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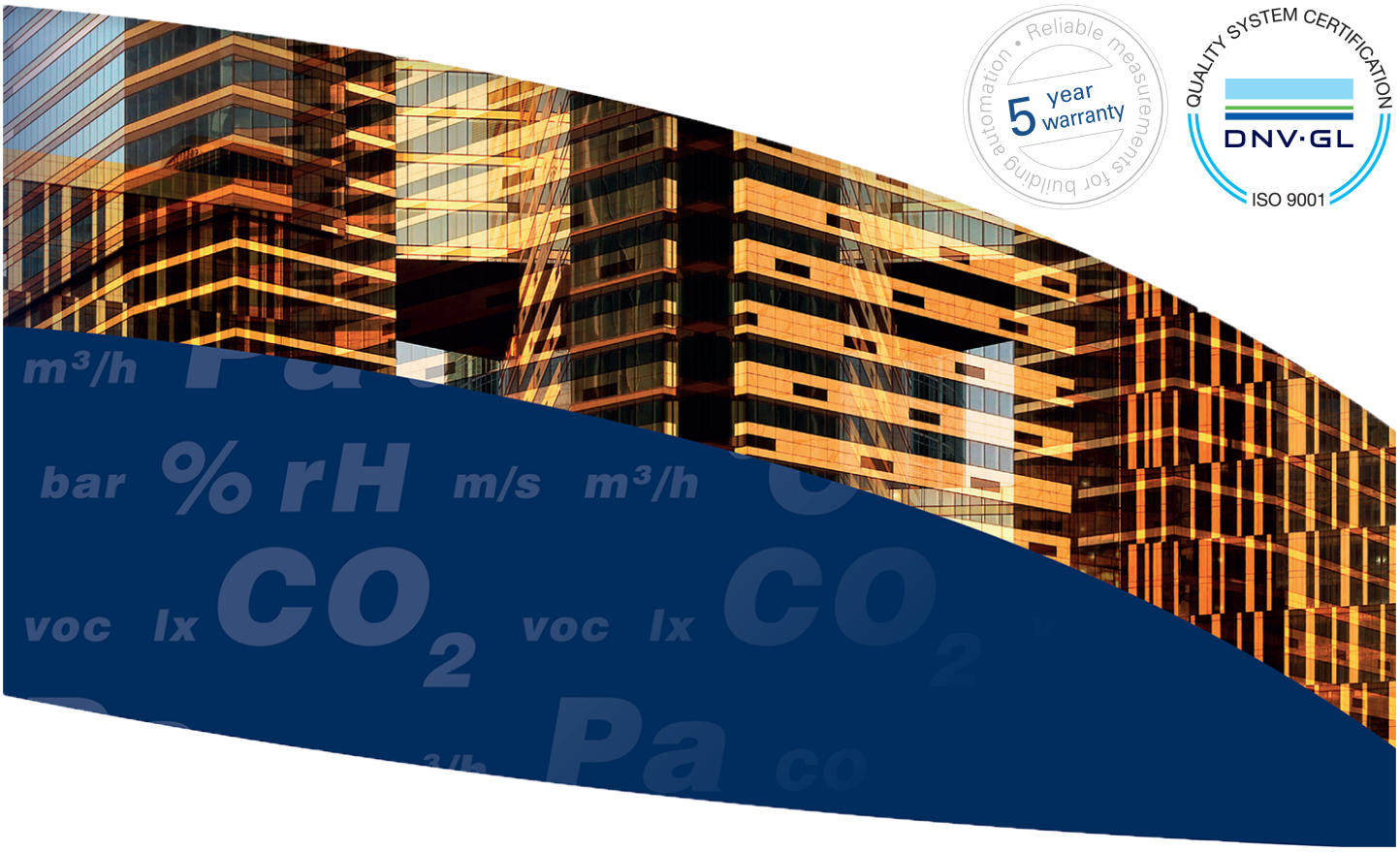
USER GUIDE

HDH

Produal

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HDH - Room CO_2 transmitter/controller

User Guide

This user guide is for devices with the software version 1.3.6 or newer.

PRODUAL
measure-be sure.

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1 Commissioning

1.1 Mounting room transmitters

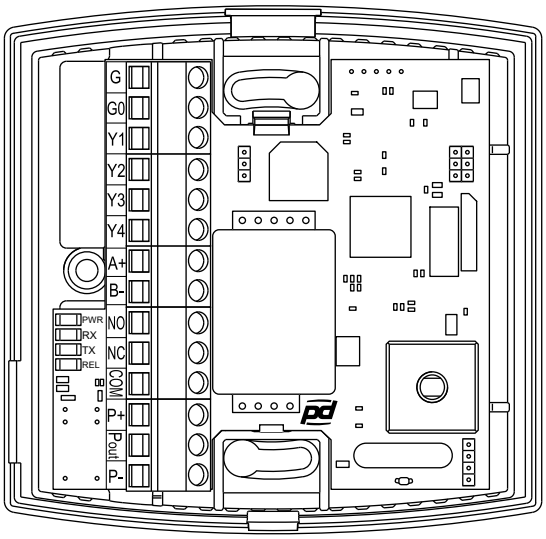
The device can be installed in dry surroundings (IP20) by screws on the wall surface or on the standard flush mounting box. The recommended installation height is 150...180 cm.

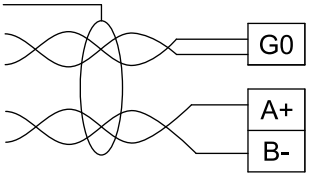
The device position should be selected carefully. All the error factors that can affect to the measurements should be eliminated as well as possible. The following list defines the typical measurement error factors.

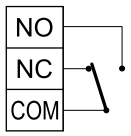
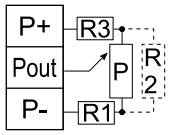
- direct sun light
- occupant proximity
- air flow coming from windows or doors
- air flow coming from ventilation nozzles
- air flow coming from the flush mounting box
- differential temperature caused by external wall

1.2 Wiring

CAUTION **CAUTION:** Device wiring and commissioning can only be carried out by qualified professionals. Always make the wirings while the power is switched off.

