

AMR-OP87/G

Graphical industrial terminal

Operation manual

Version 1.02



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History of revisions

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Revision	Date	Changes
100	16. 1. 2015	New document
101	31. 3. 2015	Chapters 3., 3.1., 9. and 11.1 fixed.
102	12. 11. 2015	Changes in chapter 2, Changed figures.

Related documentation

1. DetStudio Development Environment Help
file: Psedet_en.chm
2. Application Note AP0016 – Principles of using RS485 interface
file: ap0016_en_xx.pdf
3. Application Note AP0037 – Principles of using Ethernet network
file: ap0037_en_xx.pdf
4. Application Note AP0046 – Setting web server
file: ap0046_en_xx.pdf
5. Application Note AP0050 – Project documentation for AMiT company products
file: ap0050_en_xx.pdf

1. Introduction

AMR-OP87/G is a freely programmable control terminal. It is intended to be built-in into switchboard front panel.

- Basic features**
- TFT 7" display with resolution (800 × 480) pixels
 - Display colour depth is 65536 colours, control elements – 256 colours
 - Touchscreen operating
 - 2 × RS485 line (1 × without galvanic separation, 1 × galvanically separated)
 - 10/100 Mbps Ethernet line
 - Internal GSM modem
 - Integrated web server
 - Slot for Micro SD card
 - Power supply 24 V DC
 - Programming in DetStudio / EsiDet environment

Note Usage of peripherals and colourful displaying depends on current possibilities of DetStudio / EsiDet development environment. Details about such usage are described in application software documentation.

2. Technical parameters

Processor	Type	STM32F427
	FLASH	2 MB
	External FLASH	2 × 8 MB
	RAM on chip	256 KB
	EEPROM	32 KB
	SRAM backup	4 MB
	SRAM + RTC backup	BR2477 lithium battery removable module
	Battery lifetime	5 years in normal environment *)

Note *) Normal environment is defined at 25 °C temperature.

RTC	Type	STM32F427 (internal, in CPU)
	Precision at 25 °C	±20 ppm

Display	Type	TFT 7"
	Resolution	(800 × 480) pixels
	Visible area	(152.4 × 91.4) mm
	Luminance	280 cd/m ²
	Contrast	400 : 1
	Colour depth	65536
	Viewing angle	130 °
	Backlight	LED
	Backlight colour	White
	Backlight lifetime	20 000 hours *)

Note *) Luminance drop to 50 %.

Touch panel	Type	Resistive
	Number of touches	10 ⁶
	Touching strength	250 g
	Hardness	≥□3 H

Note Touch panel is intended for operating by finger, by tool without sharp edges or by finger-in-glove.

SD card	Type	Micro SD (HC)
	Capacity	128 MB to 16 GB *)

Note *) Micro SD card is not part of delivery.

GSM	GSM bands	850 MHz, 900 MHz, 1800 MHz, 1900 MHz
	Modem type	TELIT GL865-DUAL V3
	SIM card type	Mini (2FF)
	Antenna connection *)	SMA connector

Note *) Antenna is not included.

RS485	Quantity	2
	Overvoltage protection	Transil 160 W
	Galvanic separation *)	COM0 Yes COM1 No
	Terminating resistor **)	120 Ω on the unit

Idle state definition **) 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
Max. number of stations on segment	COM0 256 COM1 32
Operation indication	LED on back cover
Connection points	2 × WAGO 231-303/102-000
Wire cross section	0.08 mm ² to 2.5 mm ²

Note *) Insulation must not be used for dangerous voltage separation.

**) Terminating resistor and idle state definition are connected concurrently.

Ethernet	Quantity	1
	Data transmission rate	10 / 100 Mbps
	Operation indication	Connector built-in LED
	Galvanic separation	Yes
	Insulation strength	300 V AC / 1 minute *)
	Connection point	RJ45 connector, according to IEEE802.3

Note *) Insulation must not be used for dangerous voltage separation.

Power supply	Nominal power supply voltage	24 V DC
	Power supply voltage range	19.2 V DC to 28.8 V DC
	Maximum power consumption	200 mA at 24 V DC
	Connection point	WAGO 231-302/102-000
	Wire cross section	0.08 mm ² to 2.5 mm ²

Mechanics	Mechanical design	Panel + metal cover
	Panel material	Dural, EN AW 5754, 6 mm
	Surface finish	Komaxit, RAL 9006, fine matte
	Mounting	Into switchboard front panel
	Panel side ingress protection rate	IP65
	Dimensions (w × h × d)	(220 × 130 × 46) mm *)
	Weight – netto – brutto	0.86 kg ±5 % 1.06 kg ±5 %

Note *) Dimensions including FASTON connectors.

