

AMR-OP10/90

***Control unit
with graphical display***

Operation manual

Version 1.04

AMIT

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Producer: AMiT, spol. s r. o.
Naskové 1100/3, 150 00 Praha
www.amitautomation.com**

Technical support: support@amit.cz

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History of revisions

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Revision	Date	Author of change	Changes
001	3. 11. 2011	Podolák S.	Preliminary information.
100	29. 03. 2012	–	New document.
101	28. 05. 2012	–	System LED labels correction, conformity assessment update.
102	30. 07. 2012	Říha Z.	Unification of external sensor measurement accuracy according to data sheet, cancelling of measured temperatures range note, chapter 10 completion.
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104	10. 11. 2016	Říha Z.	Chapters 2, 8.1 and 10.1 correction.
		Mlejnek J.	Pictures editing (legend), template update.

Related documentation

1. Help file for EsiDet part of DetStudio development environment
file: Esidet_cs.chm
2. Application Note AP0005 – ARION network communication
file: ap0005_en_xx.pdf
3. Application Note AP0006 – Ethernet network communication
file: ap0006_en_xx.pdf
4. Application Note AP0016 – Principles of RS485 interface usage
file: ap0016_en_xx.pdf
5. Application Note AP0025 – ARION network communication – definition by table
file: ap0025_en_xx.pdf
6. Application Note AP0037 – Principles of Ethernet network usage
file: ap0037_en_xx.pdf

1 Introduction

AMR-OP10/90 is a freely programmable controller. The entire display is covered with touch panel that serves for controller operation.

- Basic features**
- FSTN display with resolution of (132 × 64) pixels
 - Operating through touchscreen
 - 2 × RS485 interface (1 × without galvanic isolation, 1 × galvanically isolated)
 - Ethernet interface 100/10 Mbps
 - 1 × analogue input for sensor type Ni1000 / Pt1000
 - Power supply 24 V DC
 - Programming in DetStudio environment, EsiDet

2 Technical parameters

Processor	Type	STM32F207
	FLASH	512 KB
	SRAM	128 KB
	EEPROM	2 KB
	Backed-up RAM	4 KB
	RAM + RTC back-up	Lithium battery CR2032
	Battery lifetime	5 years in normal environment ¹⁾

Note ¹⁾ Normal environment is defined at temperature 25° C.
A device is delivered without plugged-in battery.

RTC	Type	STM32F207 (processor component)
	Precision at 25 °C	±20 ppm

Display	Type	FSTN / positive / BW
	Resolution	(132 × 64) pixels (non-symmetric point)
	Visible area	(58 × 38) mm
	Viewing angle	90 °
	Backlight	LED
	Backlight colour	White
	Backlight lifetime	50 000 hours ²⁾

Note ²⁾ 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 for operation by finger, by tool without sharp edges or by finger-in-glove.

External temperature sensor	Type	Ni1000/6180, Ni1000/5000, Pt1000
	Range of measured temperatures	
	Ni1000/6180	-20 °C to 120 °C
	Ni1000/5000	-25 °C to 143 °C
	Pt1000	-14 °C to 200 °C
	Resolution	12 bits
	Accuracy of temperature measuring	
	Ni1000/6180	±0.5 °C
Ni1000/5000	±0.6 °C	
Pt1000	±0.8 °C	
Connection point	WAGO 231-306/102-000	
Wire cross section	0.75 mm ² to 2.5 mm ²	

Note Not included in the delivery.

RS485	Quantity	2
	Overvoltage protection	Transil 600 W
	Galvanic isolation ³⁾	1 × Yes + 1 × No
	Terminating resistor ⁴⁾	120 Ω on the unit

Idle state definition ⁴⁾ up to +5 V up to 0 V	1 kΩ on the unit 1 kΩ on the unit
Maximum wire length	1200 m / 19200 bps
Maximum number of stations on segment Interface with GI Interface without GI	256 ⁵⁾ 32 ⁵⁾
Operation indication	LED on back cover
Connection points Interface with GI Interface without GI	WAGO 231-303/102-000 WAGO 231-306/102-000
Wire cross section	0.75 mm ² to 2.5 mm ²

- Note ³⁾ Isolation must not be used for dangerous voltage separation.
⁴⁾ Terminating resistor and idle state definition are connected concurrently.
⁵⁾ Number depends on used communication protocol.

Ethernet	Quantity	1
	Data transmission rate	100 / 10 Mbps
	Operation indication	Connector with built-in LEDs
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute ⁶⁾
	Connection point	Connector RJ45, according to IEEE802.3

- Note ⁶⁾ Isolation must not be used for dangerous voltage separation.

Power supply	Nominal power supply voltage	24 V DC
	Power supply voltage range	16.8 V DC to 30 V DC
	Maximum power consumption	70 mA at 24 V DC
	Power outage (typical)	1.7 W
	Connection point	Interface with GI – WAGO 231-306/102-000
	Wire cross section	0.75 mm ² to 2.5 mm ²
	Power supplying system	The device must not be power supplied from DC distribution network of building ⁷⁾

- Note ⁷⁾ For detailed information see chapter “8.4 Installation rules” paragraph “Power supply”.

Mechanics	Mechanical design	Panel + metal cover
	Panel surface finish	Stainless steel
	Mounting	Into switchboard front panel
	Panel side ingress protection rate	IP65
	Dimensions (w × h × d)	(116 × 96 × 35) mm
	Weight	520 g

