

AMR-OP70C/xx

Programmable on-wall controller

Operation manual

Version 1.02



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History of revisions

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Version	Date	Autor of change	Changes
100	24. 02. 2016	Březina Jiří	New document
101	21. 04. 2016	Říha Zbyněk	Added information about manual calibration, changes to chapter 7, pictures.
102	23. 05. 2016	Říha Zbyněk	Added information about acoustic warning into chapter 2. Added available colour designs into chapter Completion.

Related documentation

1. Help file for EsiDet part of DetStudio development environment
file: Esidet_en.chm
2. **AMR-OP70C/xx** – Programmable on-wall controller – Datasheet
file: amr-op70cxx_d_en_xxx.pdf
3. Application Note AP0016 – Principles of using RS485 interface
file: ap0016_en_xx.pdf

1. Introduction

AMR-OP70C/xx is a programmable on-wall controller. It is connected to the superior control system via RS485 line. The whole display area consists of touch panel which serves for on-wall controller operation.

- Basic features**
- Measurement of room temperature
 - Measurement of CO₂ concentration
 - Acoustic warning
 - Periodical automatic CO₂ sensor re-calibration
 - Manual CO₂ sensor calibration from configuration menu
 - FSTN display with (64 × 132) resolution
 - Touchscreen operated
 - RS485 line without galvanic isolation
 - Power supply 24 V DC
 - Programming in DetStudio development environment / EsiDet
 - MODBUS or ARION communication protocol
 - Software selection of different control methods
 - Variant 1 – Room mode
 - Variant 2 – Room mode + fan mode
 - Variant 3 – Room mode + bistable switch

2. Technical parameters

Processor	Type	STM32F103RE
	FLASH	512 kB
	SRAM	64 kB
	EEPROM	2 kB

Display	Type	FSTN/positive/BW
	Resolution	(64 × 132) pixels
	Visible area	(38 × 58) mm
	Viewing angle	90 °
	Backlight	LED
	Backlight colour	White
	Backlight lifetime	Min. 50 000 hours ¹⁾

Note ¹⁾ Luminance drop to 50 %.

Touch panel	Type	Resistive
	Number of touches	10 ⁶
	Touching strength	10 g to 100 g
	Hardness	≥ 3 H

Note Touch panel is intended to be operated by finger, tool without sharp edges or by finger-in-glove.

Temperature sensor	Type	Semiconductor sensor
	Measuring range	-55 °C to +125 °C ¹⁾
	Resolution	12 bit
	Accuracy	±2 °C (-55 °C to 0 °C) ±0.5 °C (0 °C to 50 °C) ±2 °C (50 °C to 125 °C)
	Device temperating	45 min ²⁾

Note ¹⁾ Thermal sensor parameters. Operating temperature range of on-wall controller is lower.

²⁾ Time since turning on, during this time, the accuracy of measurement is reduced to ±2 °C.

CO₂ sensor	Type	NDIR
	Measuring range	400 ppm to 3000 ppm
	Accuracy	±150 ppm ¹⁾
	Device temperating	15 s ²⁾

Note ¹⁾ Accuracy is reached after finishing at least 3 automatic calibration cycles (hereinafter referred to as ACDL cycles). First calibration cycle after turning the device on takes 3 days, each following calibration cycle takes 7 days. The area must be ventilated during each calibration cycle, so the concentration of CO₂ reaches cca 400 ppm, which corresponds with the concentration of CO₂ in open space.

²⁾ Time since turning on, during this time, the unit displays CO₂ value of 0 ppm.

Acoustic signalization	Type	Piezo buzzer ¹⁾
-------------------------------	------	----------------------------

Note ¹⁾ Controlled from user application (volume, frequency).

RS485	Overvoltage protection	Transil 600 W
	Galvanic isolation	No
	Terminating resistor ¹⁾	120 Ω on the unit
	Idle state definition ¹⁾ – to +5 V – to 0 V	820 Ω on the unit
		820 Ω on the unit
	Maximum wire length	1200 m / 19200 bps
	Max. number of stations on segment	256
	Connection point	CHF5/2 terminal
Wire cross section	0.75 mm ² to 2.5 mm ²	

Note ¹⁾ Terminating resistor and idle state definition are connected concurrently.

Power supply	Nominal power supply voltage	24 V DC
	Power supply voltage range	10 V DC to 30 V DC
	Maximum power consumption	40 mA at 24 V DC
	Connection point	CHF5/2 terminal
	Wire cross section	0.75 mm ² to 2.5 mm ²

Mechanics	Mechanical design	Plastic cover, ABS	
	Mounting	Vertical (on the wall)	
	Ingress protection rate	IP20	
	Dimensions (w × h × d)	(90 × 90 × 31.8) mm	
	Weight	– netto	0.10 kg ±5 %
		– brutto	0.12 kg ±5 %

Temperatures	Operating temperature range	-10 °C to 50 °C
	Storage temperature range	-20 °C to 70 °C

Others	Maximum ambient humidity	< 95 % non-condensing
	Programming	DetStudio / EsiDet
	Communication protocol	ARION / MODBUS
	Max. number of stations on network	63 ARION / 247 MODBUS

2.1. Dimensions

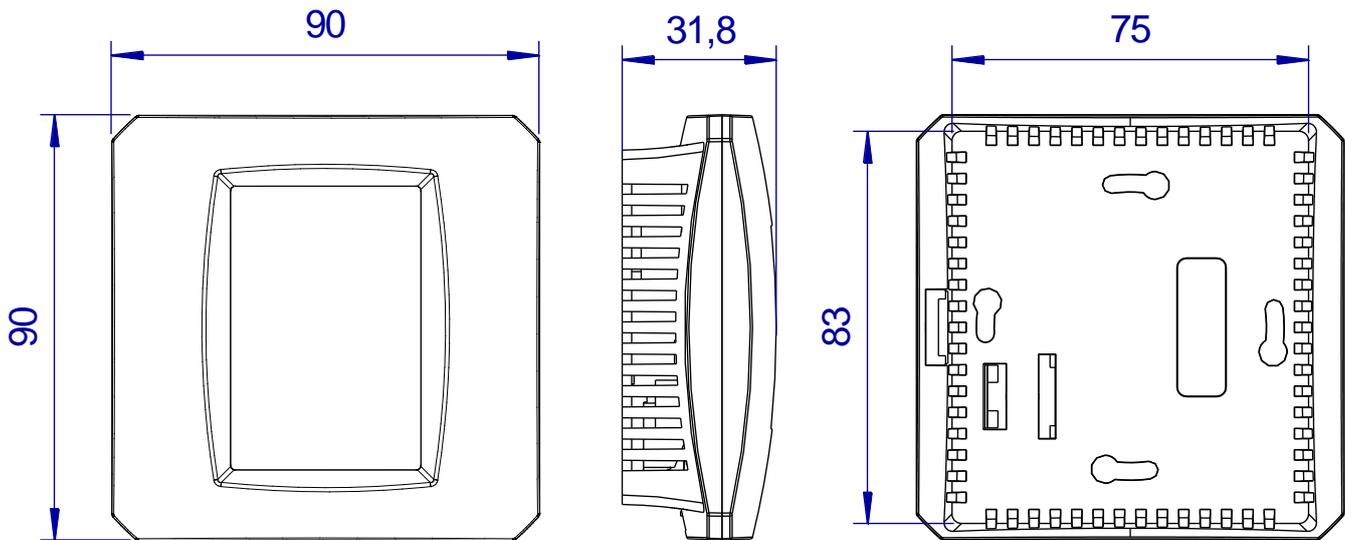


Fig. 1 - **AMR-OP70C/xx** dimensions

2.2. Recommended drawing symbol

Following drawing symbol is recommended for **AMR-OP70C/xx** on-wall controller.

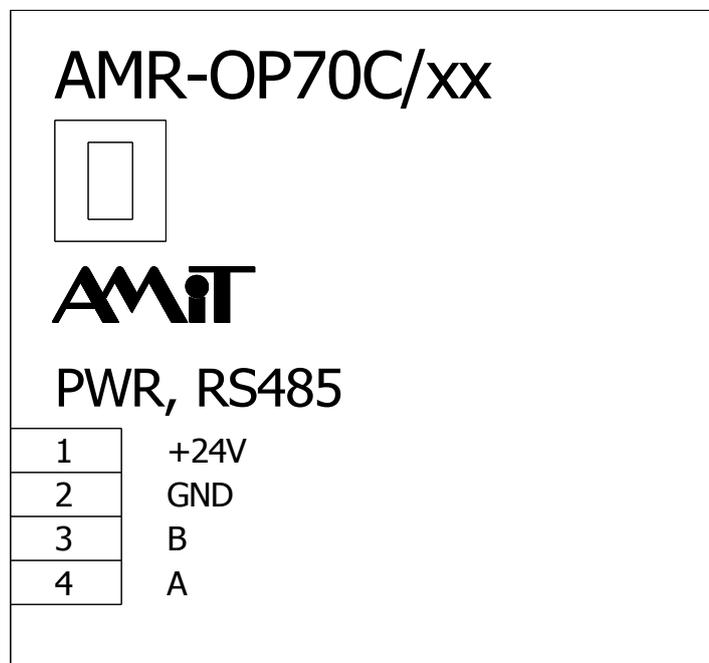


Fig. 2 - Recommended drawing symbol for **AMR-OP70C/xx**

3. Conformity assessment

The equipment meets the requirements of NV616/2006 Czech governmental decree. The compliance assessment with NV616/2006 has been performed in accordance with harmonized standard EN 61326-1.