Temperatures	Operating temperature range	-20 °C to 70 °C *)
	Storage temperature range	-20 °C to 70 °C

Note *) When the temperature reaches 40 °C – maximum backlight level is reduced, when the temperature goes above 70 °C the display is switched off.

Others	Maximum ambient humidity	< 95 % non-condensing
	Programming	DetStudio / EsiDet

2.1. Dimensions

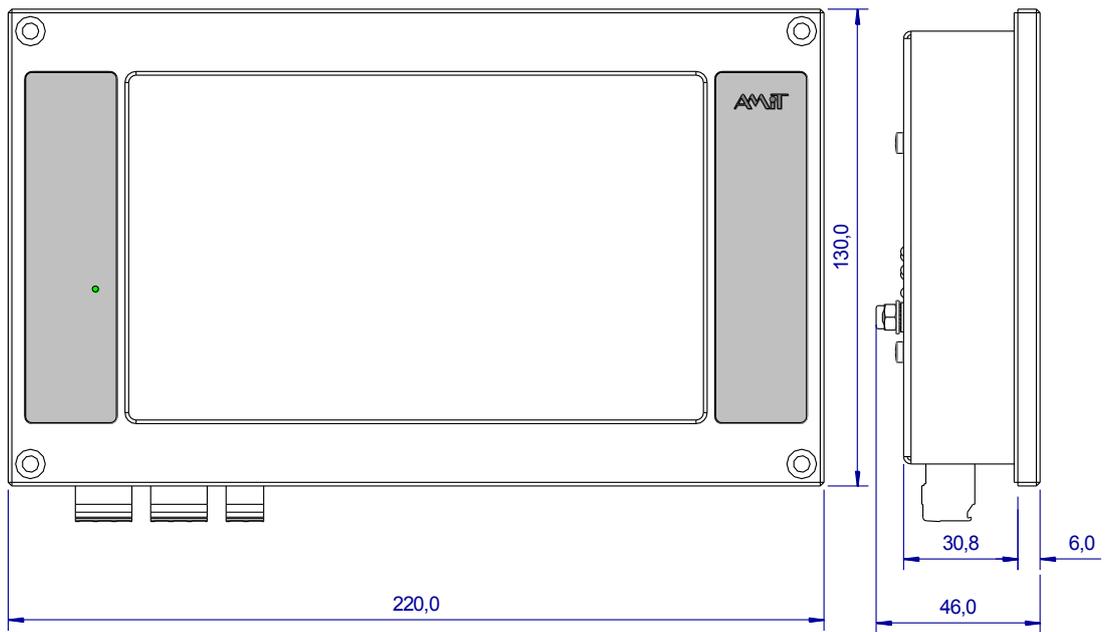


Fig. 1 - AMR-OP87/G dimensions

2.2. Connector, indication elements

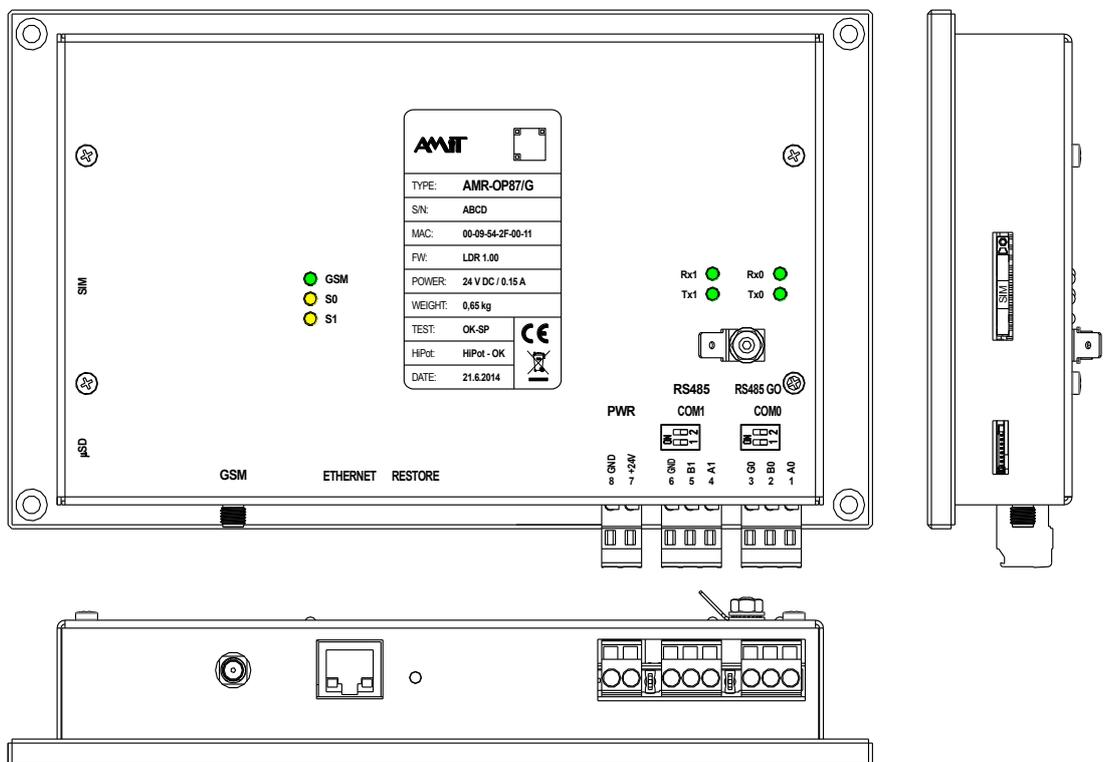


Fig. 2 - Connectors and indication elements location

2.3. Recommended drawing symbol

Following drawing symbol is recommended for **AMR-OP87/G** control terminal. Only part of it will be visible in following examples.

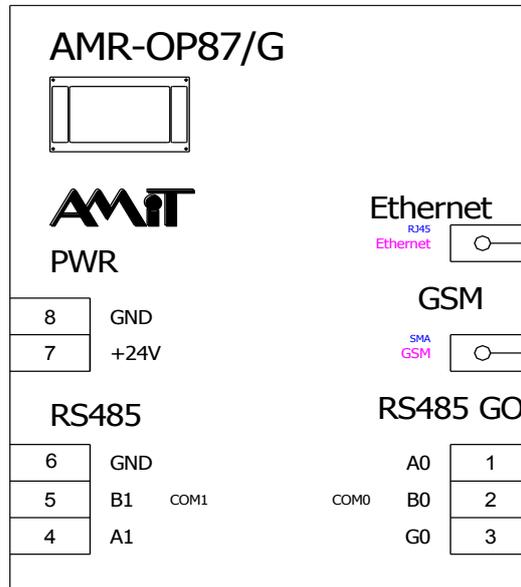


Fig. 3 - Recommended drawing symbol for **AMR-OP87/G**

3. Conformity assessment

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

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	Complies, A *)
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test	8 kV
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test	Complies
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, power supply	±4 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	±2 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

- *) This is device of Class A. In the internal environment this product can cause some radio disturbances. In such case the user can be requested to take the appropriate measures.
- #) Other than power supply circuitry cabling, which is longer than 30 m must be carried out by using the shielded cables.

3.1. Other tests

Tested in accordance with standard	Type of test	Classification
EN 61000-4-29:2000	Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on DC input power port – Immunity test	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

AMR-OP87/G control terminal can be powered only by DC power supply. Power source must meet requirements listed in chapter 2. Technical parameters.