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

2.1 Dimensions

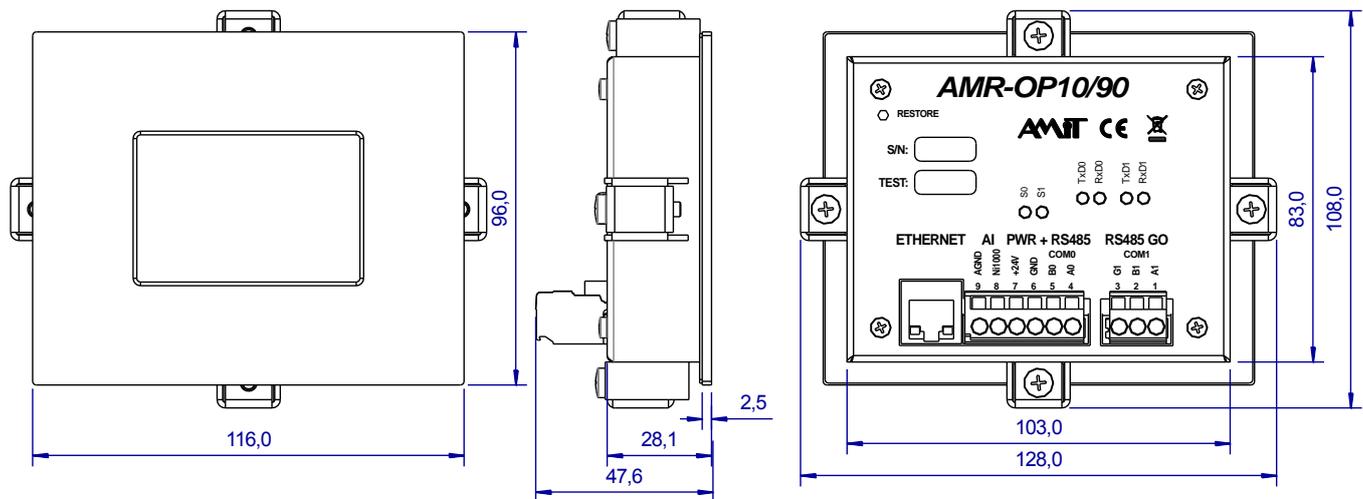


Fig. 1 – AMR-OP10/90 dimensions

2.2 Recommended drawing symbol

Following drawing symbol is recommended for the controller **AMR-OP10/90**. Only part of it will be visible in following examples.

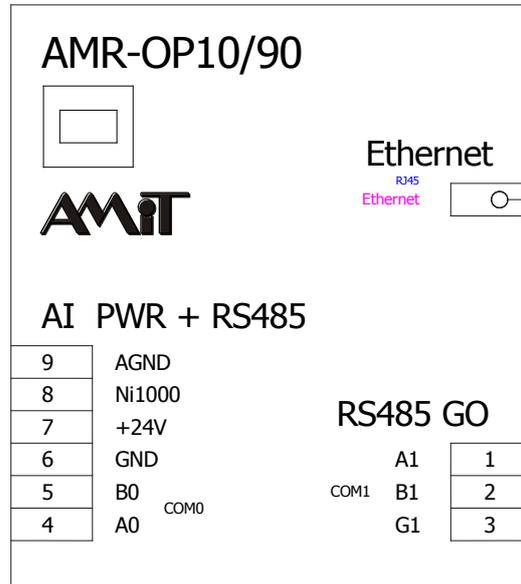


Fig. 2 – Recommended drawing symbol for **AMR-OP10/90**

3 Conformity assessment

The equipment meets the requirements of NV616/2006 Czech Government 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	Class
EN 55011:2009	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	A ⁸⁾
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test	4 kV contact
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test	8 kV by air
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test, 80 MHz to 1 GHz	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, 1 GHz to 2 GHz	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, 2 GHz to 2,7 GHz	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	±2 kV
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, RS485	±2 kV
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, Ethernet	±2 kV
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, power supply	±2 kV

EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, Ethernet, RS485, Ni1000	±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	10 V

- ⁸⁾ This is a Class A device. In the internal environment this product can cause some radio disturbances. In such case the user can be requested to take the appropriate measures.

3.1 Other tests

Tested in accordance with standard	Type of test	Class
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 tests	Complies
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

4 Power supply

The programmable controller **AMR-OP10/90** can be power supplied only by DC power supply. Power supply must meet requirements mentioned in chapter “2 Technical parameters”.

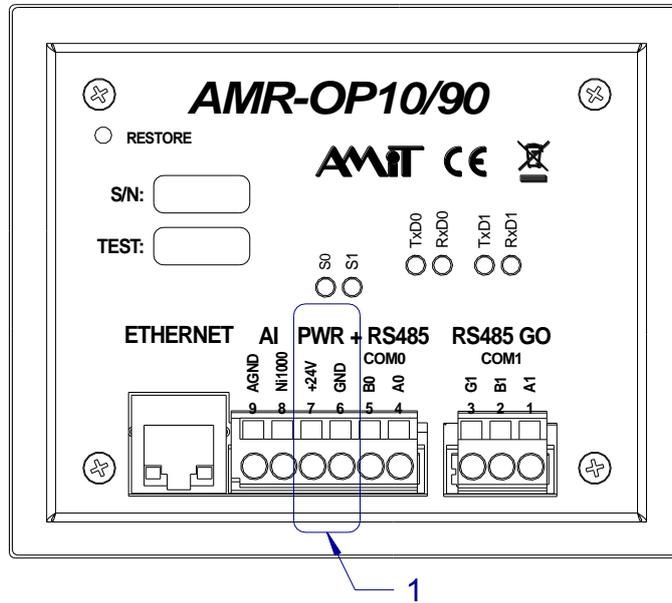


Fig. 3 – Power supply connector location

Legend	Number	Description
	1	Power supply connector

Connector wiring	Terminal	Signal	Description
	6	GND	Power supply Ground
	7	+24V	Power supply +24 V DC

Wiring example

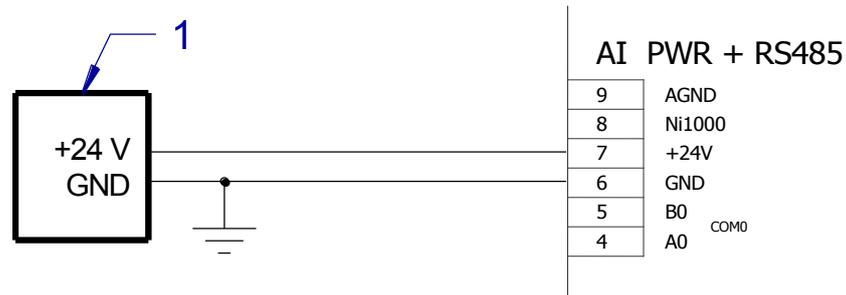


Fig. 4 – Power supply wiring example

Legend	Number	Description
	1	External power supply

Note It is recommended to connect the GND terminal with switchboard’s PE terminal at a single point during installation.