Tested in accordance with standard	Type of test	Classification
EN 55011:2009	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	Complies
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: EMC – Testing and measurement techniques – Electrostatic discharge immunity test	Complies (±8 kV)
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test, 800 MHz to 1000 MHz	Complies (10 V/m)
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test, 1000 MHz to 2100 MHz	Complies (3 V/m)
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test, 2100 MHz to 2500 MHz	Complies (1 V/m)
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, power supply	Complies (±2 kV)
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, RS485	Complies (±2 kV)
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, power supply	Complies (±2 kV)
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, RS485	Complies (±1 kV)
EN 61000-4-6:2009	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields	Complies (3 V)

3.1. Other tests

Device was tested according to:

Tested in accordance with standard	Type of test	Result
EN 60068-2-1:2007	Environmental testing – Part 2-1: Tests – Test A: Cold	Complies
EN 60068-2-2:2007	Environmental testing – Part 2-2: Tests – Test B: Dry heat	Complies
EN 61000-4-29:2000	Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port – Immunity test	Complies

4. Power supply and RS485 communication line

Power supply On wall controller **AMR-OP70C/XX** can be powered only by DC power supply. Power supply must meet requirements listed in chapter 2. Technical parameters.

RS485 line The RS485 interface without galvanic isolation uses the common GND terminal together with power supply. For proper working of RS485 is necessary to abide the rules presented in Application Note *AP0016 – Principles of using RS485 interface*.

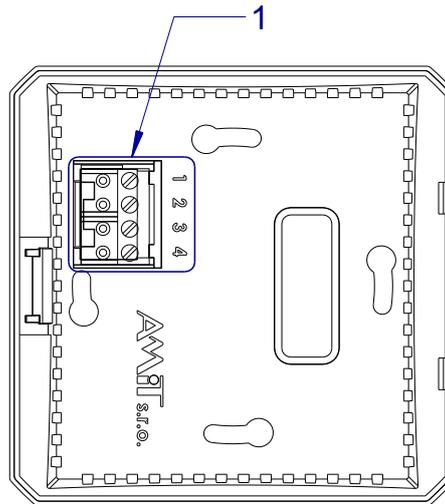


Fig. 3 - Power supply connector location

Legend	Number	Description
	1	Power supply and RS485 line terminals

Terminal wiring	Terminal	Signal	Description
	1	+24V	Power supply +24 V DC
	2	GND	Common ground
	3	B	RS485 line, signal B
	4	A	RS485 line, signal A

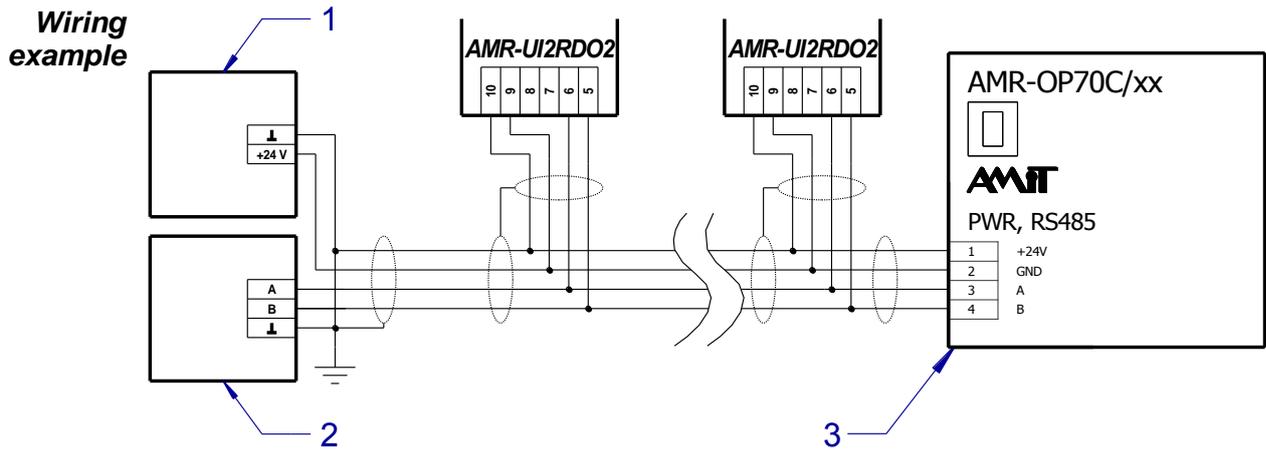


Fig. 4 - Power supply and RS485 wiring

Number	Description
1	Power supply 24 V DC
2	Superior control system
3	Programmable on-wall controller AMR-OP70C/xx

RS485 line termination Each station on RS485 communication line must have properly set the line termination. Configuration jumpers located near the connector are used for connection termination. When jumpers are fitted, line termination is connected. Line terminating stations must have the termination always connected, intermediate stations – disconnected.

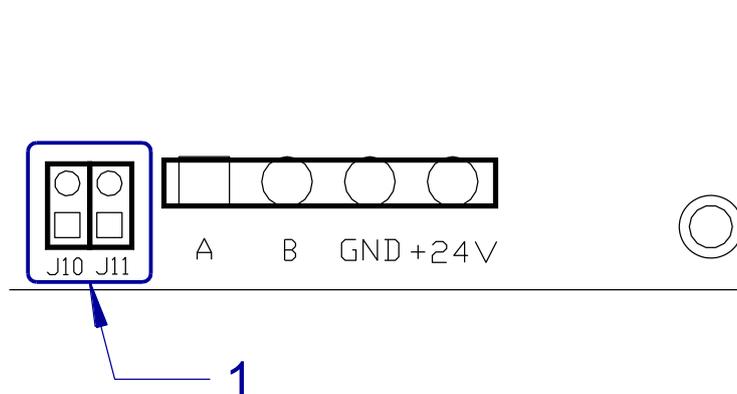


Fig. 5 - RS485 configuration jumpers location

Number	Description
1	RS485 configuration jumpers

Jumpers description	Jumpers	Description
	Are set	End-station – idle states and line termination is active.
	Are not set	Intermediate-station – idle states and line termination is inactive.

Note We recommend to use structured cabling for power supply and RS485 wiring. For power connection, we recommend to use one pair of wires for positive

terminal, and second pair for negative terminal. Cable shielding must be connected in single point to PE terminal on the side of the power supply source.

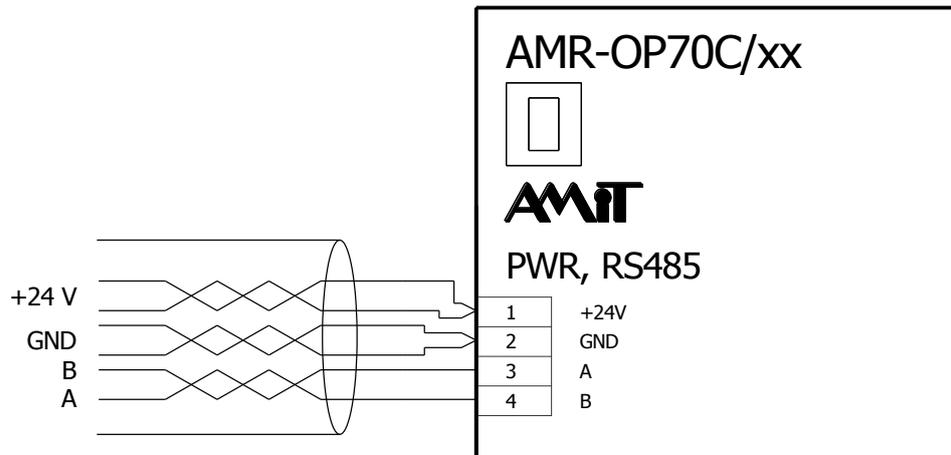


Fig. 6 - Example of structured cabling usage

5. Mounting

On-wall controller is intended to be mounted in internal, dry environment. Should be placed around 1.5 m above the floor, in an area with good and innate air circulation. Controller should not be placed in area, where its temperature can be affected by the wind, sunshine, heat radiation from the heater, or other undesirable influences. If the inlet wires are led through the plastic pipe, it is necessary to seal the pipe to avoid air flow.