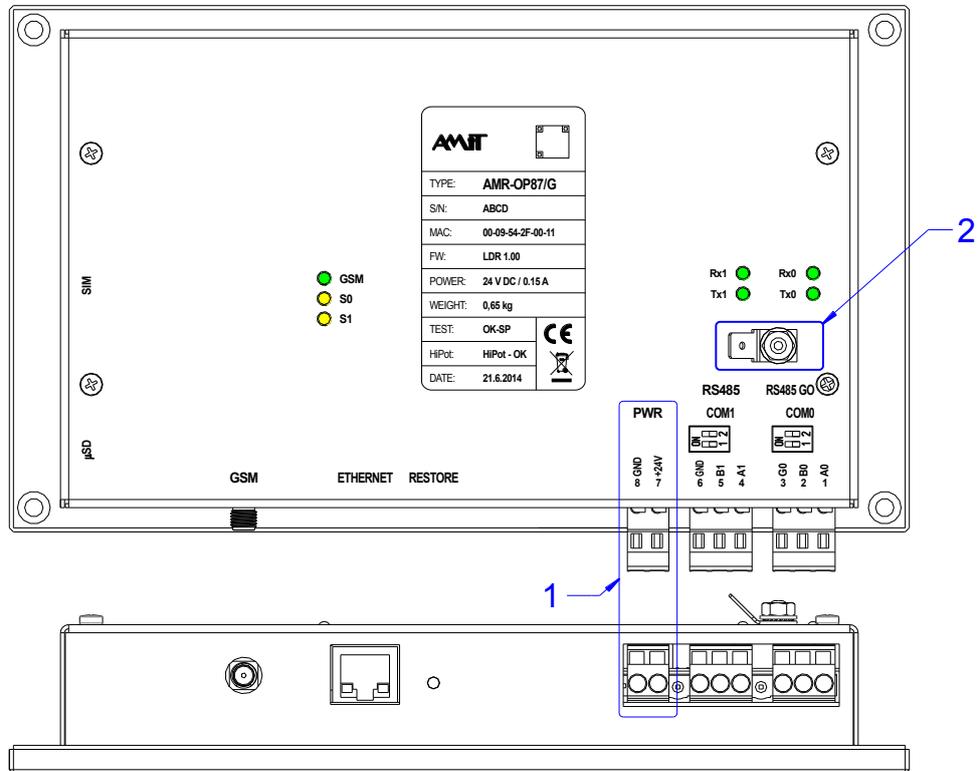


Fig. 4 - Power supply connector location

Legend

Number	Description
1	Power supply connector
2	FASTON connector for connection to PE

Connector wiring

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

Wiring example

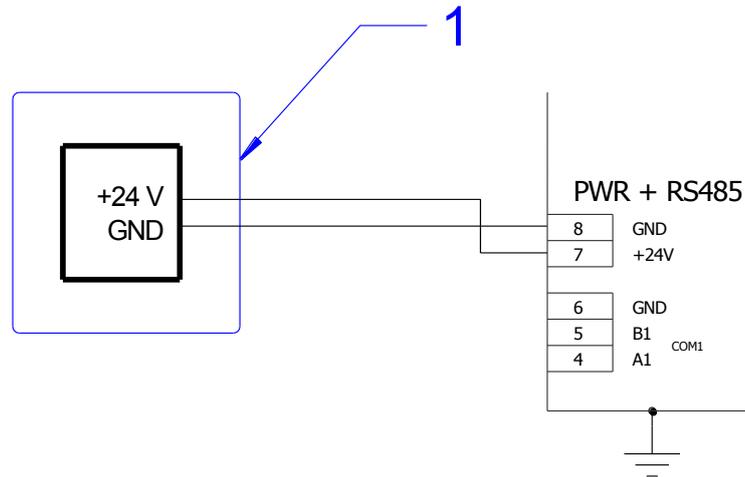


Fig. 5 - Power supply wiring example

Legend

Number	Description
1	External power supply 24 V DC

Note GND and PE are galvanically interconnected within the system. PE has its own separate terminal on the cover (see Fig. 4).