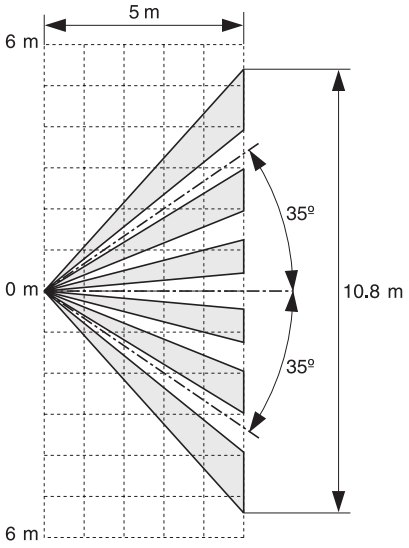
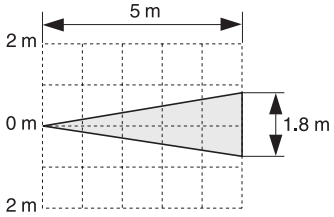


G	24 Vac/dc, 2 VA supply
G0	0 V
Y1	CO_2 output, 0...10 Vdc / 2...10 Vdc / 0...5 Vdc, < 2 mA
Y2	Temperature output, 0...10 Vdc / 2...10 Vdc / 0...5 Vdc, < 2 mA
Y3	Humidity output / active potentiometer output, 0...10 Vdc / 2...10 Vdc / 0...5 Vdc, < 2 mA
Y4	Control output / active potentiometer output, 0...10 Vdc / 2...10 Vdc / 0...5 Vdc, < 2 mA
A+ *B-*	 Modbus RTU, RS-485

NO *NC* *COM*		Relay output, 24 Vac, 1 A
P+ *Pout* *P-*		Passive potentiometer output.

NOTE **Note:** CO_2 measurement causes a current peak to the supply voltage. This can produce an error to the analogue outputs when using long and thin cables. It is recommended to increase the wire cross section area in long cable situations (e.g. by using four-wire connection) to ensure reliable measurement signal.

1.3 Detection area (PIR models)

Horizontal	Vertical
	

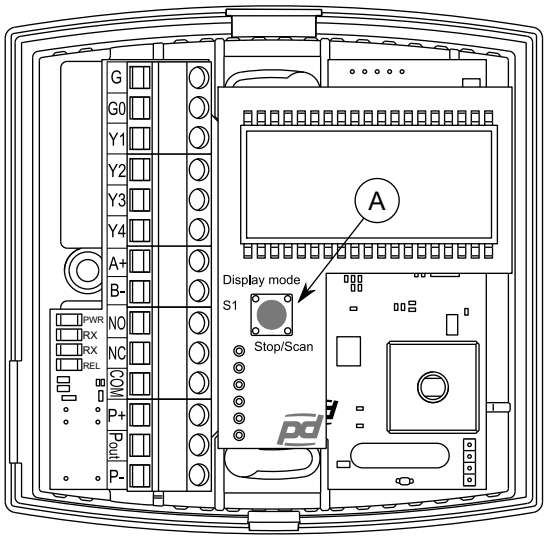
1.4 Selecting information to be viewed on the display

The measurement values scroll on the N model display by default.

NOTE **Note:** In M models, the shown measurement information can be selected also via Modbus.

NOTE **Note:** When the potentiometer (PU models) is configured to change the controller setpoint, the setpoint is shown on the display when the potentiometer is rotated.

- Press the S1 button to stop the scrolling to the currently displayed value.



A. S1 button

- Press the S1 button again to start the scrolling.

1.5 CO_2 measurement calibration

The device uses automatic CO_2 measurement calibration function (ABC algorithm). The function eliminates the possible long term drift. The automatic calibration function can be used when the CO_2 concentration drops at least two times within a week to the level of approximately 400 ppm. Therefore the automatic calibration is effective in spaces that are not continuously occupied.

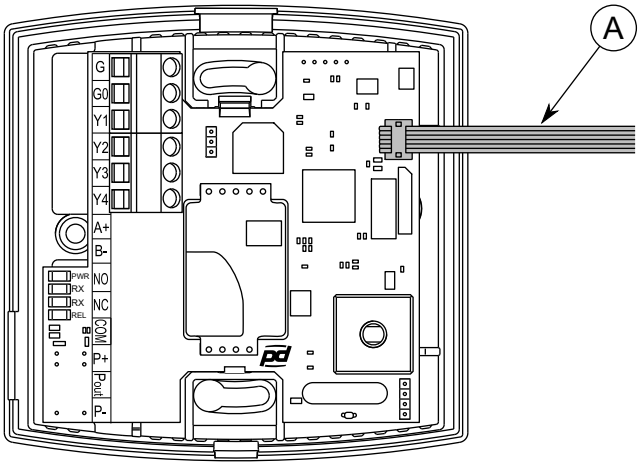
The automatic calibration function can be deactivated in continuously occupied spaces by using ML-SER tool.

If the automatic calibration function is not in use, the device should be calibrated every 6-12 months. The recommended calibration interval is 5 years even if the automatic calibration is in use.