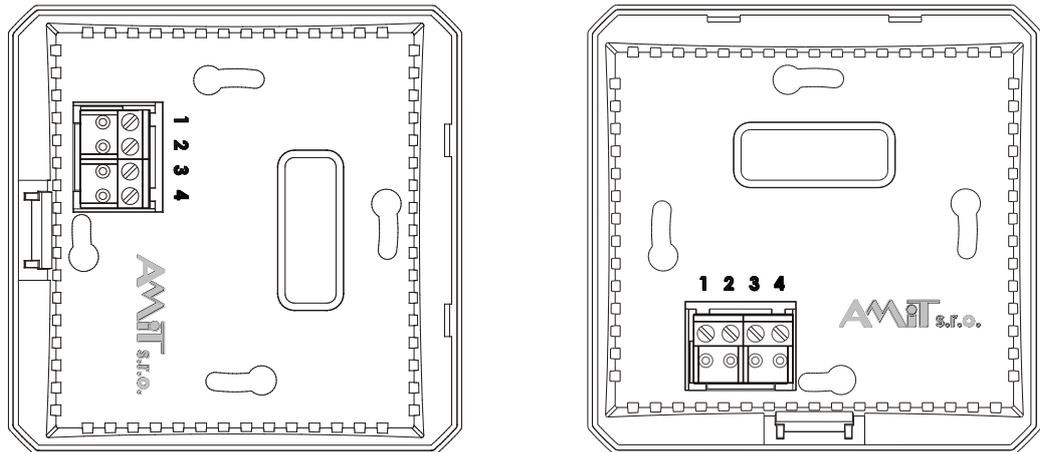


Fig. 7 - On-wall controller mounting in vertical position (left), in horizontal position (right)

Vertical mounting On-wall controller is mounted according to Fig. 7 - left. Temperature sensor is located in the bottom left corner.

Horizontal mounting On-wall controller is mounted according to Fig. 7 - right. Temperature sensor is located in the bottom right corner.

Note **Factory uploded application requires vertical mount.**

In case of incorrect mounting, temperature sensor is affected by the heat radiated by the electronics of the controller, that results in incorrect temperature readings.

5.1. Mounting procedure

1. Release the cover by pressing a latch on the on-wall controller's left side (for example, with a screwdriver or a blunt-tip). Then take off on-wall controller front part.

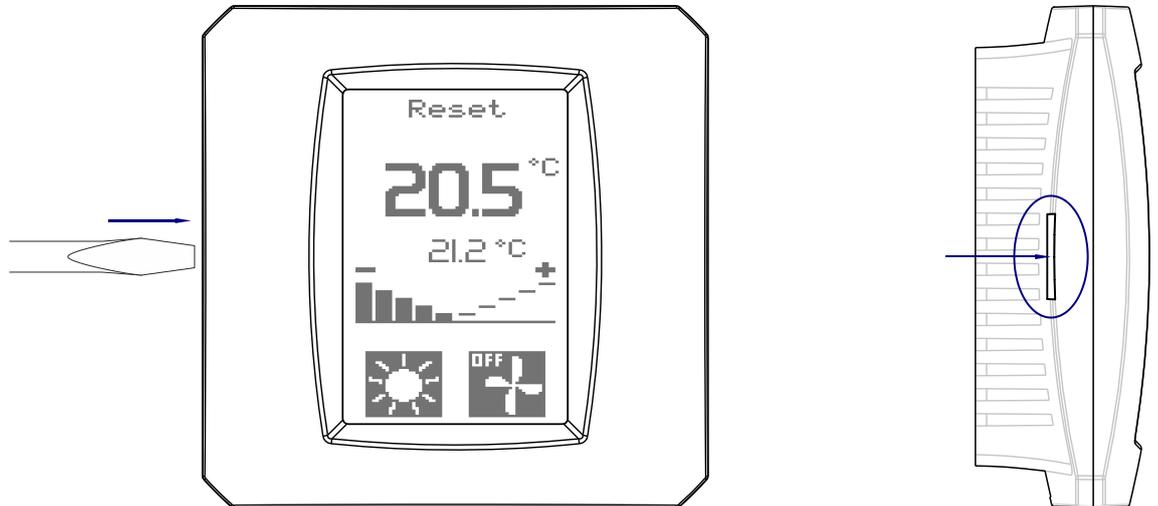


Fig. 8 - Place that must be pressed with blunt-tip

2. Mount rear cover on a selected location. There are two pairs of mounting holes available.
3. Connect the communication and power supply wiring (according to chapter 4. Power supply and RS485 communication line).
4. Set the configuration jumpers (according to chapter 4. Power supply and RS485 communication line).
5. Put the upper part on a rear cover and press gently until the latch clicks.

5.2. Installation rules

EMC filter Use EMC filter on power supply input. This requirement can be revised based on the environment nature, power source properties and wiring layout.

Cabling design Cabling connected to the power supply and RS485 communication line terminals must be shielded.

Connecting to PE Connect negative power supply terminal (GND) and cable shielding to PE terminal in one place, close to power supply.

RS485 line It is necessary to perform connection of RS485 line according to recommendations presented in Application Note *AP0016 – Principles of using RS485 interface*.

Note All PE connections must be done with as lowest impedance as possible. Technical parameters of on-wall controller are guaranteed only when these wiring rules are applied.

6. Setup and operation of on-wall controller

On-wall controller has several working screens.

- Basic is displayed all time.
- User menu is displayed by touching on a particular area of a display.
- Configuration menu is displayed by touching continuously on a particular area of a display.
- Screen saver if allowed, it will be displayed after pre-set time of controller inactivity.

6.1. Basic screen

The design of basic screen depends on application variant setting and on mode of displaying measured values settings. Application variant is set by the service organization, during on-wall controller instalation. Mode of displaying measured values can be set in configuration menu. Part of the basic screen is same for all variants, part depends on selected variant

Common icons

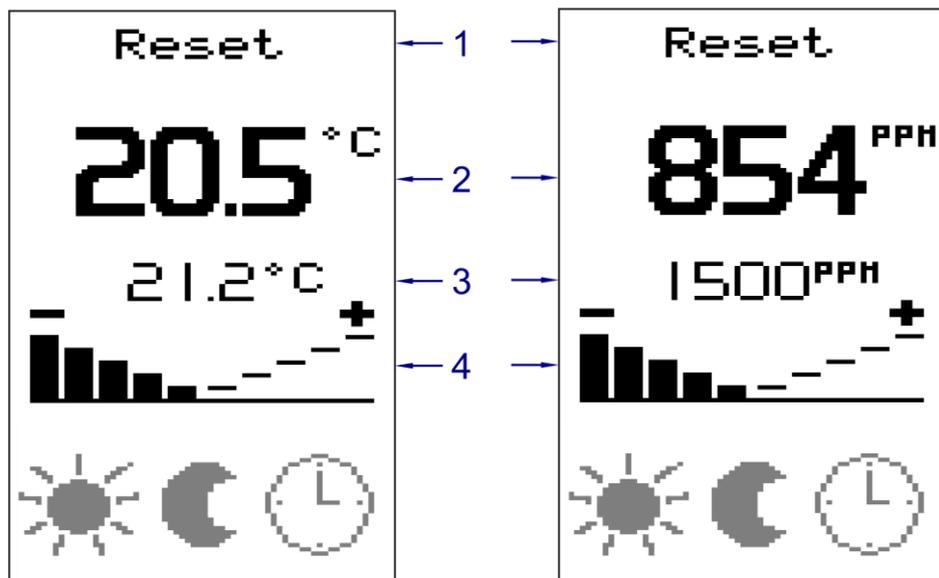


Fig. 9 - Common icons

Legend

Number	Description
1	Status bar
2	Measured temperature / measured CO ₂ value
3	Requested temperature / CO ₂ value for acoustic warning
4	Correction of required temperature

Status bar



Fig. 10 - Status bar

Following data is displayed:

Status	Description
Reset	Controller was restarted. No communication took place since the restart.
Error	Communication error. Time longer than Guard Time elapsed since last communication
Menu	Flawless operation of the unit.

Measured temperature



Fig. 11 - Measured temperature

Display of measured temperature depends on the mode of displaying measured values settings in configuration menu (according to chapter 6.3.3 Sensors).

Requested temperature



Fig. 12 - Requested temperature.

The value of requested temperature is being sent by superior control system. Change hyphens are displayed during correction, until new requested value is received from the superior control system. Value can be displayed with the delay of several seconds.

Correction bar graph



Fig. 13 - Correction of required temperature

Bar graph is displayed only in Auto room mode. It is not displayed in other modes (Energy saving and Comfort).

Desired temperature correction value is changed to plus or minus by pressing left or right side of the bar graph. After each correction change, hyphens are displayed instead of requested temperature, until new requested temperature value is received from the superior control system.

Measured CO₂ concentration

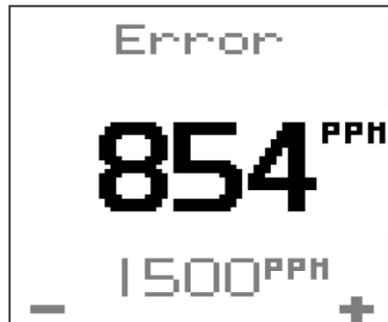


Fig. 14 - Measured CO₂ concentration

Display of measured temperature depends on the mode of displaying measured value settings in configuration menu (according to chapter 6.3.3 Sensors).

CO₂ concentration for acoustic warning



Fig. 15 - CO₂ concentration for acoustic warning

CO₂ concentration for warning can be set in configuration menu (according to chapter 6.3.3 Sensors), or can be sent from superior system.

Mode icons Mode icons depend on application.

Variant 1

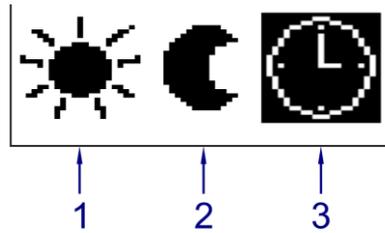


Fig. 16 - Icon for mode variant 1

Legend

Number	Description
1	Comfort mode
2	Energy saving mode
3	Auto mode

Three icons are displayed for room mode. Highlighted icon indicates selected room mode. Mode is activated by pressing particular icon.