5. Communication lines

5.1. RS485 with galvanic separation (COM0)

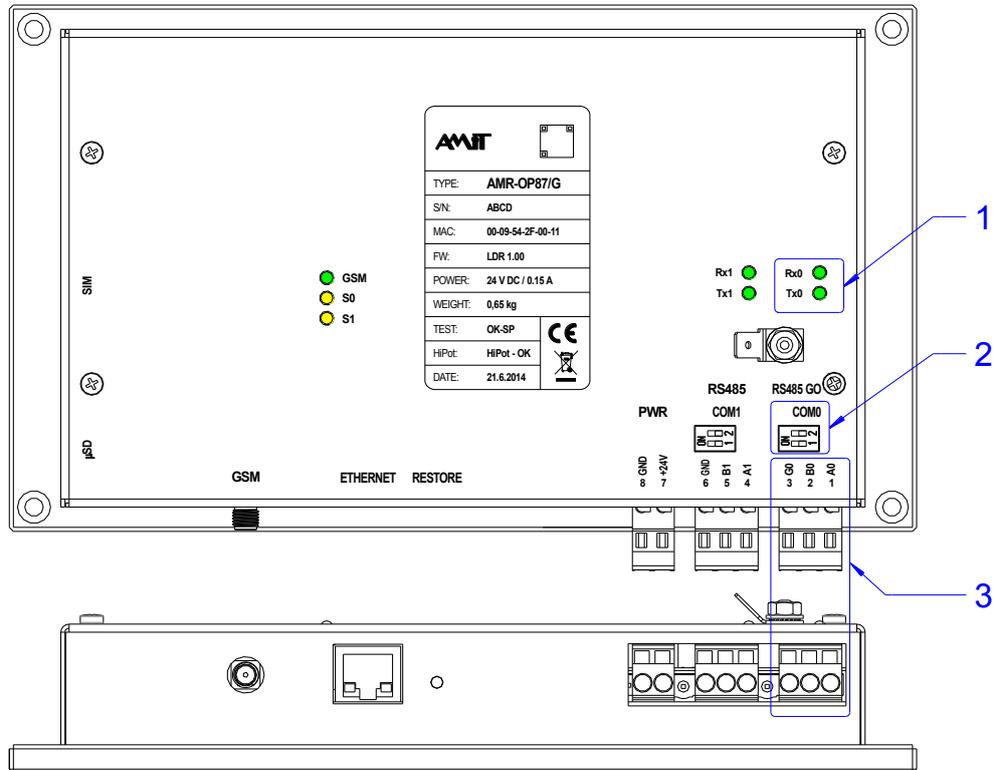


Fig. 6 - Location of galvanically separated RS485 connector

Legend

Number	Description
1	Indication LED, COM0
2	RS485 line termination, COM0
3	RS485 connector, COM0

Software operation When programming, the galvanically separated RS485 has number 0.

Connector wiring For proper working of RS485 is necessary to abide the rules presented in Application Note AP0016 – Principles of using RS485 interface.

Terminal	Signal	Description
1	A0	Galvanically separated RS485 line, signal A
2	B0	Galvanically separated RS485 line, signal B
3	G0	Galvanically separated RS485 line, ground

Configuration DIP Each station on RS485 communication line must have properly set the line termination resistors. Configuration DIP switches used for termination adjusting, are located near the RS485 connector.

Switch state description	Both switches	Description
	ON	End-station – Idle state and line termination is active.
	OFF	Intermediate station – Idle state and line termination is inactive.

Status indication The line status is indicated by a LED on back cover.

5.2. RS485 without galvanic separation (COM1)

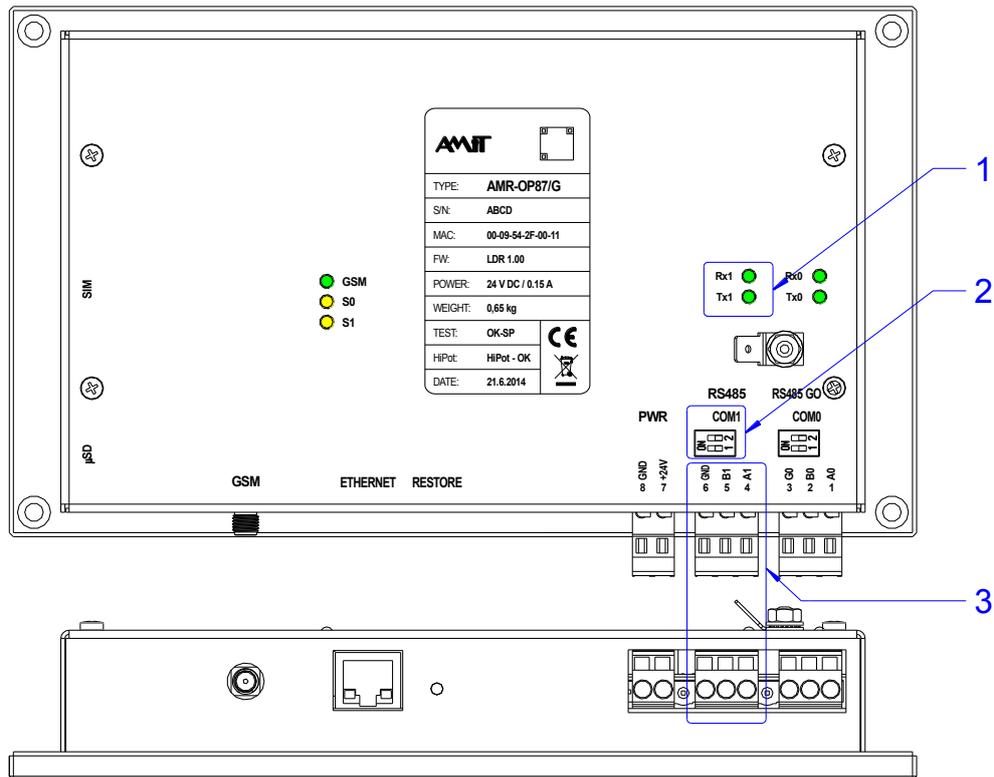


Fig. 7 - Location of RS485 line connectors

Legend	Number	Description
	1	Indication LED, COM1
	2	RS485 line termination, COM1
	3	RS485 connector, COM1

Software operation When programming, RS485 without galvanic separation has number 1.