1.6 ML-SER tool

1.6.1 Connecting ML-SER tool to the device

1. Open the cover.
2. Remove the display.
3. Connect the ML-SER cable to the display connector.



A. ML-SER cable

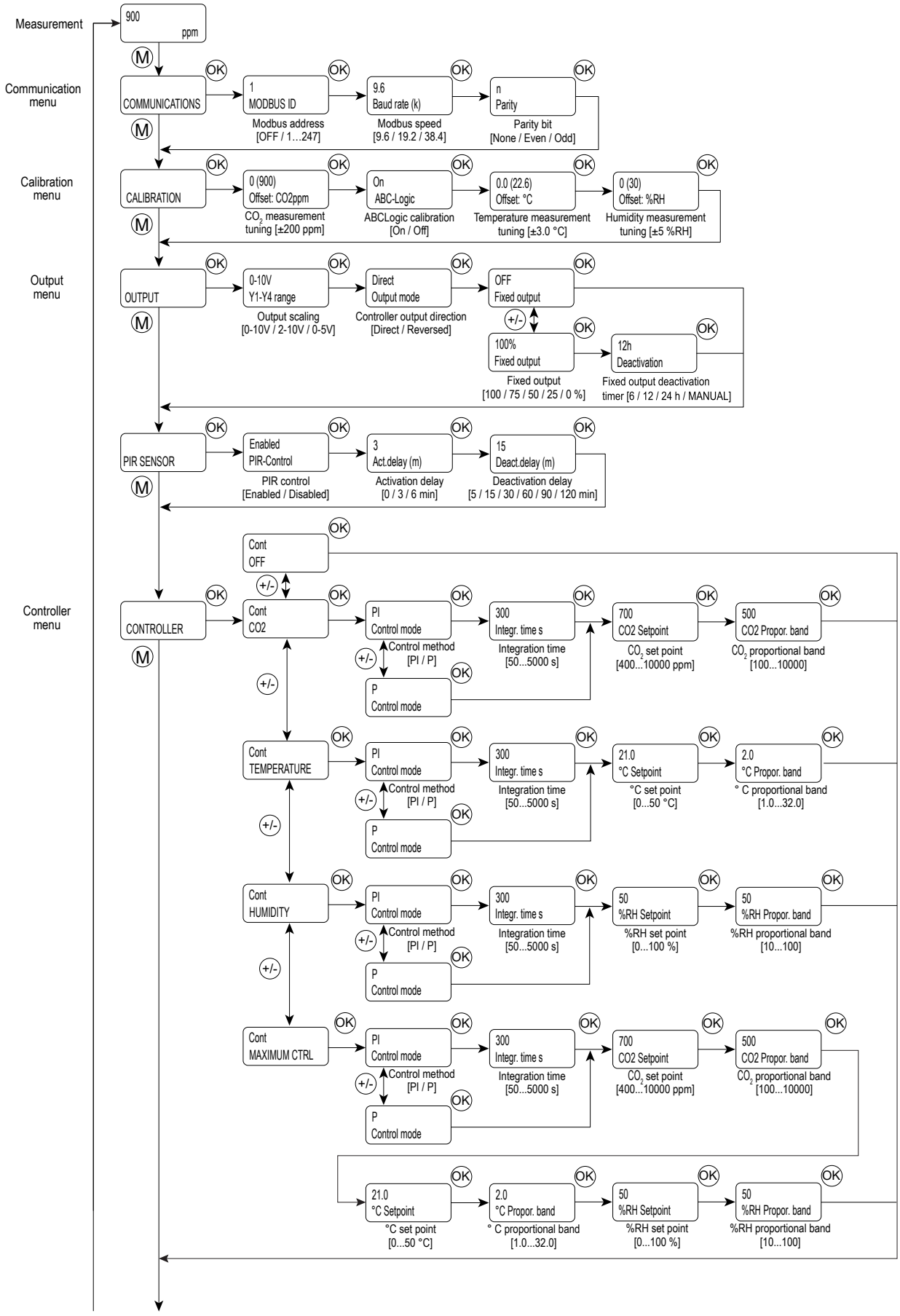
1.6.2 ML-SER menu

ML-SER menu opens by pressing the M button. The values can be changed with the ”+” and ”-” buttons. The menu is device-specific and the content depends on the device and installed options.

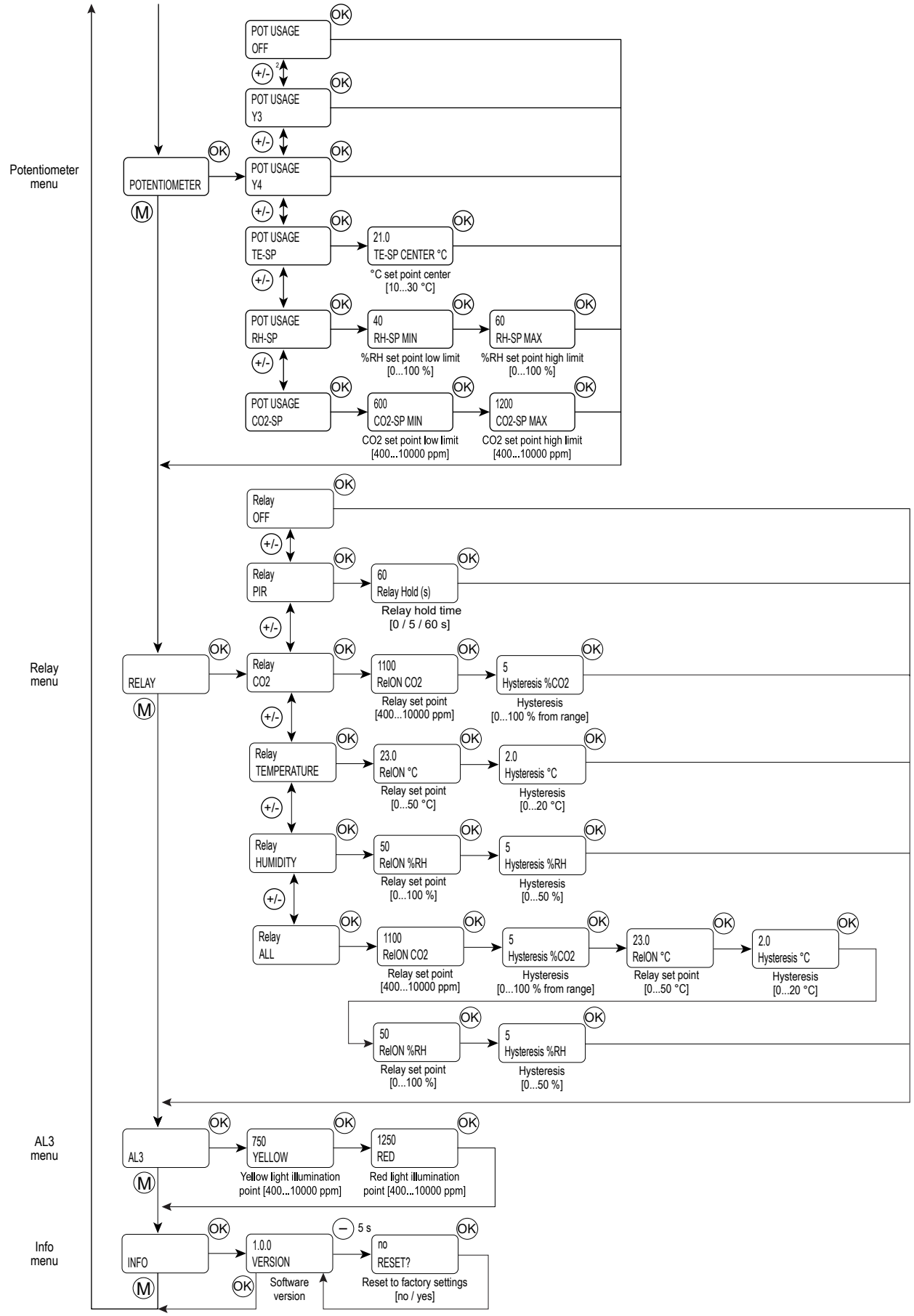
The following menu structure contains the factory settings.