Icon	Mode	Description
	Comfort	Is regulated to constant (comfort) temperature.
	Energy saving	Is regulated to constant (energy saving) temperature.
	Auto	Is regulated according to time plan, adjusted by correction value.

Variant 2

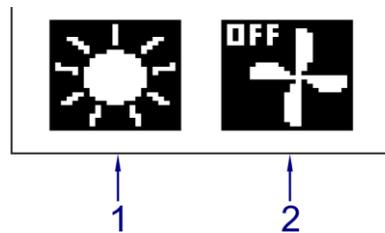


Fig. 17 - Icon for mode variant 2

Legend

Number	Description
1	Room mode
2	Fan mode

Icon for ventilation and room mode is displayed. By pressing the room mode icon you can switch between three states.

Icon	Mode	Description
	Comfort	Is regulated to constant (comfort) temperature.
	Energy saving	Is regulated to constant (power saving) temperature.
	Auto	Is regulated according to time plan, adjusted by correction value.

By pressing the ventilation icon you can switch between five states.

Icon	Mode	Description
	OFF	Fan is off.
	Auto	Fan is controlled automatically.
	Speed 1	Fan speed is set to level 1.
	Speed 2	Fan speed is set to level 2.
	Speed 3	Fan speed is set to level 3.

Variant 3

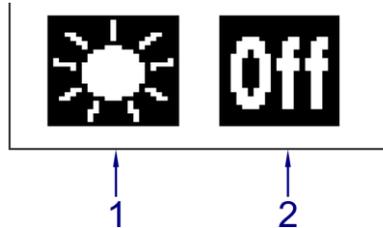


Fig. 18 - Icon for mode variant 3

Legend

Number	Description
1	Room mode
2	Switch

Room mode icon and power off icon are displayed. By pressing the room mode icon you can switch between three states.

Icon	Mode	Description
	Comfort	Is regulated to constant (comfort) temperature.
	Energy saving	Is regulated to constant (energy saving) temperature.
	Auto	Is regulated according to time plan, adjusted by correction value.

By pressing the power off icon you can switch between two states.

Icon	Mode	Description
	Off	Switch is off.
	On	Switch is on.

6.2. User menu

User menu is called out by pressing the area shown below.

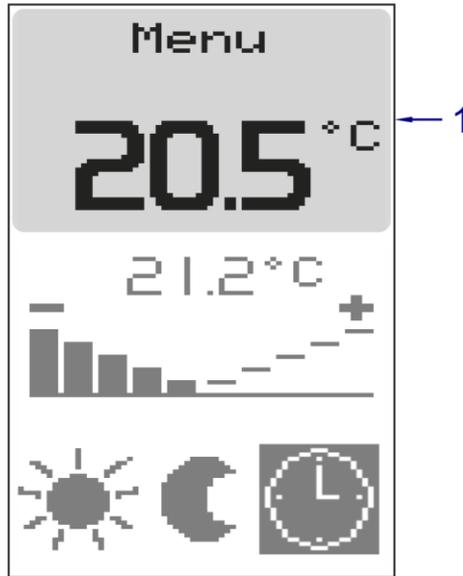


Fig. 19 - Calling user menu

Legend

Number	Description
1	Area for pressing

Menu items



Fig. 20 - User menu items

Legend

Number	Description
1	Brightness adjustment
2	Contrast adjustment
3	Language selection
4	Screen saver setting
5	Firmware version
6	Return back

Brightness Item **Brightness** allows to set the display's brightness.

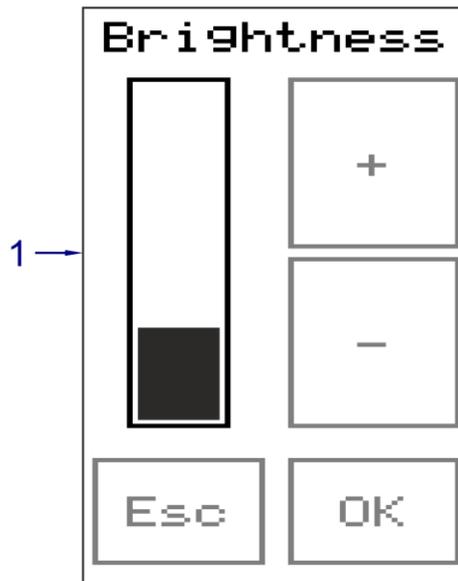


Fig. 21 - Brightness adjustment

Legend

Number	Description
1	Set level of brightness

Contrast Item **Contrast** allows to set the display's contrast.

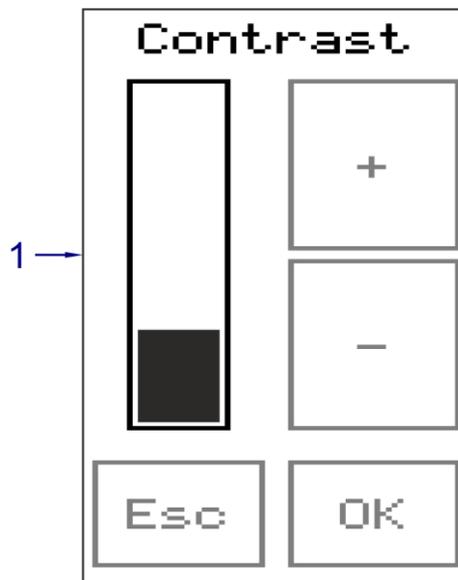


Fig. 22 - Contrast adjustment

Legend

Number	Description
1	Set level of contrast

Language Item **Language** allows to switch between Czech and English texts on the on-wall controller.



Fig. 23 - Language selection

Legend

Number	Description
1	Language selection

Display Item **Display** allows to set screen saver time delay.

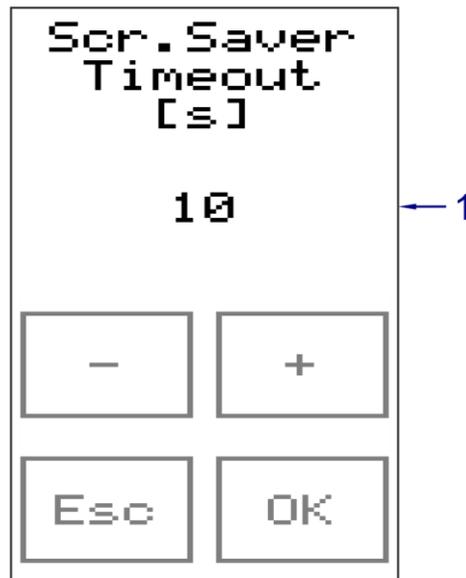


Fig. 24 - Setting time for screen saver activation

Legend

Number	Description
1	Time set for screen saver activation [s]

Following values can be set:

Value	Description
-1	Screensaver is off.
10 to 120	Screen saver time delay in seconds.

Help Item **Help** allows to display the actual version of application software loaded into the on-wall controller.



Fig. 25 - Firmware version

Legend

Number	Description
1	Return back to user menu

Return Item **Return** allows to return to the basic screen of on-wall controller.

6.3. Configuration menu

Configuration menu can be displayed by a long press for at least 10 seconds on the area shown below.

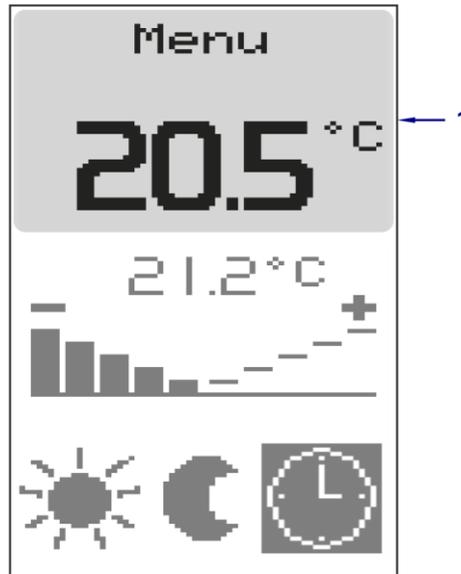


Fig. 26 - Calling configuration menu

Legend

Number	Description
1	Area for touching

Caution Setting of on-wall controller (software and hardware) should be performed strictly by the service company. Wrong configuration settings could result in a controller malfunction.

Menu items

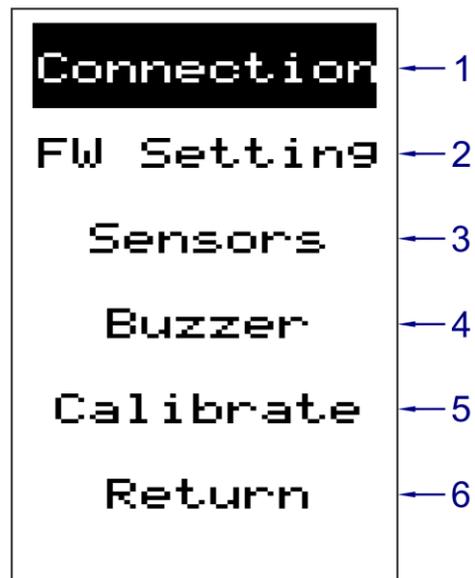


Fig. 27 - Configuration menu items

Legend

Number	Description
1	Communication settings
2	Variant selection
3	Settings of temperature and CO ₂ sensors
4	Setting of acoustic signalization
5	Calibration
6	Return back

6.3.1 Connection

Item **Connection** allows to set communication parameters of **AMR-OP70C/xx** communication parameters can be set via the **Connection** item.