5 Communication interface

5.1 RS485 without galvanic isolation (COM0)

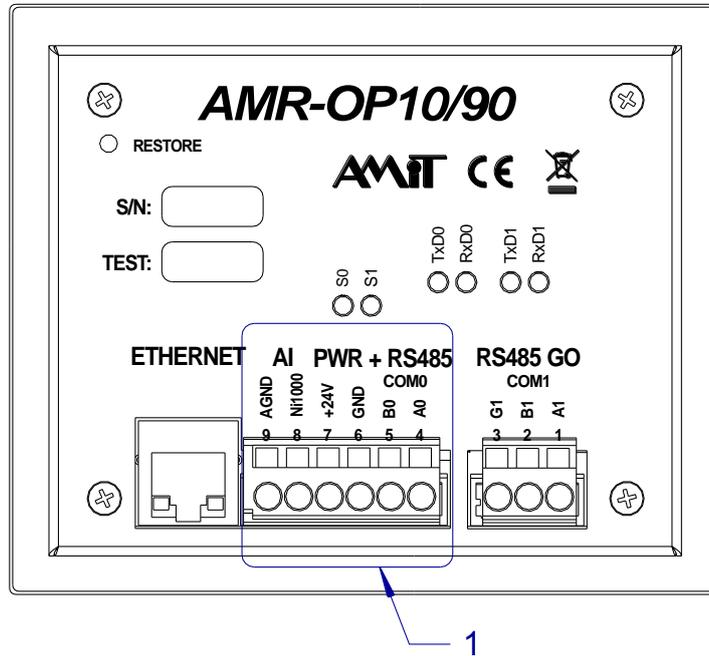


Fig. 5 – Location of power supply and RS485 interface connector

Legend	Number	Description
	1	Power supply, RS485 interface (COM0) and Ni1000 connector

Software operation RS485 interface without galvanic isolation has number 0 during programming.

Connector wiring RS485 interface without galvanic isolation is located together with 24 V power supply voltage on the common connector. It is necessary to follow the rules mentioned in Application Note AP0016 – Principles of RS485 interface usage for correct working of RS485.

Terminal	Signal	Description
4	A0	RS485 interface, signal A
5	B0	RS485 interface, signal B
6	GND	Ground

Configuration jumpers Each station on RS485 network must have wires termination resistors properly set. Configuration jumpers located near the RS485 connector are used for termination setting. Jumpers are accessible after cover removal. If jumpers are placed, terminating resistor is connected. The terminal stations must have always connected terminating resistors, intermediate stations – disconnected.

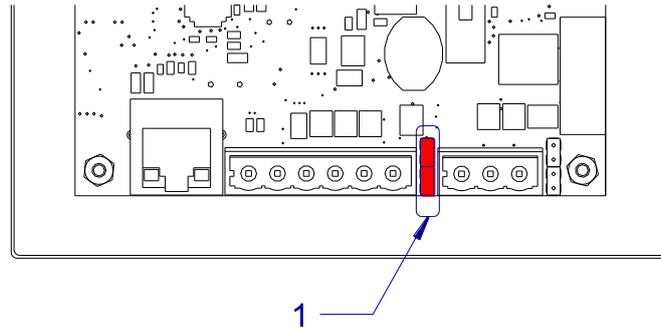


Fig. 6 – Location of RS485 interface configuration jumpers (after cover removal)

<i>Legend</i>	Number	Description
	1	COM0 termination

<i>Jumpers description</i>	Jumper	Description
	J12	Signal A idle state + termination
	J13	Signal B idle state + termination

Factory setting All jumpers are installed.

Activity indication RS485 interface activity is indicated by LEDs located on back cover.

5.2 RS485 with galvanic isolation (COM1)

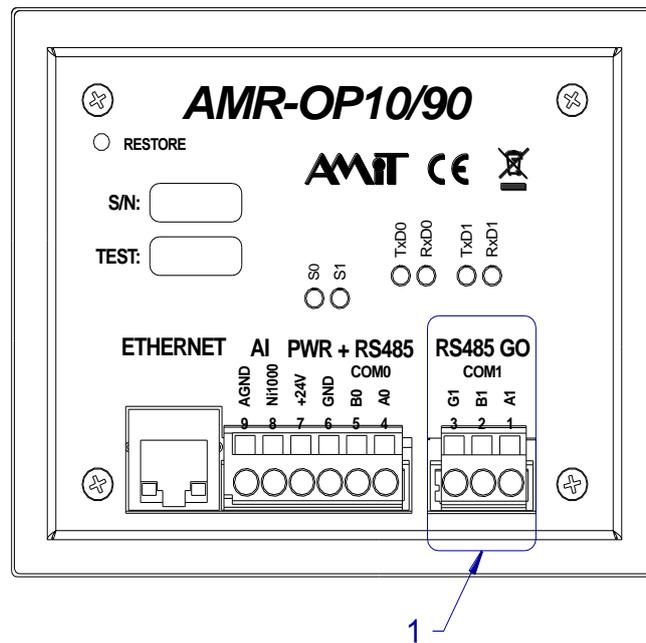


Fig. 7 – Location of galvanically isolated RS485 connector

Legend	Number	Description
	1	RS485 connector GI (COM1)

Software operation The galvanically isolated RS485 interface has number 1 during programming.

Connector wiring RS485 interface is used for superior system connection. It is necessary to follow the rules mentioned in Application Note AP0016 – Principles of RS485 interface usage for correct working of RS485.

Terminal	Signal	Description
1	A1	Galvanically isolated RS485 interface, signal A
2	B1	Galvanically isolated RS485 interface, signal B
3	G1	Galvanically isolated RS485 interface, ground

Configuration jumpers Each station on RS485 network must have wires termination resistors properly set. Configuration jumpers located near the RS485 connector are used for termination setting. Jumpers are accessible after cover removal. If jumpers are placed, terminating resistor is connected. The terminal stations must have always connected terminating resistors, intermediate stations – disconnected.