NOTE **Note:** The default relay CO_2 set point is 2500 ppm in 10K models.

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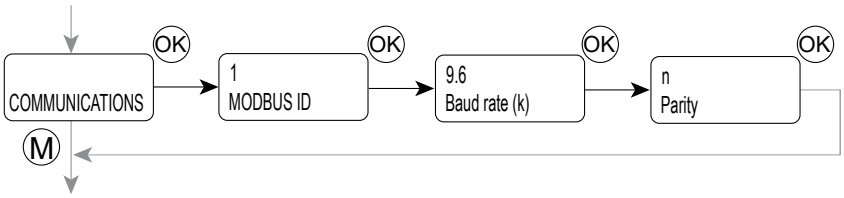


The diagram continues on the next page.



1.6.2.1 Communication menu

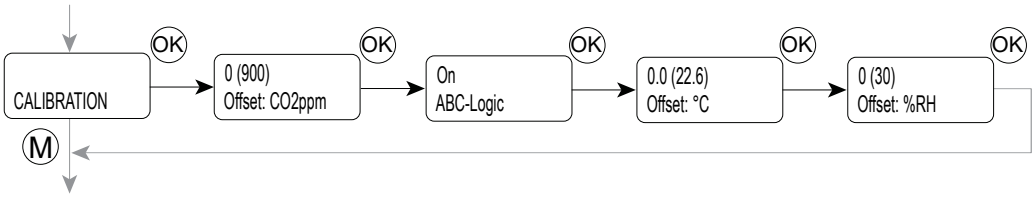
Communication menu is available in M models.



Parameter	Available values	Description
MODBUS ID	*OFF / 1...247*	Modbus address.
Baud rate (k)	*9.6 / 19.2 / 34.8 / 56.0 / 57.6 / 76.8 / 115.2*	Modbus speed (kbit/s).
Parity	*n / E / O*	Parity bit. *n* None *E* Even *O* Odd

1.6.2.2 Calibration menu

All the measurements can be tuned through the calibration menu.

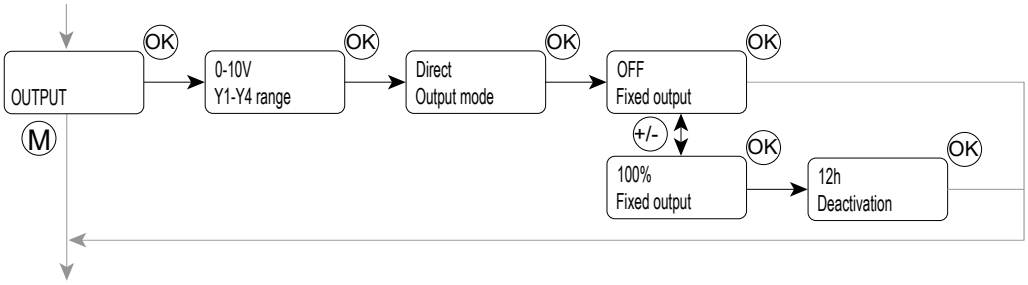


Parameter	Available values	Description
Offset CO2ppm	*-200...200*	CO_2 measurement tuning. The value can be adjusted by 10 ppm steps.
ABC-Logic	*On / Off*	Automatic calibration function (On/Off).
Offset °C	*-3.0...3.0*	Temperature measurement tuning. The value can be adjusted by 0.1 °C steps.
Offset %RH	*-5...5*	Humidity measurement tuning, RH models. The value can be adjusted by 1 % steps.

ML-SER tool display shows how much the current value is tuned. The measured value is shown in brackets after the tuning value.

1.6.2.3 Output menu

You can change the output scaling of all outputs and the controller output direction through the output menu. Also, the fixed controller output value and duration can be selected through the menu.

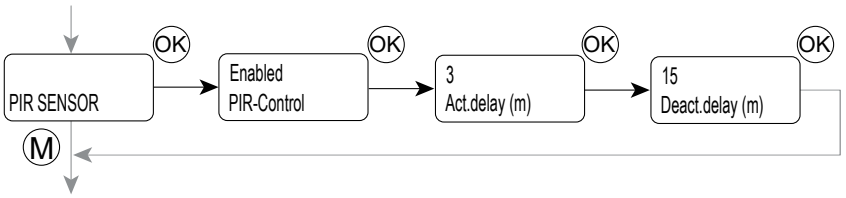


Parameter	Available values	Description
Y1-Y4 range	*0-10V / 2-10V / 0-5V*	Output scaling.

Parameter	Available values	Description
Output mode	*Direct / Reversed*	Controller output direction.
Fixed output	*OFF / 100% / 75% / 50% / 25% / 0%*	Fixed output.
Deactivation	*6h / 12h / 24h / MANUAL*	Fixed output deactivation timer.

1.6.2.4 PIR menu

PIR menu is available in PIR models.