Menu items

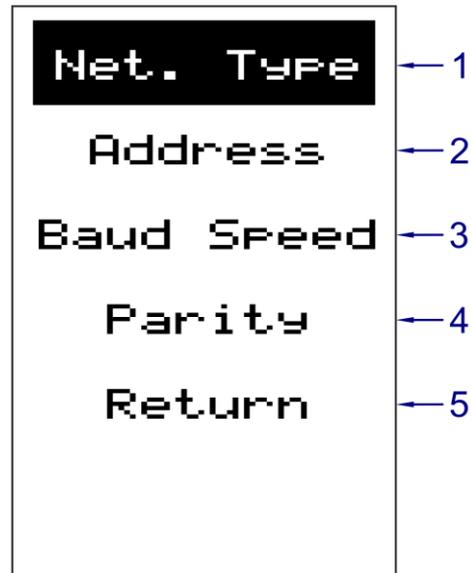


Fig. 28 - Menu with communication settings

Legend

Number	Description
1	Protocol selection
2	Address setting
3	Speed setting
4	Parity setting (only for MODBUS protocol)
5	Return back

Net. Type Item **Net. Type** allows to select one of the two communication protocols:

- ARION,
- MODBUS.

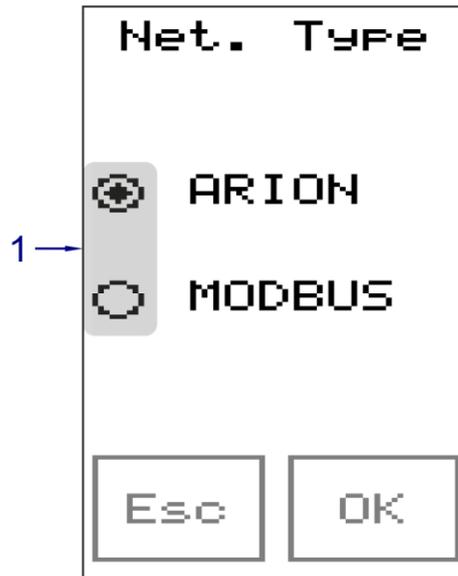


Fig. 29 - Communication protocol selection

Legend

Number	Description
1	Protocol selection

- Address** Item **Address** allows to set the address within selected communication network. Each unit must have unique address. Allowed address range is:
- 1 to 63 (ARION),
 - 1 to 247 (MODBUS).

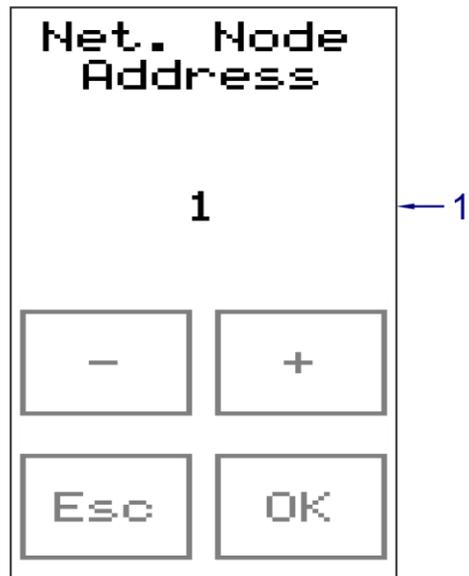


Fig. 30 - Address setting

Legend

Number	Description
1	Set address

Baud Speed Item **Baud Speed** allows to set the connection speed within selected communication network. All devices connected to the network must be set on same communication speed (according to communication speed of the superior control system).

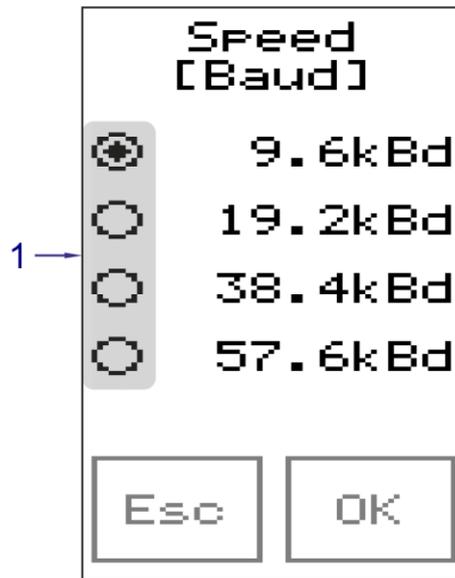


Fig. 31 - Setting connection speed

Legend

Number	Description
1	Selection of speed

Parity Item **Parity** allows to set the parity settings and is relevant only when the MODBUS communication protocol is chosen.

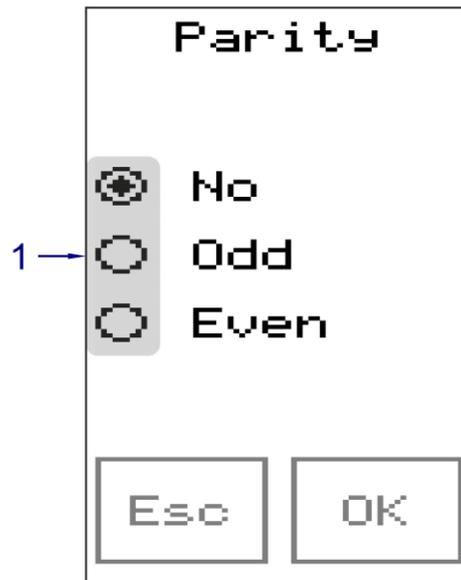


Fig. 32 - Setting parity for MODBUS protocol

Legend

Number	Description
1	Selection of parity

Return To return to configuration menu – select the **Return** item.

6.3.2 FW Setting

Item **FW Setting** allows to set one of three variants of **AMR-OP70C/xx** (see chapter 6.1. Basic screen).

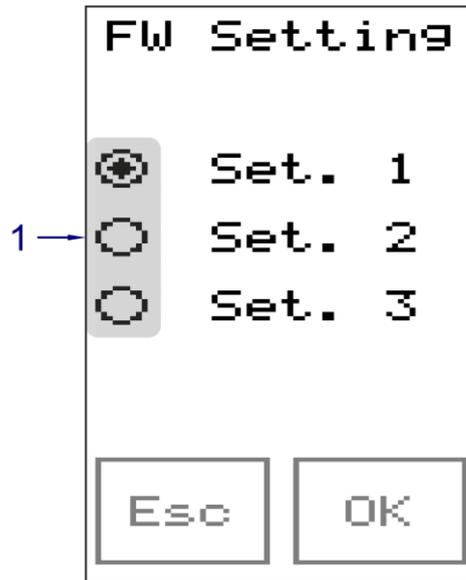


Fig. 33 - Variant selection

Legend

Number	Description
1	Variant selection

6.3.3 Sensors

Item **Sensors** allows to set sensors for temperature and CO₂, which are located in on-wall controller.

Menu items

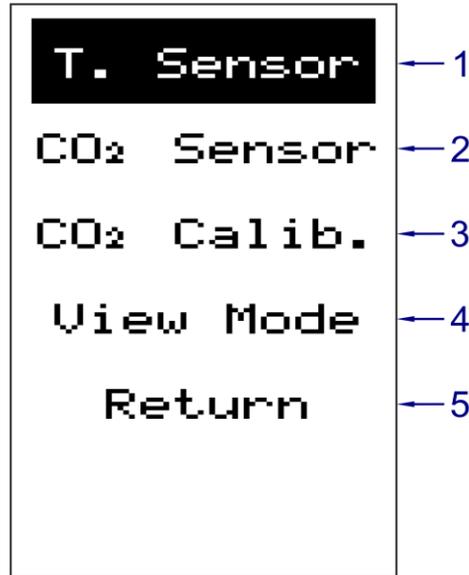


Fig. 34 - Menu items Sensors

Legend

Number	Description
1	Setting of measured temperature correction
2	Setting of value of CO ₂ for acoustic warning
3	CO ₂ sensor calibration
4	Display of measured values
5	Return

T. Sensor Item **T. Sensor** allows to set the correction of measured value.

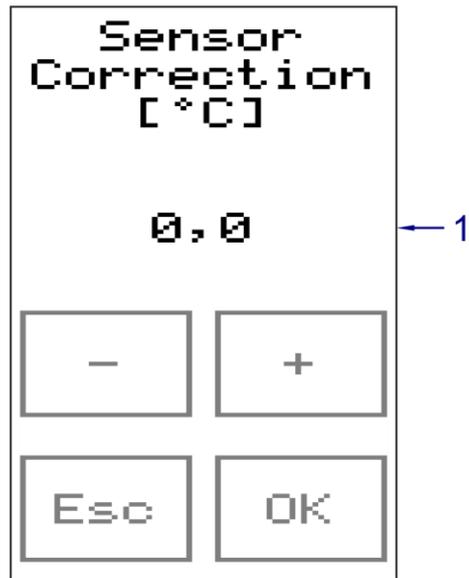


Fig. 35 - Correction of temperature sensor

Legend

Number	Description
1	Measured temperature correction [°C]

Following values can be set:

Value	Description
-10.0 to 10.0	Measured temperature correction [°C]

CO₂ Sensor Item **CO₂ Sensor** allows to set the CO₂ concentration value for triggering acoustic warning. Buzzer settings (according to chapter 6.3.4 Buzzer).