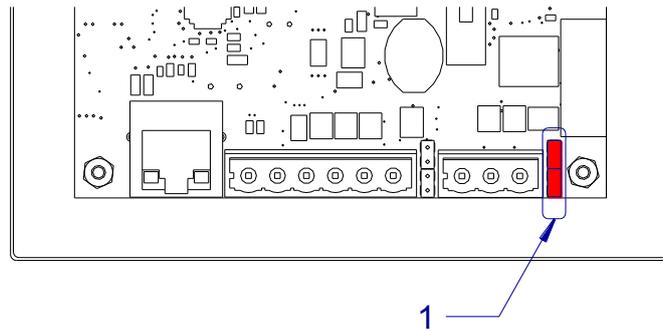


Fig. 8 – Location of RS485 interface configuration jumpers with GI (after cover removal)

<i>Legend</i>	Number	Description
	1	COM1 termination

<i>Jumpers description</i>	Jumper	Description
	J16	Signal A idle state + termination
	J18	Signal B idle state + termination

Factory setting All jumpers are installed.

Activity indication RS485 interface activity is indicated by LEDs located on back cover.

6 Ethernet

The controller can be directly connected into LAN network through Ethernet interface. Components of standard structured cabling can be used for connection.

The Ethernet interface can be used both for visualization and remote uploading of application software into the controller through Internet. This interface is supported by DetStudio environment. TCP/IP protocols family is used for communication, therefore the communication network can be shared both by the controllers and personal computers.

Note Ethernet galvanic isolation must not be used for dangerous voltage separation.

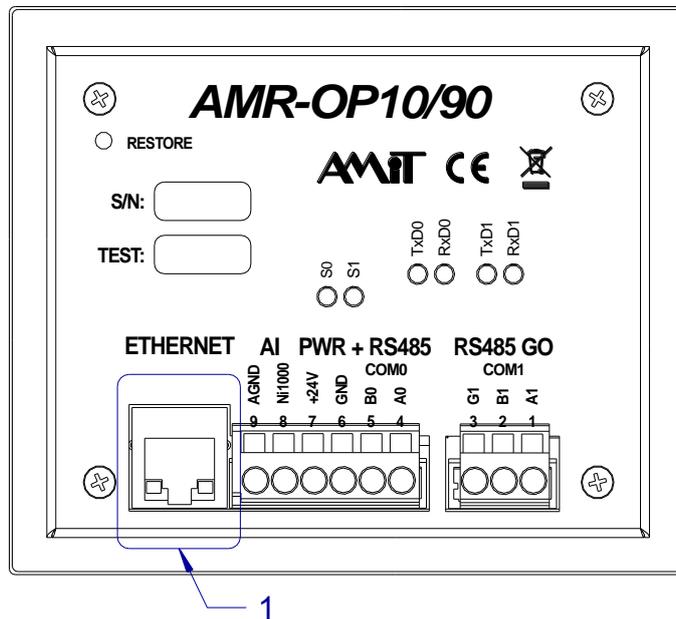


Fig. 9 – Ethernet interface connector location

<i>Legend</i>	Number	Description
	1	Ethernet interface connector

Interface state indication Ethernet activity is indicated by LEDs (LNK and ACT) directly on Ethernet interface connector.

<i>LEDs description</i>	LED	Colour	Description
	LNK	green	Ethernet connection
	ACT	yellow	Data receiving or transmitting

More information can be found in Application note AP0037 – Principles of Ethernet network usage.

7 Analogue input and battery voltage

7.1 Analogue input

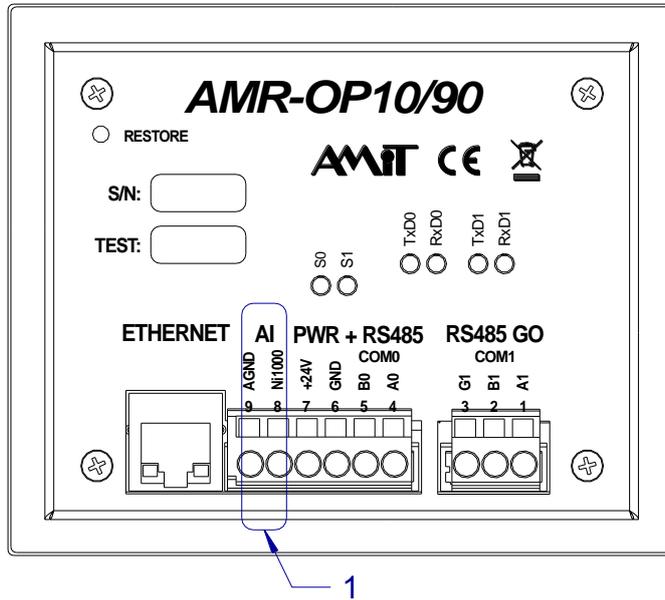


Fig. 10 – Connector Ni1000 location

Legend	Number	Description
	1	Input Ni1000

The controller **AMR-OP10/90** has a single analogue input for connection of external temperature sensor type Ni1000/Pt1000. Connect the temperature sensor cable shielding to terminal 9 – AGND.

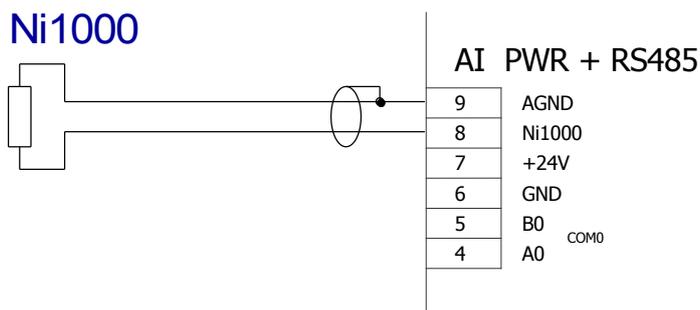


Fig. 11 – Temperature sensor Ni1000 wiring

7.2 Backup battery voltage

Backup battery voltage can be measured in applications written by DetStudio development environment by the following script:

Operation example `Ram.fUbat = IO.VBatt;`

Measured value is battery voltage [V].

