 | 210 | 200 |
| | | max. Power loss on cable | [W] | 0,2 | 0,4 | 0,6 | 0,9 | 1,1 | 1,3 | 1,5 | 1,7 | 1,9 | 2,1 | 2,3 | 2,6 | 2,8 | 3,0 | 3,2 | 3,4 |

Table 40: Cable Length and Power Loss on Cable

## 7.2. Sensor Specifications

**Ambient Temperature Sensor**

| | |
|---|---|
| Type: | CMOS |
| Measuring range, temperature: | –40....+125 °C |
| Resolution: | 0.1 °C |
| Deviation of temperature: | ± 0.5 °C (+5...+60 °C) |

**Relative Humidity Sensor**

| | |
|---|---|
| Type: | capacitive |
| Measuring range, humidity: | 0...100 % r.H. |
| Resolution: | 0.1 % r.H. |
| Deviation of humidity: | ±2 % r.H. (at +25 °C, 20...80 % r.H.) |
| | ±3 % r.H. (at +25 °C, 0... 20 % r.H. and 80...100 % r.H.) |

**Infrared Receiver**

| | |
|---|---|
| Protocol: | NEC |
| Carrier: | 38 kHz @ 950 nm |
| | Apple remote control compatible |