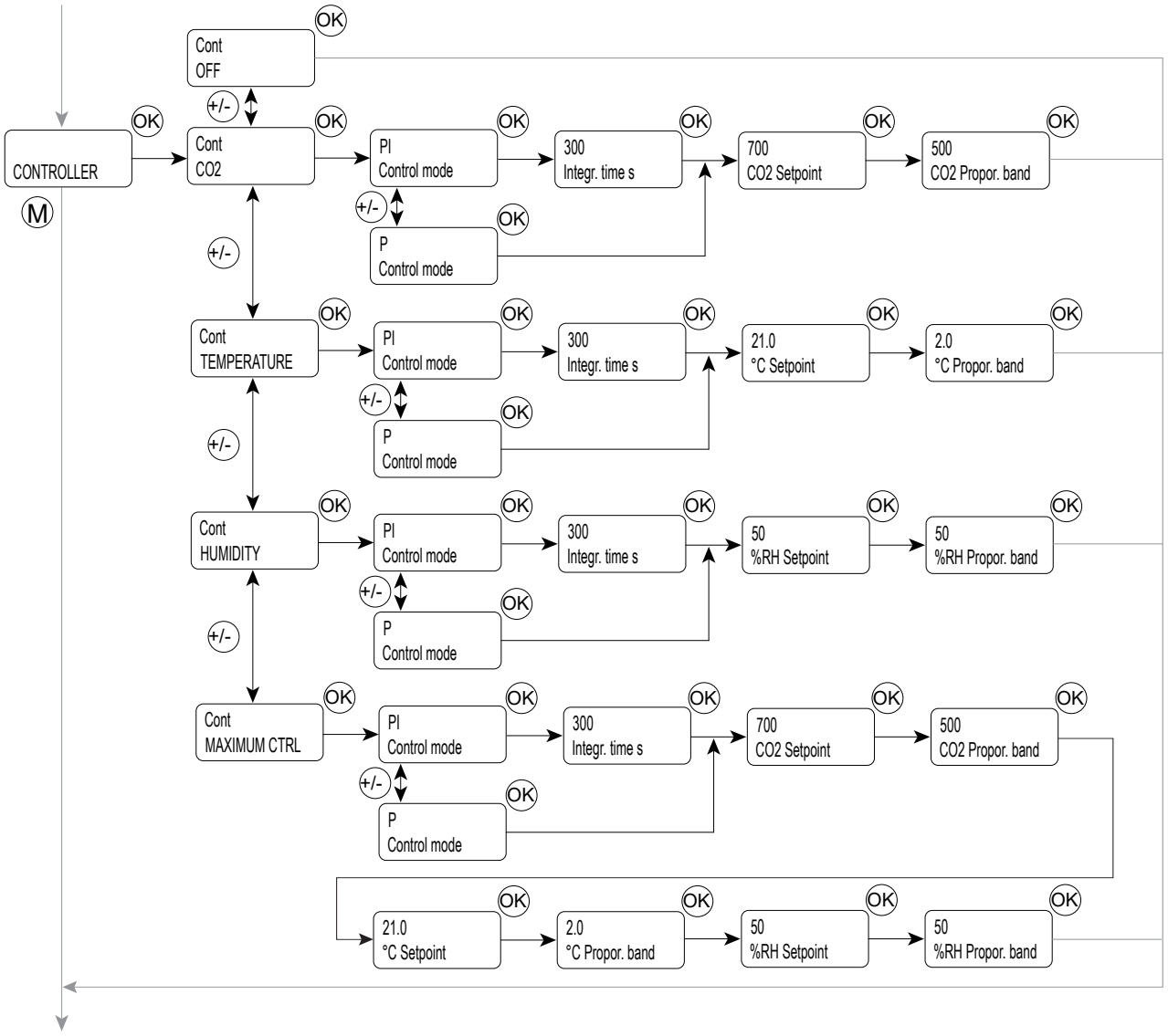


Parameter	Available values	Description
PIR-Control	*Enabled / Disabled*	PIR control. When the parameter value is *Enabled*, the control output works if movement is detected. If movement is not detected, the control output is 0 %.
Act.delay (m)	*0 / 3 / 6 min*	Activation delay.
Deact.delay (m)	*5 / 15 / 30 / 60 / 90 / 120 min*	Deactivation delay.

1.6.2.5 Controller menu

The control output can be controlled either according to a one measurement value or according to the maximum selection of all values.

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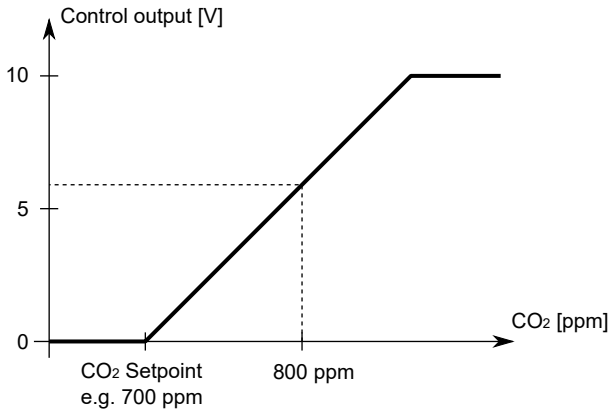


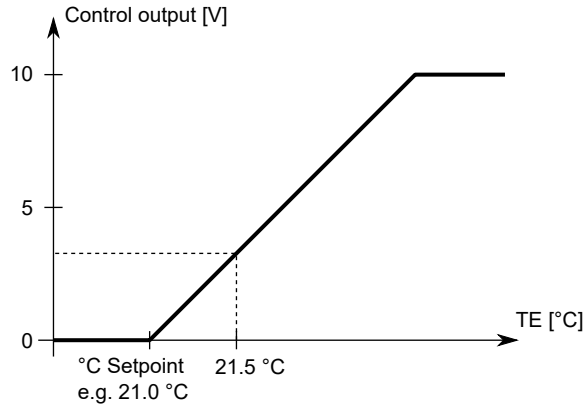
Parameter	Available values	Description
Cont	*OFF / CO2 / TEMPERATURE / HUMIDITY / MAXIMUM CTRL*	Controlled value. *OFF* — Controller off *CO2* — CO_2 *TEMPERATURE* — Temperature *HUMIDITY* — Relative humidity, RH models *MAXIMUM CTRL* — Maximum selection control. See more details after the table.
Control mode	*P / PI*	Control method.
Integr. time s	*50...5000*	Integration time (s).
CO2 Setpoint	*400...10000*	Set point for CO_2 (ppm). The value can be adjusted by 10 ppm steps.
CO2 Propor. band	*100...10000*	Proportional band for CO_2 (ppm). The value can be adjusted by 10 ppm steps.
°C Setpoint	*0...50.0*	Set point for temperature (°C). The value can be adjusted by 0,1 °C steps.
°C Propor. band	*1.0...32.0*	Proportional band for temperature (°C). The value can be adjusted by 0,1 °C steps.

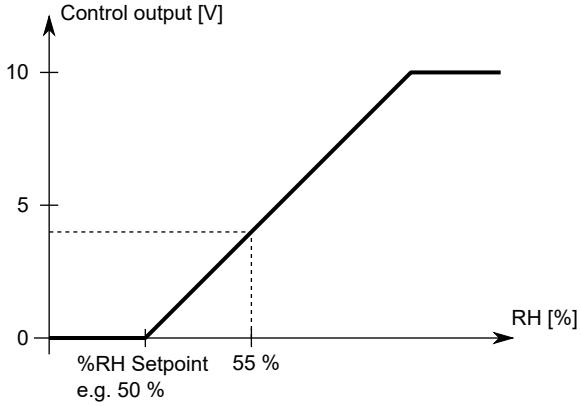
Parameter	Available values	Description
%RH Setpoint	*0...100*	Set point for humidity (%rH), RH models. The value can be adjusted by 5 % steps.
%RH Propor. band	*10...100*	Proportional band for humidity (%rH), RH models. The value can be adjusted by 5 % steps.