Connector wiring For proper working of RS485 is necessary to abide the rules presented in Application Note AP0016 – Principles of using RS485 interface.

Terminal	Signal	Description
4	A1	RS485 line, signal A
5	B1	RS485 line, signal B
6	GND	Ground

Configuration DIP Each station on RS485 communication line must have properly set the line termination resistors. Configuration DIP switches used for termination adjusting, are located near the RS485 connector.

Switch state description	Both switches	Description
	ON	End-station – Idle state and line termination is active.
	OFF	Intermediate station – Idle state and line termination is inactive.

Status indication The line status is indicated by a LED on back cover.

5.3. Ethernet

Through Ethernet interface the control terminal can be directly connected to LAN network. Components of standard structured cabling can be used for connection.

The Ethernet interface can be used both for visualization and remote loading of application software into control terminal via Internet. Ethernet interface is supported by DetStudio Environment. TCP/IP protocols family is used for communication, therefore the communication network can be shared both by terminals and personal computers.

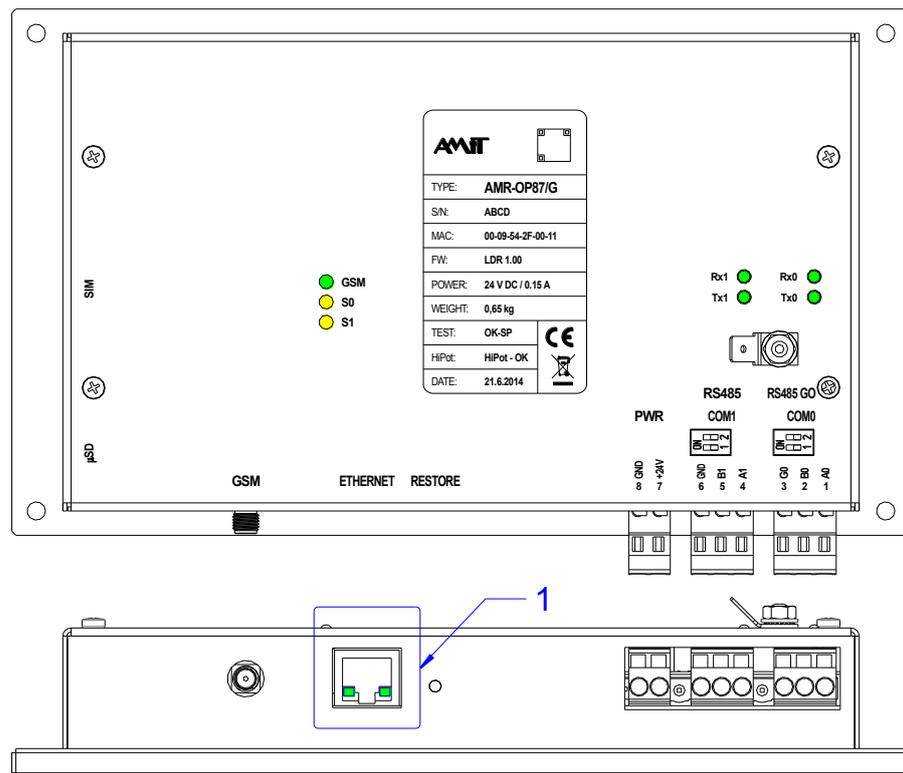


Fig. 8 - Location of Ethernet line connector

Legend	Number	Description
	1	Connector RJ45 for Ethernet with LED indicators

Line state indication Status of Ethernet line is indicated by LEDs (LNK / ACT and SPEED) on Ethernet line connector.

Description of LED	LED	Colour	Description
	LNK/ACT	Green	Ethernet line connection, data reception and transmission.
	SPEED	Green	LED is lit during 100 Mbps connection.

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

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

5.4. GSM modem

SMS messages can be sent/received to/from control terminal in UPD mode via integrated modem. Within SW the GSM port has number 2. Antenna (not included) can be connected to control terminal via SMA connector on the bottom of the control terminal. SIM card slot is located on the side of the control terminal, near the Micro SD Card slot.

The way modem is used is given by current possibilities of DetStudio / EsiDet development environment. Details about modem usage are described in application software documentation.