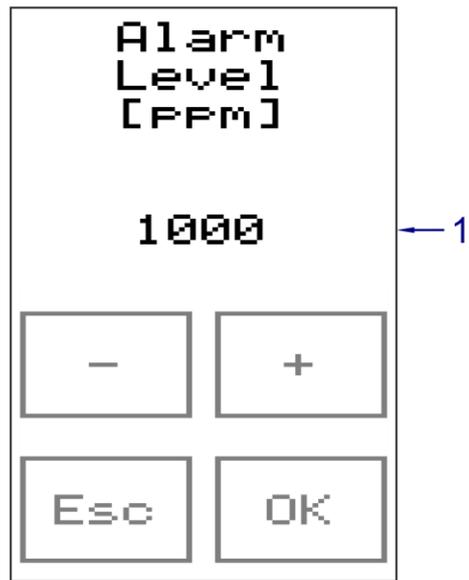


Fig. 36 - CO₂ concentration for acoustic warning

Legend

Number	Description
1	CO ₂ value for acoustic warning [ppm]

Following concentration values can be set:

Value	Description
400 to 3000	CO ₂ concentration for acoustic warning [ppm]

CO₂ Calib. Item **CO₂ Calib.** allows to manage the manual CO₂ calibration.

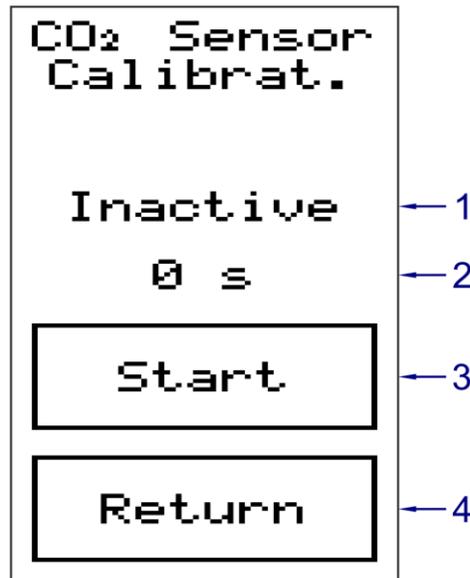


Fig. 37 - Manual CO₂ sensor calibration

Legend	Number	Description
	1	Information about calibration progress
	2	Duration until the end of calibration
	3	Manual calibration start
	4	Return

Note Before manual calibration, area must be ventilated, so the concentration of CO₂ in area reaches cca 400 ppm, which corresponds with concentration of CO₂ in open space. The duration of calibration is approximately 15 minutes.

The controller also has an ability of automatic CO₂ sensor calibration, that cannot be deactivated. Automatic calibration process is described in chapter 2. Technical parameters, CO₂ sensor.

View Mode Item **View Mode** allows to set one of three variants of displaying the measured value. When **Switch** variant is selected, values of temperature and CO₂ concentration will alternate every 5 seconds.

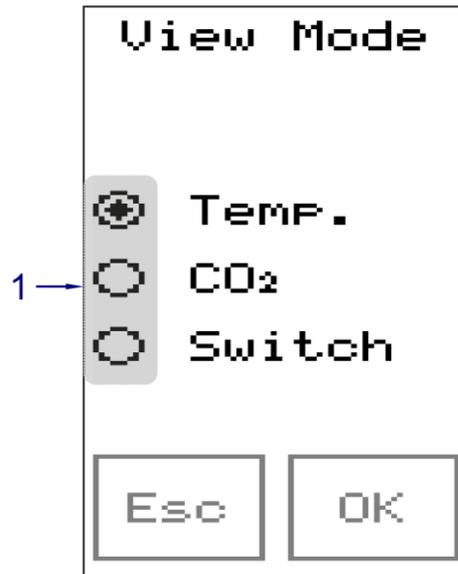


Fig. 38 - Mode of displaying measured value

Legend

Number	Description
1	Variant selection

Return Item **Return** allows to return back to configuration menu.

6.3.4 Buzzer

Item **Buzzer** allows to set the acoustic warning.

Menu items

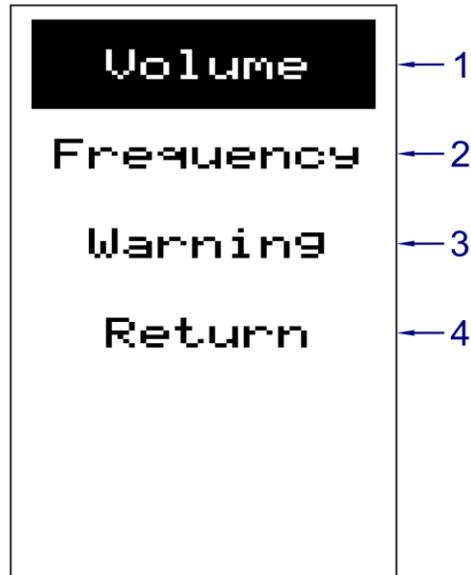


Fig. 39 - **Buzzer** menu items

Legend

Number	Description
1	Setting the volume level of acoustic warning
2	Setting the frequency of acoustic warning
3	Setting the interval of acoustic warning
4	Return

Volume Item **Volume** allows to set the volume level of acoustic warning in four steps.

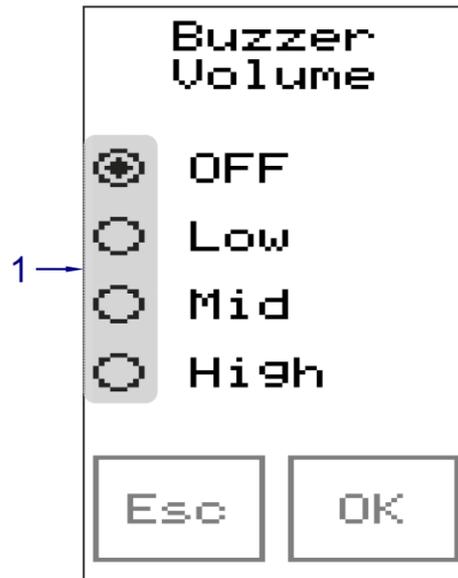


Fig. 40 - Buzzer volume

Legend

Number	Description
1	Volume settings

Note By selecting the option "OFF", the user will not be informed about exceeding the CO₂ value set for warning.

Frequency Item **Frequency** allows to set the tone pitch of acoustic warning.



Fig. 41 - Frequency of acoustic warning

<i>Legend</i>	Number	Description
	1	Setting the frequency of acoustic warning [Hz]

Following values can be set:

Value	Description
20 to 20000	Frequency of acoustic warning [Hz]

Warning Item **Warning** allows to set the interval between each acoustic warning

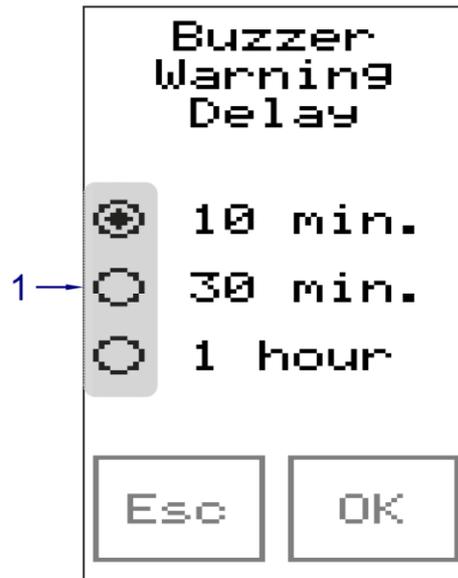


Fig. 42 - Interval of warning

Legend	Number	Description
	1	Interval selection

Return Item **Return** allows to return back to configuration menu.

6.3.5 Calibrate

Item **Calibrate** allows to calibrate the touch screen.

6.3.6 Return

Item **Return** allows to restart on-wall controller (this will confirm the settings) and will return the controller to its default screen.

6.4. Screen saver

If turned on in menu, screen saver is displayed after pre-set time (screen saver is displayed, backlight is off). After the first touch of the screen – backlight is turned on, after the second touch- basic screen is displayed.