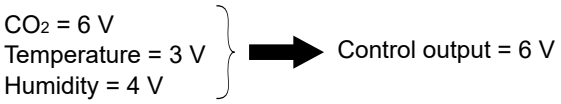
In the maximum selection control, the control output signal is formed according to the measurement that causes the largest control signal value. The following situation is described in the example figure:

- Carbon dioxide concentration is 800 ppm.
- Temperature is 21.5 °C.
- Relative humidity is 55 %.





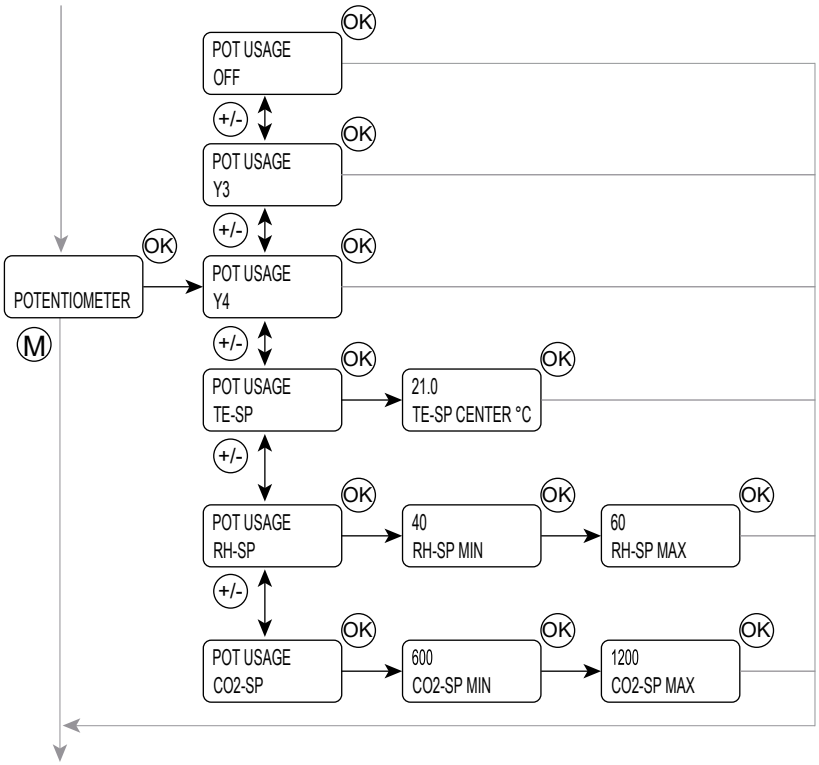




1.6.2.6 Potentiometer menu

Potentiometer menu is available in PU models. You can select the potentiometer output connector and disable the potentiometer through the menu. You can also set the potentiometer for the set point adjustment purposes. The potentiometer is connected to the Y4 output as factory setting.

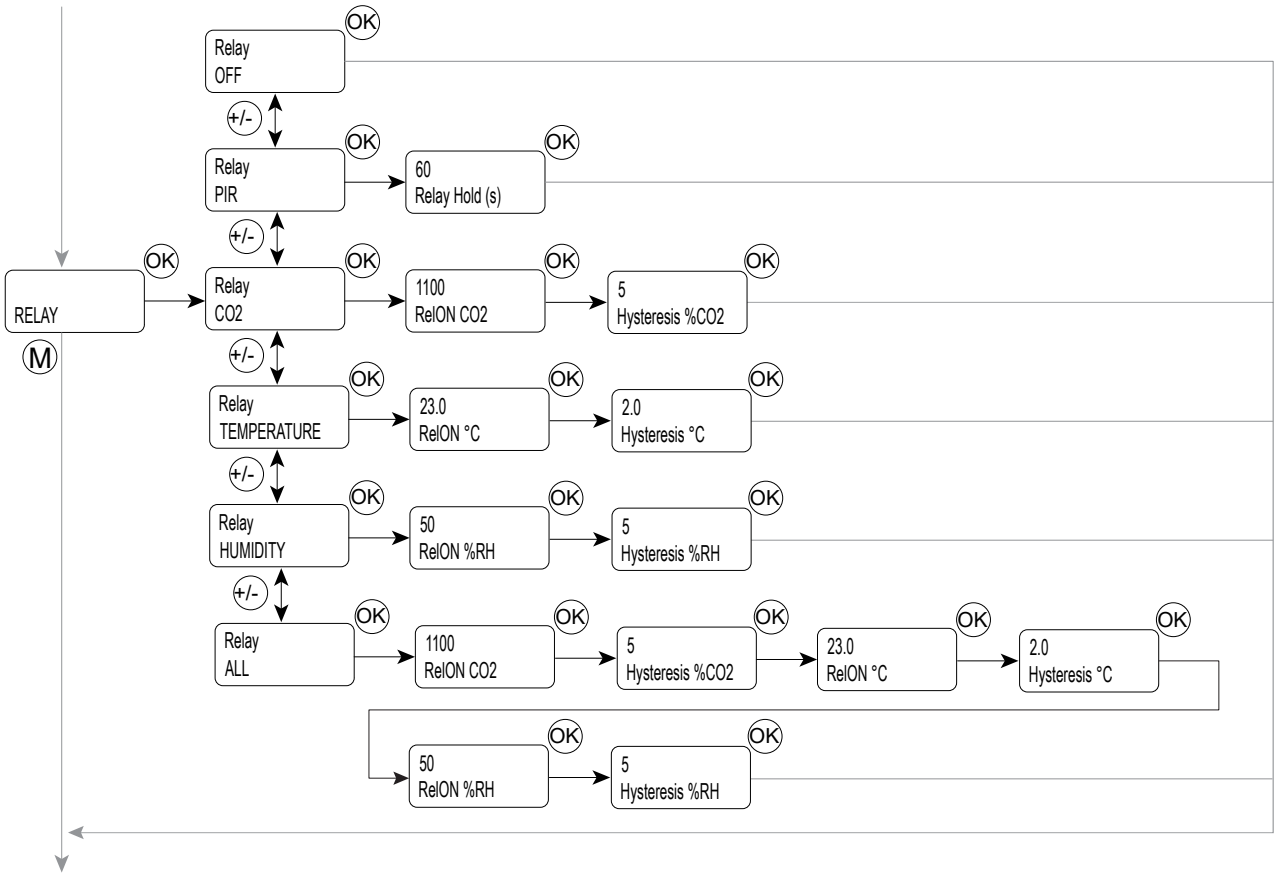
NOTE **Note:** The set point that is adjusted with the potentiometer cannot be adjusted via Modbus.