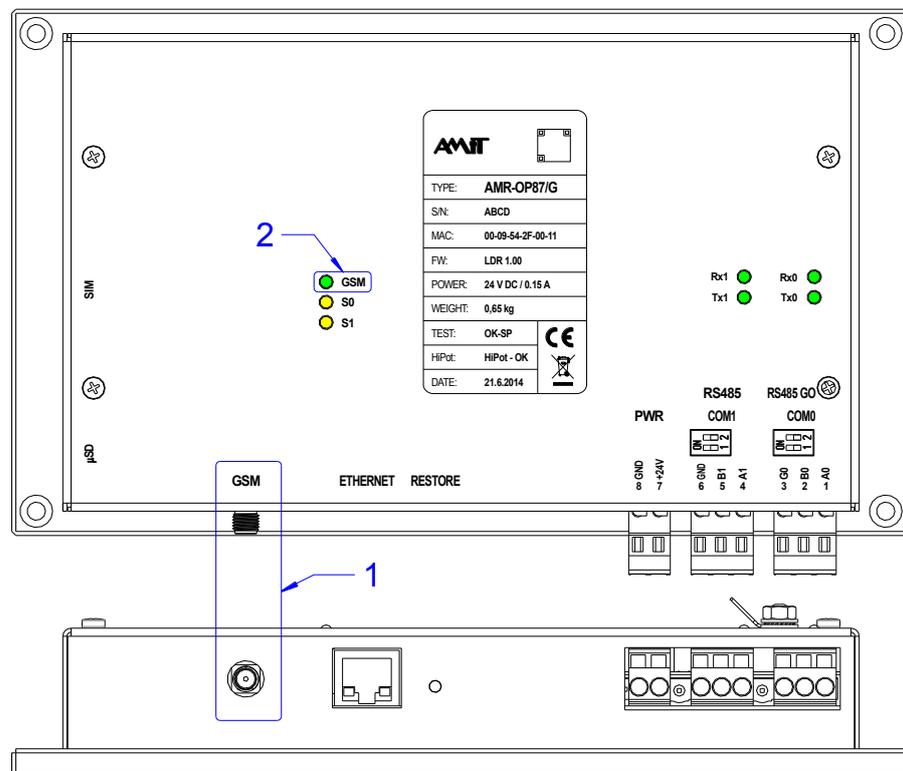


Fig. 9 - Location of Ethernet line connector

Legend

Number	Description
1	SMA connector for GSM modem
2	LED indicating GSM modem status

SIM card is inserted with contacts towards the panel. SIM card insertion / ejection can be performed only when the control terminal power supply is off!

GSM interface status is indicated via separate LED on the cover.

When the modem is turned off, the LED is also off. The LED flashes with 1 s period after the modem is turned on, without logging to GSM network. After the modem is logged on to the network, the LED flashes with 3 s period.