The operator can be alerted to replace the battery according to this value.

More information regarding backup battery can be found in chapter "11 Maintenance".

8 Mounting

The device can be mounted in any position.

Display can be “Landscape” or “Portrait” oriented.

8.1 Mounting procedure

1. Cut the rectangular hole in switchboard front panel with dimensions (105 × 85) mm; attached template makes the work easier. Unit can be oriented horizontally or vertically.
2. Insert the controller into the hole in switchboard from the front side.
3. Stick the mounting clamps into holes in the device case and fix the controller in switchboard by tightening the screws.
4. Connect the communication and power supply wires.

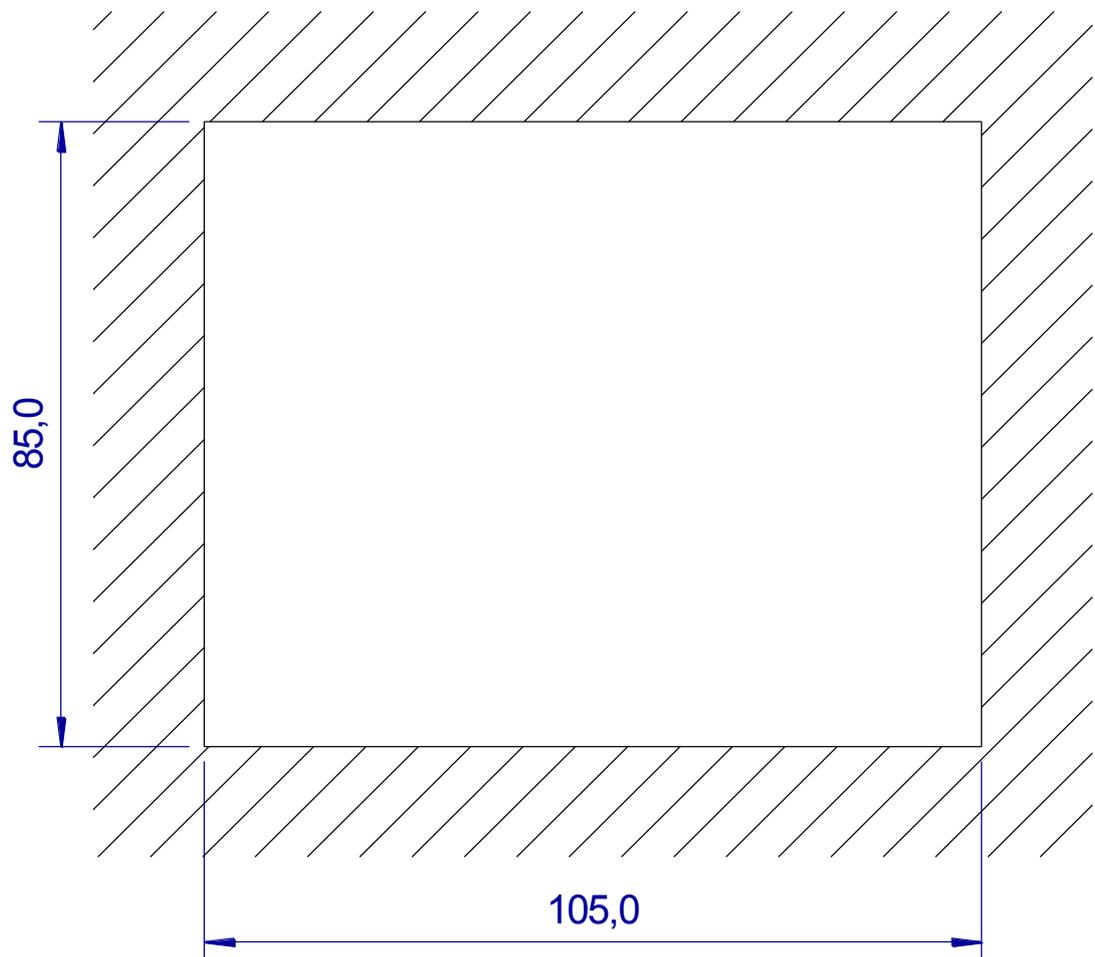


Fig. 12 – Mounting hole

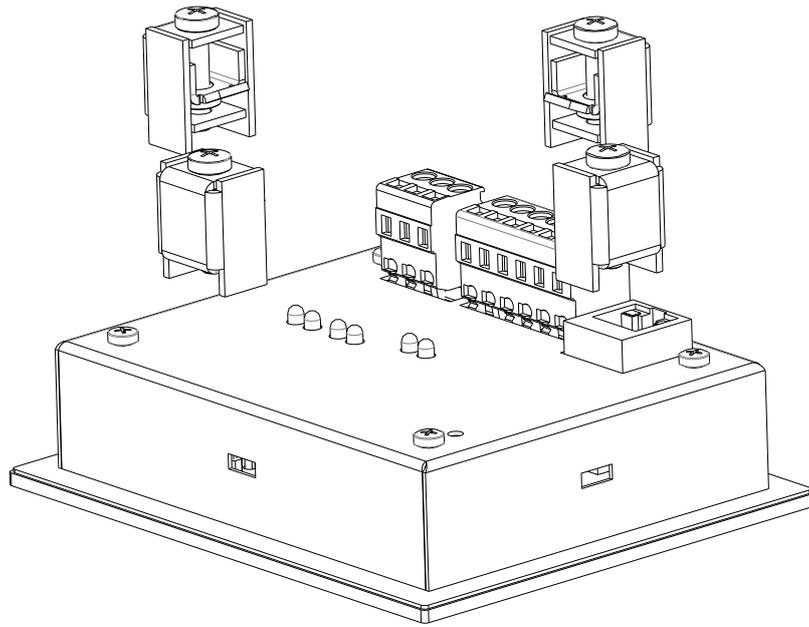


Fig. 13 – Fixing clamps

8.2 Jumpers setting

Unscrew four screws and remove the back cover to access the RS485 configuration jumpers.