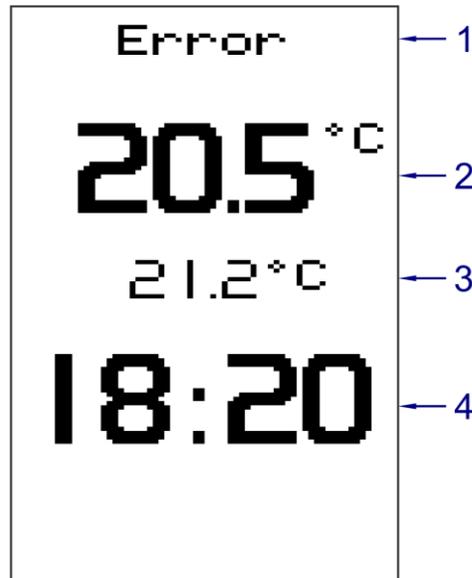


Fig. 43 - Screen for screen saver

Legend

Number	Description
1	Status bar
2	Measured temperature / measured CO ₂ value
3	Desired temperature / CO ₂ value for acoustic warning
4	Time of superior system

When screen saver is active, status bar displays only Reset and Error status (see chapter 6.1. Basic screen). Values of temperature and CO₂ are displayed according to set method of displaying measured values in configuration menu (see chapter 6.3.3 Sensors).

Note If time is not transmitted over the network, -- is displayed instead of numerical value.

7. ARION protocol program operation

In ARION network, **AMR-OP70C/xx** can acquire following states:

- Reset** Bits 0 to 7 of the **Status** registry are set to the True value after the restart of on-wall controller. On-wall controller does not have a valid value:
- room and fan mode setting
 - button status,
 - correction values (it has a zero value),
 - required temperature.

The correct value can be written only by a superior system. Values that have been written by the user will be ignored, until the valid value from the superior control system is received.

- Error** On-wall controller supports communication interruption control (parameter **Guard Time** in ARION network). If the communication fails – the **Error** text will be displayed in the status bar and the controller will behave the same as in **Reset** state (with the exception of correction value, which remains at initial value).

7.1. Digital inputs

On-wall controller status information is transmitted on digital inputs.

<i>Description of the function module</i>	Function module	Number of signals	Note
	ARI_DigIn	3	Multiple signals can be read simultaneously via this module. Single signals correspond with single bits of database variables.

<i>Description of single signals</i>	Module signal	Description
	0	Restart.
	1	Writing to arbitrary register from the side of the controller has occurred.
	2	Communication interruption.

- Note** We recommend periodic reading of digital input channel. If writing to the registry from the side of the controller has occurred, then the bit n. 1 of this channel (DI.1) is set to True. Once the superior control system reads out registry values, by writing value True to bit n. 1 of digital output channel (DO.1), it sets bit n. 1 of the digital input channel to the False value.

7.2. Digital outputs

Single bits of digital input channels are set to value False by corresponding digital outputs.

<i>Description of the function module</i>	Function module	Number of signals	Note
	ARI_DigOut	3	Multiple signals simultaneously can be written by the module. Single signals correspond with single bits of the database variable.

<i>Description of single signals</i>	Module signal	Description
	0	Zeroing bit DI.0
	1	Zeroing bit DI.1
	2	Zeroing bit DI.2

7.3. Register layout

Register with n. 0

Name	Number	Type	Description
Status reset	0 (bit 0 to 15)	R/W	Zeroing corresponding bits of Status registry. The bit is set in case of simultaneous writing of value True to the setting and zeroing bit (prevailing "set"). While reading this registry, the last recorded value is returned.
Status set	0 (bit 16 to 32)	R/W	Setting corresponding bits of Status registry. The bit is set in case of simultaneous writing of value True to the setting and zeroing register (prevailing "set"). While reading this registry, the last recorded value is returned.

Registers with numbers 1 to 6

Name	Number	Type	Description																									
Status	1	R	Description of single bits <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Change of value from the controller This bit is set when the value of Status registry is changed by the on-wall controller. Value of this bit has no affect on the controller function.</td> </tr> <tr> <td>1</td> <td>Room mode.</td> </tr> <tr> <td>2</td> <td> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Bit 2</th> <th>Bit 1</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Automat</td> </tr> <tr> <td>0</td> <td>1</td> <td>Power saving</td> </tr> <tr> <td>1</td> <td>0</td> <td>Comfort</td> </tr> <tr> <td>1</td> <td>1</td> <td>Not used</td> </tr> </tbody> </table> </td> </tr> <tr> <td>3</td> <td>Switch. Applies only for the Variant 3. In other variants this bit is not used.</td> </tr> </tbody> </table>	Bit	Description	0	Change of value from the controller This bit is set when the value of Status registry is changed by the on-wall controller. Value of this bit has no affect on the controller function.	1	Room mode.	2	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Bit 2</th> <th>Bit 1</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Automat</td> </tr> <tr> <td>0</td> <td>1</td> <td>Power saving</td> </tr> <tr> <td>1</td> <td>0</td> <td>Comfort</td> </tr> <tr> <td>1</td> <td>1</td> <td>Not used</td> </tr> </tbody> </table>	Bit 2	Bit 1	Description	0	0	Automat	0	1	Power saving	1	0	Comfort	1	1	Not used	3	Switch. Applies only for the Variant 3. In other variants this bit is not used.
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Correction (Float)	2	R/W	Correction of required temperature [%]. Range: -100 to 100 with floating point.																																											
Requested temperature (Float)	3	R/W	Requested temperature [°C] with floating point.																																											
Measured temperature (Float)	4	R	Measured temperature [°C] with floating point.																																											
Measured Ni1000 *) (Float)	5	R	Measured temperature Ni1000 [°C] with floating point.																																											
LED Brightness*) (Float)	6	R/W	LED brightness [%]. Range: 0 to 100. Value 0 corresponds with minimal brightness, but not LED power off.																																											
Measured CO ₂ value	7 (bit 0 to 15)	R	Measured concentration of CO ₂ [ppm].																																											
CO ₂ limit	7 (bit 16 to 32)	R/W	Limit value of CO ₂ concentration for acoustic warning.																																											

Note *) Is not active in **AMR-OP70C/xx**. Possible writing value to the registry is ignored and does not affect the function of the on-wall controller.

7.4. Operating time setting

On-wall controller allows to display time while screen saver is active (see chapter 6.4. Screen saver). This is a superior control system time, which is displayed only if the parameter TimeBroadcast is set to the True value in superior control system during ARION network parameterization.

8. MODBUS protocol program operation

In MODBUS network **AMR-OP70C/xx** can acquire following states:

Reset Bits 0 to 7 of the **Status** registry are set to the True value after the restart of on-wall controller. On-wall controller does not have a valid value:

- room and fan mode setting
- button status,
- correction values (it has a zero value),
- required temperature.

The correct value can be written only by a superior system. Values that have been written by the user will be ignored, until the valid value from the superior system is received.

Error On-wall controller supports communication interruption control (**Guard Time** register).

If the superior system does not use the **Guard Time** parameter, and on-wall controller is not receiving valid frame within 30 s, it automatically switches to Error status. In the **Error** state – the **Error** text will be displayed in a status bar and the controller will behave the same as in **Reset** state (with the exception of correction value, which remains at initial value).

Note Communication with **one stop-bit takes place, if there is an odd or even parity set**. Communication with **two stop-bits takes place, when no parity is set**.

8.1. Register layout

Supported functions:

- 03 Read Holding Registers – reading from registers,
- 16 Write Multiple Registers – writing to registers.

All values are saved in BigEndian format.

System registers with addresses 0 to 8

Name	Address	Type	Description
Module ID	0	R	Module identification Unit type is given by number. 35 = AMR-OP7x, is given by HW type.
FW	1	R	Firmware version, taken from the project
Time	2 3	R/W	System time. Number of seconds since 1.1.1980, 0:00:00.
Guard Time	4	R/W EEPROM	Number of [ms] for evaluation of MODBUS communication interruption. Zero value will result in permanent disconnection, and Error state.
Baud Rate	5	R/W EEPROM	EEPROM, communication rate.
Parity	6	R/W EEPROM	EEPROM, parity.

Name	Address	Type	Description
Address	7	R/W EEPROM	EEPROM, address.
System Status	8	R/W	System status register. System uses it, it can not be accessed by the application.

Application registers with addresses 100 to 115 These parameters are given by the application program. They can be either pre-defined and system-supported by special object, or they can be programmed by standard objects.