Parameter	Available values	Description
POT USAGE	*OFF / Y3 / Y4 / TE-SP / RH-SP / CO2-SP*	Controlled value. *OFF* — Potentiometer is not in use. *Y3* — Potentiometer output is Y3. *Y4* — Potentiometer output is Y4. NOTE **Note:** You have to set the controller off, if the potentiometer is configured to Y4 output. *TE-SP* — Potentiometer is used to set the temperature setpoint. The potentiometer adjustment range is ±3 °C around the set point centre. *RH-SP* — Potentiometer is used to set the humidity setpoint. *CO2-SP* — Potentiometer is used to set the CO_2 setpoint.
TE-SP CENTER °C	*10.0...30.0 °C*	Temperature setpoint centre. The value can be adjusted by 0.1 °C steps.
RH-SP MIN	*0...100 %*	Humidity setpoint range, low limit. The value can be adjusted by 5 % steps.
RH-SP MAX	*0...100 %*	Humidity setpoint range, high limit. The value can be adjusted by 5 % steps.
CO2-SP MIN	*400...10000 ppm*	CO_2 setpoint range, low limit. The value can be adjusted by 10 ppm steps.
CO2-SP MAX	*400...10000 ppm*	CO_2 setpoint range, high limit. The value can be adjusted by 10 ppm steps.

1.6.2.7 Relay menu

Relay menu is available in R models. The relay switching point and hysteresis can be changed through the menu.

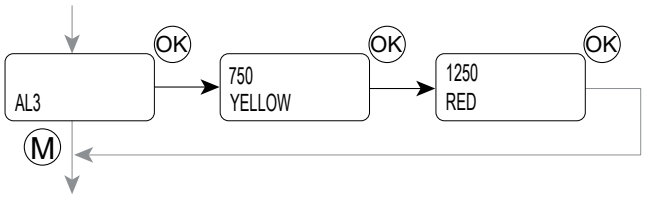


Parameter	Available values	Description
Relay	*OFF / PIR / CO2 / TEMPERATURE / HUMIDITY / ALL*	Relay control value. *OFF* — Relay not in use. *PIR* — Occupancy detection (PIR models) *CO2* — CO_2. *TEMPERATURE* — Temperature. *HUMIDITY* — Relative humidity. *ALL* — All measurement values (not occupancy detection). When the relay is controlled according to the all values, the relay activates when one measured value exceeds the set point.
Relay Hold (s)	*0 / 5 / 60 s*	Relay hold on time.
RelON CO2	*400...10000*	Set point for CO_2 (ppm). The value can be adjusted by 10 ppm steps. NOTE **Note:** The default relay CO_2 set point is 2500 ppm in 10K models.
Hysteresis %CO2	*0...100*	Hysteresis for CO_2 (% from range). The value can be adjusted by 1 % steps.
RelON °C	*0...50.0*	Set point for temperature (°C). The value can be adjusted by 0,1 °C steps.
Hysteresis °C	*0.0...20.0*	Hysteresis for temperature (°C). The value can be adjusted by 0,1 °C steps.
RelON %RH	*0...100*	Set point for humidity (%rH). The value can be adjusted by 5 % steps.
Hysteresis %RH	*0...50*	Hysteresis for humidity (%rH). The value can be adjusted by 1 % steps.

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1.6.2.8 AL3 menu

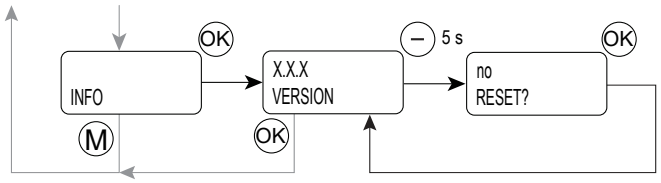
AL3 menu is available in AL3 models. The indicator light limits can be changed through the menu. The hysteresis is 50 ppm.



Parameter	Available values	Description
YELLOW	*400...10000 ppm*	Yellow indicator light illumination point. The value can be adjusted by 10 ppm steps.
RED	*400...10000 ppm*	Red indicator light illumination point. The value can be adjusted by 10 ppm steps.

1.6.2.9 Info menu

You can check the device software version and reset the device to factory settings through the menu.



Parameter	Available values	Description
VERSION	*X.X.X*	Device software version.
RESET?	*no / yes*	Reset to factory settings.

2 Modbus

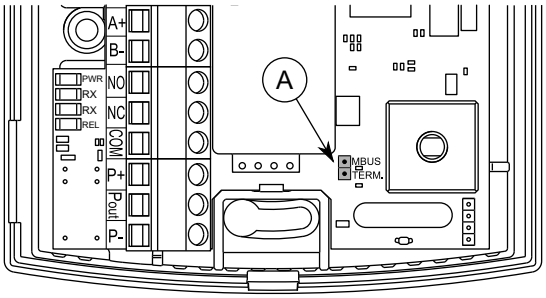
2.1 Modbus properties

Protocol	RS-485 Modbus RTU
Bus speed	9600*/14400/19200/38400/57600/115200 bit/s
Data bits	8
Parity	none*/odd/even
Stop bits	1
Modbus ID	1*
Unit load	1/4 UL
	* factory setting

Important: The non-volatile memory durability is 100000 write cycles.

2.2 Terminating Modbus

1. Open the cover.
2. Place the termination jumper.



A. Termination jumper

2.3 Modbus function codes

The device supports the following Modbus function codes.

Decimal	Hexa-decimal	Function
1	0x01	Read Coils
2	0x02	Read Discrete Inputs
3	0x03	Read Holding Registers
4	0x04	Read Input Registers
5	0x05	Write Single Coil
6	0x06	Write Single Register
15	0x0F	Write Multiple Coils
16	0x10	Write Multiple Registers
23	0x17	Read/Write Multiple Registers

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2.4 Modbus registers

NOTE **Note:** If you try to write a parameter value that is beyond the parameter value range, the value will be replaced by the nearest acceptable value.

Example:

1. The register value range is -500…500.
2. You try to write the value 600 to the register.
3. The value 500 is written to the register.