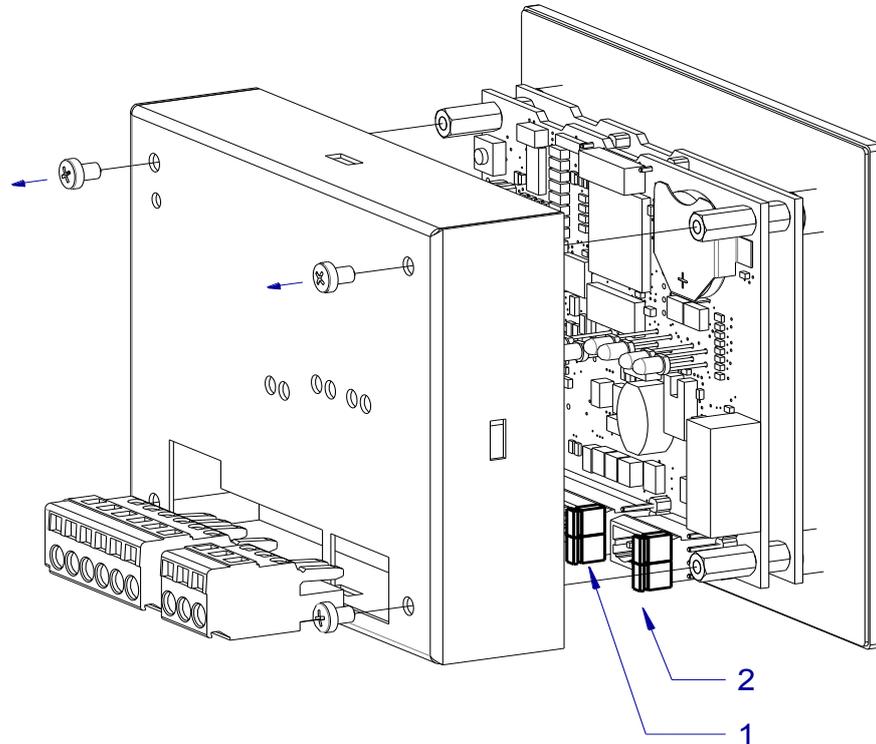


Fig. 14 – Configuration jumpers of COM0 and COM1 termination

Legend

Number	Description
1	COM0 termination
2	COM1 termination

8.3 Battery replacement

Remove the back cover and eject the battery in direction as shows the arrow. Used battery is CR2032 type.

A polarity is marked both on battery holder and battery.

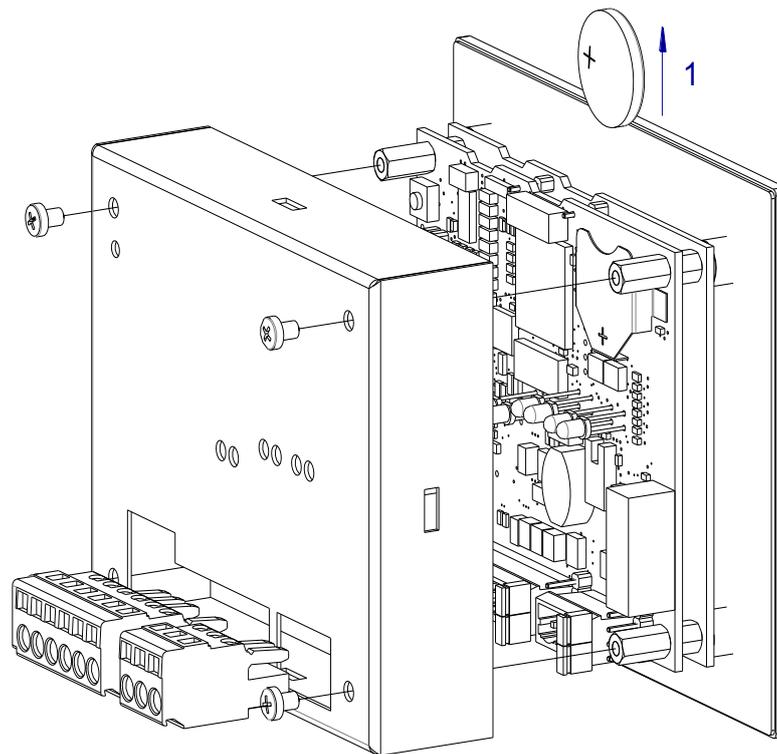


Fig. 15 – Battery ejection

<i>Legend</i>	Number	Description
	1	Direction of battery ejection

8.4 Installation rules

EMC filter Use an EMC filter on 230 V AC power supply voltage input. This requirement can be revised on the basis of environment character and wiring layout.

Power supply The equipment must not be power supplied from DC distribution network in building. More equipment can be power supplied from a single power supply, assuming it power supplies similar-type equipment located in the same building.

Connecting to PE Negative power supply terminal (GND) of the device is connected with PE.
If the wires are led outside the building, the appropriate inputs and outputs need to be overvoltage protected.

RS485 It is necessary to perform RS485 interface connection according to recommendations in Application Note AP0016 – Principles of RS485 interface usage.

Ethernet It is necessary to perform Ethernet connection according to recommendations in Application Note AP0037 – Principles of Ethernet network usage.

Note All PE terminal connections must be realized with the lowest impedance as possible. Technical parameters of the device are guaranteed only when these wiring rules are applied.

9 Programming

Programming of the controller **AMR-OP10/90** is done through Ethernet interface through DetStudio development environment.

Follow the instructions from DetStudio development environment help – EsiDet.

“Landscape” and “Portrait” variants are supported.

9.1 Service application

Service application allows:

- Setting of controller basic parameters through “Service menu”.
- Restoring the controller to “Factory settings”.
- Putting the controller into “Loader” state.

AMR-OP10/90 service application is always available. User can always switch to it and it cannot be deleted. The service menu is displayed after switching to service application. Switching procedure is shown in following chapters.