Name	Address	Type	Description																																																			
Status Set	100	R/W	Setting corresponding bits of Status registry. In case of simultaneous writing of True value into both setting and zeroing bit (prevailing "set"). While reading this registry, the last recorded value is returned.																																																			
Status Reset	101	R/W	Zeroing corresponding bits of Status registry. The bit is set in case of simultaneous writing of value True to the setting and zeroing register (prevailing "set"). While reading this registry, the last recorded value is returned.																																																			
Status	102 103	R	<p>Description of single bits</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Change of value from the controller When the Status register is changed by the on-wall controller, this bit is set. Value of this bit has no affect on the controller function.</td> </tr> <tr> <td>1 2</td> <td>Room mode <table border="1"> <thead> <tr> <th>Bit 2</th> <th>Bit 1</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Automat</td> </tr> <tr> <td>0</td> <td>1</td> <td>Energy saving</td> </tr> <tr> <td>1</td> <td>0</td> <td>Comfort</td> </tr> <tr> <td>1</td> <td>1</td> <td>Not used</td> </tr> </tbody> </table> </td> </tr> <tr> <td>3</td> <td>Switch. Applies only for the Variant 3. In other variants this bit is not used.</td> </tr> <tr> <td>4 5 6</td> <td>Fan mode. <table border="1"> <thead> <tr> <th>Bit 6</th> <th>Bit 5</th> <th>Bit 4</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Device is OFF</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Level 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Level 2</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Level 3</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Automat</td> </tr> </tbody> </table> <p>Applies only for the Variant 2. These bits are not used by the controller in other variants.</p> </td> </tr> <tr> <td>7 *)</td> <td>Status of DI input Ni1000 / contact.</td> </tr> </tbody> </table>	Bit	Description	0	Change of value from the controller When the Status register is changed by the on-wall controller, this bit is set. Value of this bit has no affect on the controller function.	1 2	Room mode <table border="1"> <thead> <tr> <th>Bit 2</th> <th>Bit 1</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Automat</td> </tr> <tr> <td>0</td> <td>1</td> <td>Energy saving</td> </tr> <tr> <td>1</td> <td>0</td> <td>Comfort</td> </tr> <tr> <td>1</td> <td>1</td> <td>Not used</td> </tr> </tbody> </table>	Bit 2	Bit 1	Description	0	0	Automat	0	1	Energy saving	1	0	Comfort	1	1	Not used	3	Switch. Applies only for the Variant 3. In other variants this bit is not used.	4 5 6	Fan mode. <table border="1"> <thead> <tr> <th>Bit 6</th> <th>Bit 5</th> <th>Bit 4</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Device is OFF</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Level 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Level 2</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Level 3</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Automat</td> </tr> </tbody> </table> <p>Applies only for the Variant 2. These bits are not used by the controller in other variants.</p>	Bit 6	Bit 5	Bit 4	Description	0	0	0	Device is OFF	0	0	1	Level 1	0	1	0	Level 2	0	1	1	Level 3	1	0	0	Automat	7 *)	Status of DI input Ni1000 / contact.
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7 *)	Status of DI input Ni1000 / contact.																																																					

Name	Address	Type	Description
Correction (Float)	104 105	R/W	Correction of required temperature [%]. Range: -100 to 100 with floating point.
Requested temperature (Float)	106 107	R/W	Requested temperature [°C] with floating point.
Measured temperature (Float)	108 109	R	Measured temperature [°C] with floating point.
Measured Ni1000 *) (Float)	110 111	R	Measured temperature Ni1000 [°C] with floating point.
LED brightness (Float)	112 113	R/W	LED brightness [%]. Range: 0 to 100. Value 0 corresponds with minimal brightness, but not LED power off.
CO ₂ limit	114	R/W	Limit value of CO ₂ concentration for acoustic warning.
Measured CO ₂ value	115	R	Measured concentration of CO ₂ [ppm].

Note *) Is not active in **AMR-OP70C/xx**. Possible writing value to the registry is ignored and does not affect the function of the on-wall controller.

8.2. Operating time setting

Writing time to the single on-wall controller, connected to the MODBUS network is performed by writing to the registers 2 and 3 of the particular on-wall controller.

9. Programming

The on-wall controller **AMR-OP70C/xx** is supplied by the manufacturer with loaded application program, which can be downloaded from www.amitautomation.com for free. On-wall controller can be also reprogrammed with another, custom program.

Application program creation is possible by using:

- DetStudio / EsiDet development environment

Loading the application from the DetStudio to the on-wall controller can be performed via:

- DetStudio development environment
- AMRconfig service and programming utility
- AMRmultidownload multiprogramming utility

SW Download Development environment can be downloaded from www.amitautomation.com for free.

9.1. Setting of communication parameters

Change of communication parameter can be performed:

- from PC via DetStudio / AMRconfig,
- from application program via configuration menu, see chapter 6.3. Configuration menu,
- from service application via service menu, see chapter 9.2. Service mode.

Connection to the PC On-wall controller **AMR-OP70C/xx** must be connected to the PC via the RS485 converter (for example type **SB485s** offered by AMIT company) using point-to-point connection.

Note Communication with on-wall controller via DetStudio can be established only with MODBUS RTU communication protocol. If another type of network is set in application program (ie. ARION communication protocol), loader must be activated first (see chapter 9.3. Loader).

9.2. Service mode

Service application supports setting of basic parameters of the on-wall controller via "Service menu".

Service application in **AMR-OP70C/xx** is always available, user can always switch to it, and it can not be deleted. After switching to service application, the service menu is displayed.

Service mode is activated by this procedure:

- disconnect the **AMR-OP70C/xx** from power supply,
- touch the touchscreen anywhere and keep pressing,
- connect the **AMR-OP70C/xx** to power supply,
- release the pressure on the touchscreen.

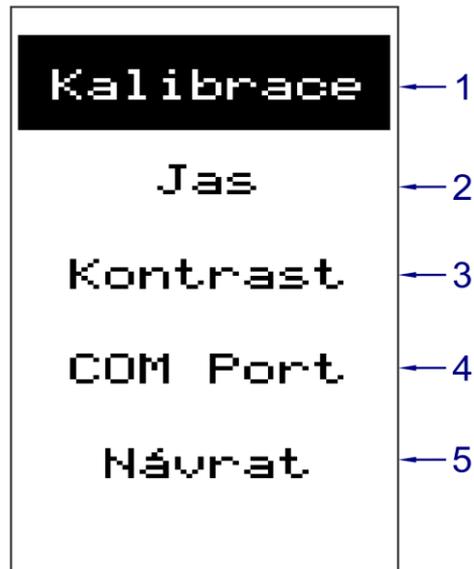


Fig. 44 - Items of service menu

Legend

Number	Description
1	Calibration
2	Brightness adjustment
3	Contrast adjustment
4	Serial Line Setting
5	Return back

Following items can be set via service menu:

- Calibration – calibration of the touchscreen sensitive layer,
- Brightness – brightness intensity change,
- Contrast – change of display contrast,
- Serial interface communication parameters. *)

*) Can be set only if they are not given by user application.

To quit from service menu press button **“Return”**. The on-wall controller will restart.

9.3. Loader

The state, when the Loader is running can be used in cases when the user application is causing any troubles, for example repetitive restarting, inability to connect to the unit, etc.

Loader activation Loader can be activated by interconnecting service jumper. Particular action is called-out according to moment and length of interconnection, see following table.

Interconnection duration	Action
> 1 s – after turning on	Loader with original communication parameters is launched.
> 3 s and < 10 s – while the application is running	Loader with original communication parameters is launched.
> 10 s	Loader with factory pre-set communication parameters is launched, see chapter 10. The original application is launched after each further start.

Jumper location The service jumper, located on PCB, is accessible after the cover is taken off, see Fig. 45.

Note Unwanted interconnection of pins located close to each other, when the controller is on – has no effect on its functionality.

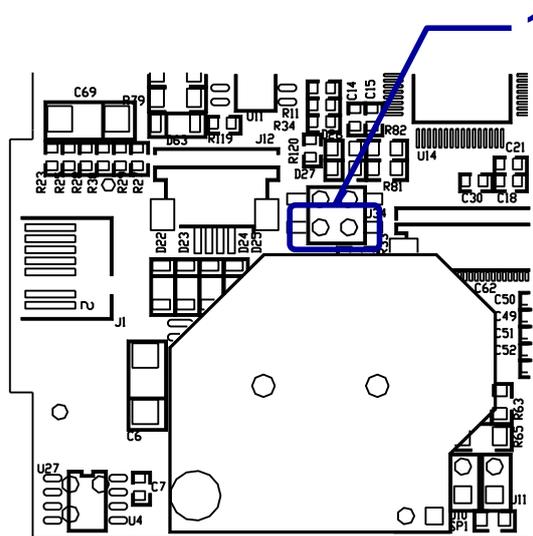


Fig. 45 - Interconnection of service jumper on **AMR-OP70C/xx** PCB

Number	Description
1	Service jumper

10. Factory settings

RS485 configuration Jumpers which activate the line termination and idle state definition are fitted.

Program settings	Item	Value set
	Network type	ARION
	Address	1
	Speed	38400 bps
	Viewing variant	Var. 1
	Display of measured values	Switch
	Correction	0.0 °C
	Buzzer volume	Off
	Buzzer frequency	4000 Hz
	Warning by a buzzer	10 min.
	CO ₂ concentration for acoustic warning	1000 ppm
	Display	Value set
	Brightness	100 %
	Contrast	50 %
	Language	Czech
	Display – dimming time	60 s

11. Ordering information and completion

On-wall controller	AMR-OP70C/xx ¹⁾	Complete, see chapter 11.1. Completion
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Note ¹⁾ **xx** indicates colour design of the product. Available versions are listed in the table below.

Colour design	Frame colour	Cover colour
AMR-OP70C/01	grey	white
AMR-OP70C/02	ivory	ivory
AMR-OP70C/03	grey	grey
AMR-OP70C/04	white	white

11.1. Completion

AMR-OP70C/xx	Part	Quantity
	On-wall controller	1

12. Maintenance

With exception of cleaning, the device requires no periodic control, nor maintenance.

Cleaning Depending on equipment usage, the dust is to be removed occasionally from equipment. The equipment can be cleaned by dry soft brush or vacuum cleaner, only when turned-off and disassembled.

Note **The maintenance mentioned above can be performed by manufacturer or authorized service only!**

13. Waste disposal

Electronics disposal The disposal of electronic equipment is subject to the regulations on handling electrical waste. The equipment must not be disposed of in common public waste. It must be delivered to places specified for that purpose and recycled.