2.4.1 Coils

Register	Parameter description	Data type	Values	Range	Default
1	Y1 output overdrive activation	Bit	0 - 1	0. Off 1. On	0
2	Y2 output overdrive activation	Bit	0 - 1	0. Off 1. On	0
3	Y3 output overdrive activation	Bit	0 - 1	0. Off 1. On	0
4	Y4 output overdrive activation	Bit	0 - 1	0. Off 1. On	0
5	Relay overdrive activation	Bit	0 - 1	0. Off 1. On	0
6	Relay overdrive	Bit	0 - 1	0. Off 1. On	0
7	Controller output direction	Bit	0 - 1	0. Direct 1. Reversed	0
8	PIR controller	Bit	0 - 1	0. Disabled 1. Enabled	1

2.4.2 Discrete inputs

Register	Parameter description	Data type	Values	Range
10001	Relay status	Bit	0 - 1	0. Off 1. On
10002	PIR sensor state (immediate)	Bit	0 - 1	0. No detection 1. Detection
10003	PIR sensor state (control)	Bit	0 - 1	0. Off 1. On

2.4.3 Input registers

Register	Parameter description	Data type	Values	Range
30001	CO_2 measurement	S16	400...10000	400...10000 ppm
30002	Temperature measurement	S16	0...500	0.0...50.0 °C
30003	Humidity measurement	S16	0...100	0...100 %rH
30004	Y1 output voltage	U16	0...1000	0.00…10.00 V

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Register	Parameter description	Data type	Values	Range
30005	Y2 output voltage	U16	0...1000	0.00…10.00 V
30006	Y3 output voltage	U16	0...1000	0.00…10.00 V
30007	Y4 output voltage	U16	0...1000	0.00…10.00 V
30008	Active potentiometer value	U16	0...1000	0.00…10.00 V
30009	Active potentiometer setpoint value	U16	variable	variable

2.4.4 Holding registers

Register	Parameter description	Data type	Values	Range	Default
40001	Y1 output overdrive	S16	0...1000	0...10.00 V	0
40002	Y2 output overdrive	S16	0...1000	0...10.00 V	0
40003	Y3 output overdrive	S16	0...1000	0...10.00 V	0
40004	Y4 output overdrive	S16	0...1000	0...10.00 V	0
40005	CO_2 measurement tuning (offset)	S16	-200...200	-200...200 ppm	0
40006	Temperature measurement tuning (offset)	S16	-30...30	-3.0...3.0 °C	0
40007	Humidity measurement tuning (offset)	S16	-5...5	-5...5 %rH	0
40008	Control method	S16	0 - 1	0. P 1. PI	1
40009	Controller output	S16	0 - 1 - 2 - 3 - 4	0. Off 1. CO_2 2. Temperature 3. Humidity 4. Maximum selection	1 [1)]
40010	Set point, CO_2	S16	400...10000	400...10000 ppm	700
40011	Set point, temperature	S16	0...500	0.0...50.0 °C	210
40012	Set point, humidity	S16	0...100	0...100 %rH	50
40013	Proportional band, CO_2	S16	100...10000	100...10000 ppm	500
40014	Proportional band, temperature	S16	10...320	1.0...32.0 °C	20
40015	Proportional band, humidity	S16	10...100	10...100 %rH	50
40016	Integration time	S16	50…5000	50…5000 s	300
40017	Active potentiometer usage	S16	0 - 1 - 2 - 3 - 4 - 5	0. Off 1. Y3 2. Y4 3. Temperature setpoint 4. Humidity setpoint 5. CO_2 setpoint	1 [1)]
40018	Relay set point, CO_2	S16	400...10000	400...10000 ppm	1100 [2)]
40019	Relay hysteresis, CO_2	S16	0...100	0...100 %	5
40020	Yellow indicator light illumination point	S16	400...10000	400...10000 ppm	750
40021	Red indicator light illumination point	S16	400...10000	400...10000 ppm	1250

Register	Parameter description	Data type	Values	Range	Default
40022	Value shown on the display	S16	0 - 1 - 2 - 3	0. CO_2 1. Temperature 2. Humidity 3. Scrolling	3
40023	Not in use	S16	-	-	1
40024	Not in use	S16	-	-	0
40025	Relay set point, temperature	S16	0...500	0.0...50.0 °C	230
40026	Relay hysteresis, temperature	S16	0...200	0.0...20.0 °C	20
40027	Relay set point, humidity	S16	0...100	0...100 %rH	50
40028	Relay hysteresis, humidity	S16	0...50	0...50 %rH	5
40029	Relay function	S16	0 - 1 - 2 - 3 - 4 PIR models: 0 - 1 - 2 - 3 - 4 - 5	0. Off 1. CO_2 2. Temperature 3. Humidity 4. CO_2, temperature, humidity PIR models: 0. Off 1. PIR 2. CO_2 3. Temperature 4. Humidity 5. CO_2, temperature, humidity	1
40030	Potentiometer temperature setpoint centre	S16	100...300	10.0...30.0 °C	210
40031	Potentiometer humidity setpoint low limit	S16	0...100	0...100 %	40
40032	Potentiometer humidity setpoint high limit	S16	0...100	0...100 %	60
40033	Potentiometer CO_2 setpoint low limit	S16	400...10000	400...10000 ppm	600
40034	Potentiometer CO_2 setpoint high limit	S16	400...10000	400...10000 ppm	1200
40035	PIR activation delay	S16	0 - 1 - 2	0. 0 min 1. 3 min 2. 6 min	1
40036	PIR deactivation delay	S16	0 - 1 - 2 - 3 - 4 - 5	0. 5 min 1. 15 min 2. 30 min 3. 60 min 4. 90 min 5. 120 min	1
40037	Relay hold time in movement detection	S16	0 - 1 - 2	0. 0 s 1. 5 s 2. 60 s	2

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Regis-ter	Parameter description	Data type	Values	Range	Default
40038	Y1…Y4 output range	S16	0 - 1 - 2	0. 0...10 V 1. 2...10 V 2. 0...5 V	0
40039	Fixed control output	S16	0 - 1 - 2 - 3 - 4 - 5	0. Off 1. 100 % 2. 75 % 3. 50 % 4. 25 % 5. 0 %	0
40040	Fixed control output timer	S16	0 - 1 - 2 - 3	0. 6 h 1. 12 h 2. 24 h 3. Manual	1

[1] In RH models the register 40009 default value is 0 and register 40017 default value is 2.

[2] The default relay CO_2 set point is 2500 ppm in 10K models.

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