9.2 Service menu

Service menu can be called-up switching to “Service application” by following procedure:

- Switch off the power supply voltage.
- Touch the touchscreen in any place.
- Switch on the power supply voltage.

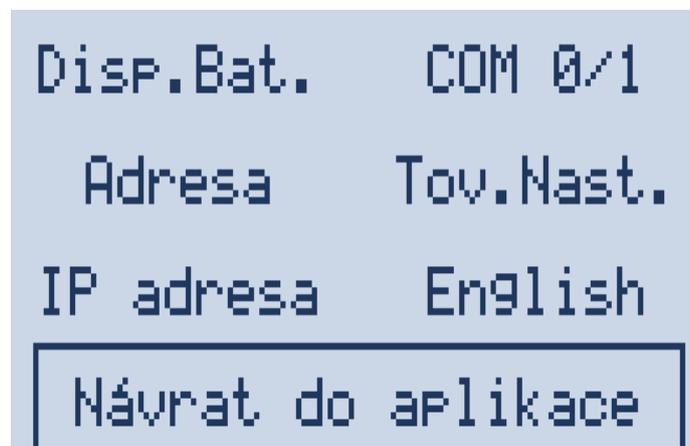


Fig. 16 – Service menu triggered by screen touching

Following items can be set through service menu:

- Service mode language selection
- Calibration – calibration of the touchscreen sensitive layer
- Brightness – brightness intensity change
- Contrast – display contrast change
- COM0 and COM1 controller address

- COM Port – communication parameter settings: ⁹⁾
 - Parity
 - Speed
- Ethernet:
 - IP address
 - Network mask
 - Default gateway
- Factory setting.

⁹⁾ It can be set only in case they not “permanently” set by user application.

Backup battery state can be determined through Service menu.

It is necessary to press the button “Return to application” to exit service menu. Then the controller restarts automatically.

9.3 Factory setting

Factory settings can be restored from the service menu

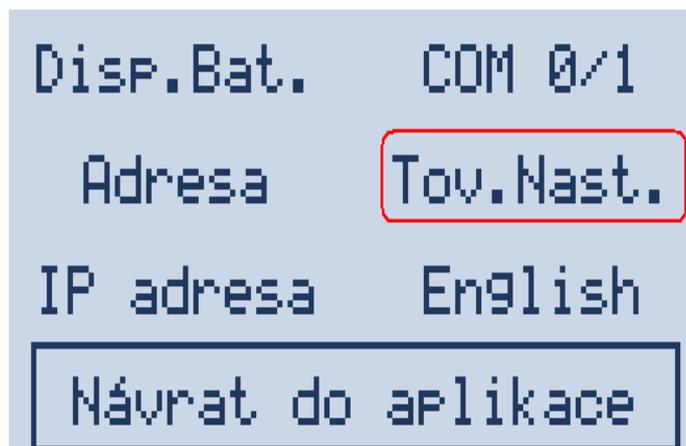


Fig. 17 – Factory settings item in the service menu

or through “**RESTORE**” button on the controller rear side.

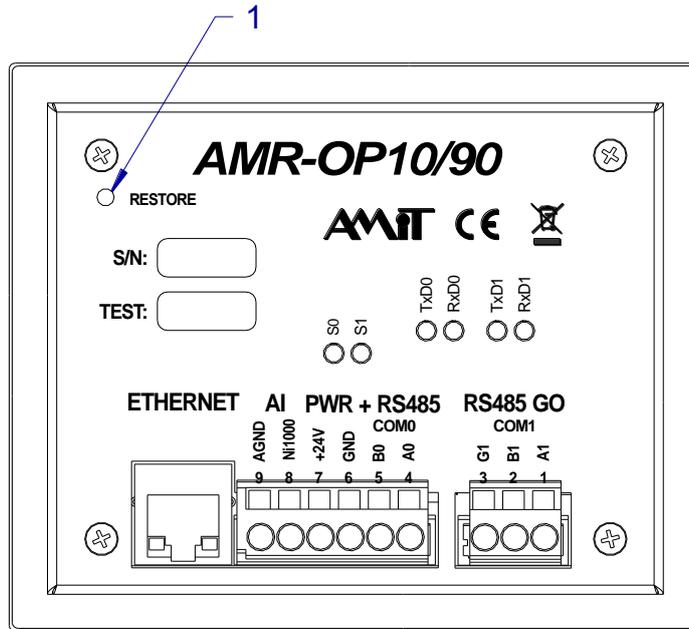


Fig. 18 – “RESTORE” button

Legend	Number	Description
	1	“RESTORE” button

“**RESTORE**” button can be pushed by suitable blunt tool. It is necessary to hold the button for approximately 15 seconds, until the LED S0 is permanently lit. While holding the button for approximately 5 seconds, following screen is displayed (the button must be kept pressed).

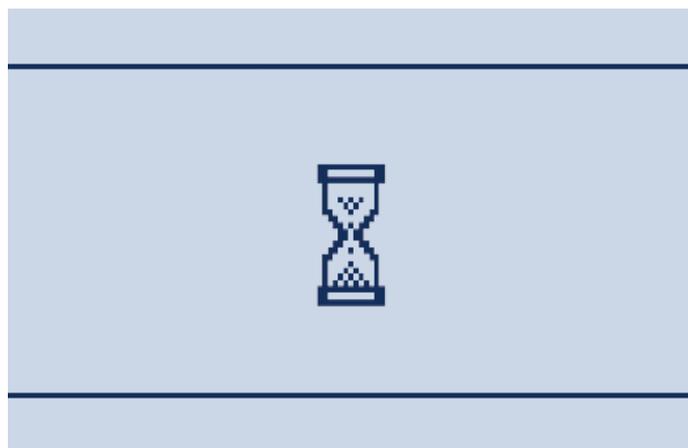


Fig. 19 – Loader start

Then the screen is switched to following one (“**RESTORE**” button must be kept pressed) and LED S0 will be flashing quickly.

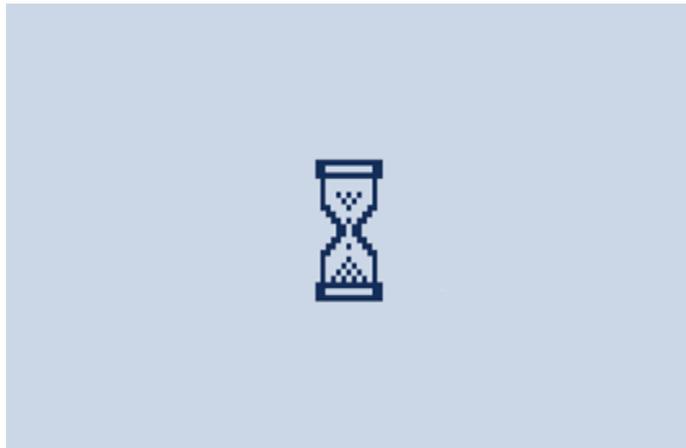


Fig. 20 – Factory setting conditions evaluating

Hourglass picture is dismissed after approximately 10 seconds and LED S0 is permanently lit. This means the device was restored to the factory settings successfully. Release the button!

Once the device is restored to factory settings – following parameters are set.

Ethernet factory settings

Parameter	Default value
Station IP address	192.168.1.1
Network mask	255.255.255.0
Default gateway	0.0.0.0

Web server factory settings

Parameter	Default value
Administrator login / password	root / amit
Service login / password	service / amit
User login / password	user / amit

Parameter	TCP port default value
FTP server – data	20
FTP server – control	21
WEB server	80

Web server factory settings are restored only in case the server is included in user application.

9.4 Loader

Loader launching state can be used in cases the user application is causing any troubles, e.g. repeated restarting, controller connection inability, etc.

- Loader activation** Controller can be put into the Loader in two ways:
- 1) Procedure in case of flawless application running:
 - Press and hold “**RESTORE**” button until following screen is displayed (approximately 5 s).

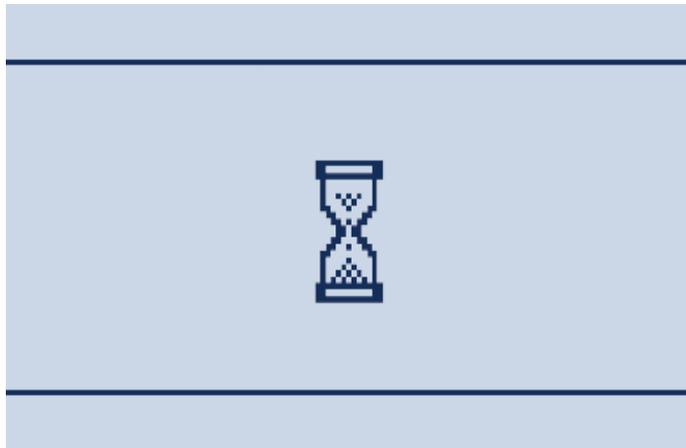


Fig. 21 – Loader start

- Release “**RESTORE**” button.
- 2) Procedure in case of application problems (restarts, controller connection inability, etc.)
 - Disconnect controller power supply.
 - Press “**RESTORE**” button.
 - Connect power supply while holding the Restore button.
 - Release “**RESTORE**” button“.

In both cases the controller restarts and LED S0 flashes with approximately 0.5 s period. “Service menu” is displayed.

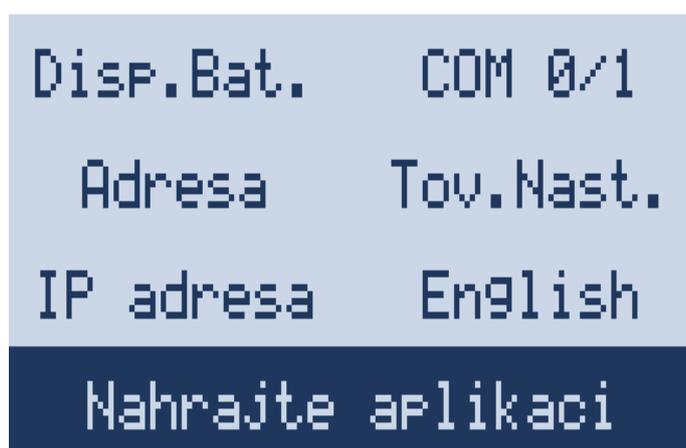


Fig. 22 – Service menu in the state “Loader”

9.5 Factory setting, jumpers

RS485 configuration The RS485 interface is fitted by jumpers that activate the wires termination and idle state definition.

Ethernet factory settings

Parameter	Default value
Station IP address	192.168.1.1
Network mask	255.255.255.0
Default gateway	0.0.0.0

Web server factory settings

Parameter	Default value
Administrator login / password	root / amit
Service login / password	service / amit
User login / password	user / amit

Parameter	TCP port default value
FTP server – data	20
FTP server – control	21
WEB server	80

10 Ordering information and completion

<i>Control unit</i>	AMR-OP10/90	Control unit, graphical display, Ni1000, Ethernet, 2 × RS485, Web server
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10.1 Completion

<i>AMR-OP10/90</i>	Part	Quantity
	Control unit	1
	WAGO 231-303/102-000	1
	WAGO 231-306/102-000	1

11 Maintenance

The device does not require any regular inspection or service, except of checking the backup battery voltage.

Backup battery Backup battery is used for backing up program, time and RAM memory parameters. Its nominal voltage is 3.0 V DC; nominal capacity is 1 Ah. If battery voltage drops under 1.9 V, it is considered as discharged. When this happens, it is necessary to change it.

Checking is necessary at least once every year. An assumed battery lifetime is 5 years according to manufacturer. We recommend implementing the backup battery measuring directly into application.

Cleaning Time after time with regard to way of device usage, it is necessary to remove dust from inside electronics. The device can be cleaned by dry soft brush or vacuum cleaner, only when switched-off and disassembled.

Note User can replace the CR2032 battery after case removal.

12 Waste disposal

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

Battery disposal The equipment contains a lithium battery. The battery is a hazardous waste. Therefore, it must be delivered to places specified for that purpose. Disposal of worn-out batteries and accumulators must not be in contrary to valid regulations.