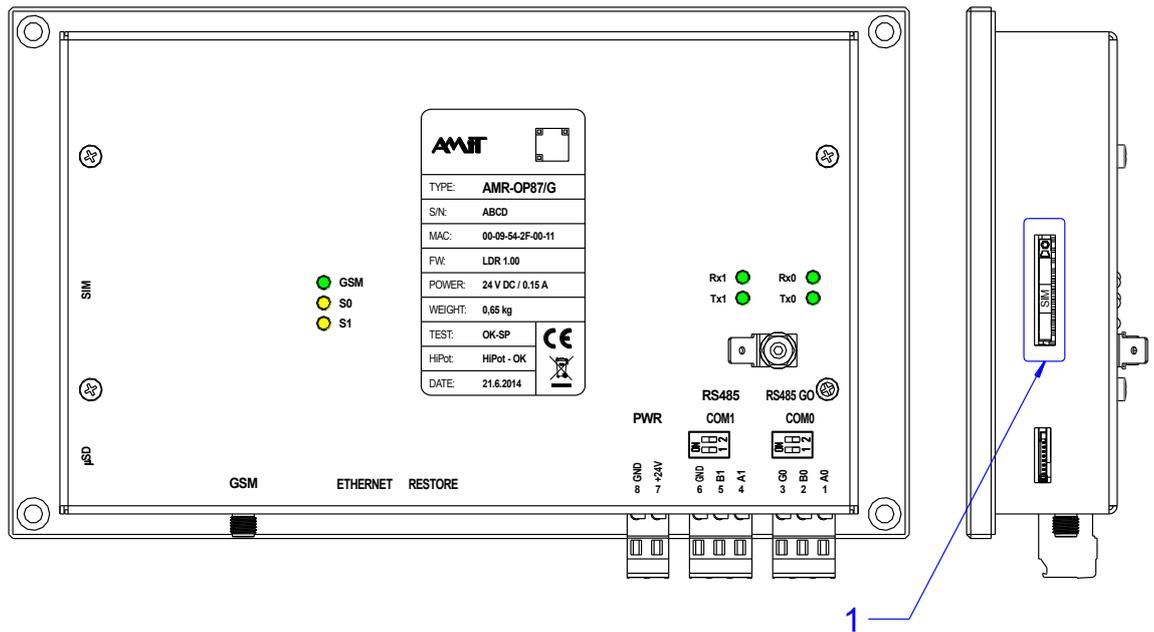


Fig. 10 - Location of SIM card slot

Legend

Number	Description
1	Location of input hole for SIM card holder

6. Battery voltage, SD card

6.1. Backup battery voltage

Voltage of backup battery can be measured in applications, written in DetStudio development environment by using the following script:

Operation example Ram.fUbat = IO.VBatt;

Measured value is battery voltage [V].

Based on this check, the operator can be alerted to necessity of battery exchange.

More information regarding backup battery can be found in chapter 10. Maintenance.

6.2. SD card

Micro SD card slot is located on the side of **AMR-OP87/G** control terminal.

The way card is used is given by current possibilities of DetStudio / EsiDet development environment. Details about card usage are described in application software documentation.

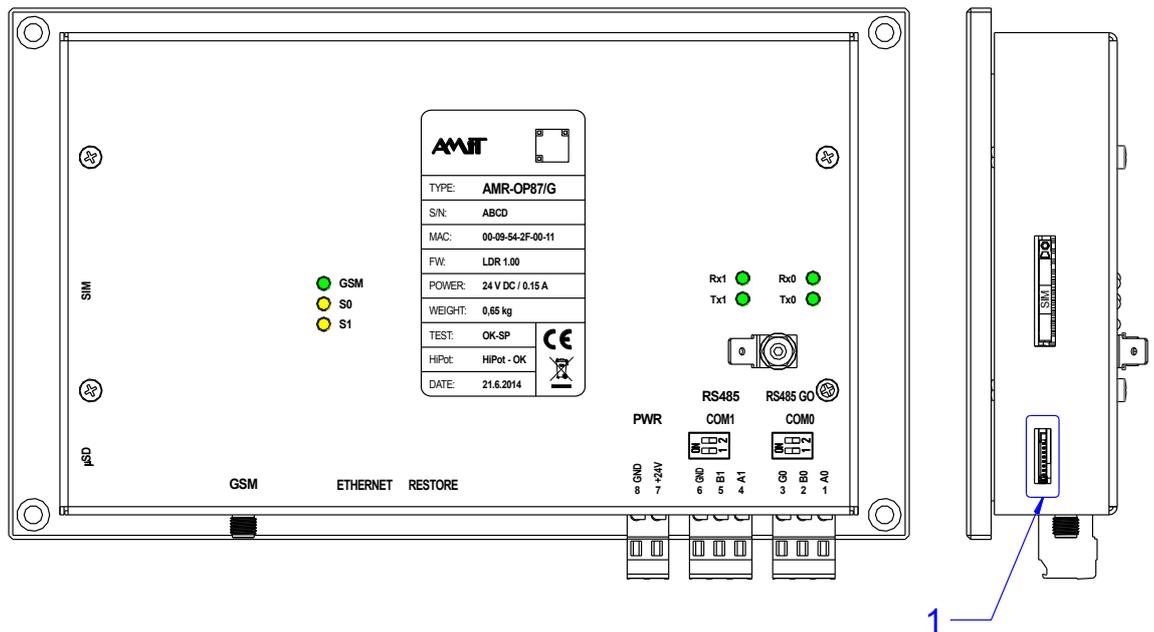


Fig. 11 - Location of Micro SD card slot

Legend	Number	Description
	1	Location of Micro SD card slot

7. Mounting

Control terminal can be mounted in any position.

7.1. Mounting procedure

1. Cut the rectangular hole in switchboard front panel, with dimensions (197 × 120) mm; attached template makes the work easier.
2. Drill a mounting holes with a spacing (208 × 118) mm, Ø 4.2 mm.
3. Insert the control terminal into hole in switchboard from the front side.
4. Screw the control terminal into the front panel, using four M4 bolts and nuts.
5. Attach the communication and supplying conductors.

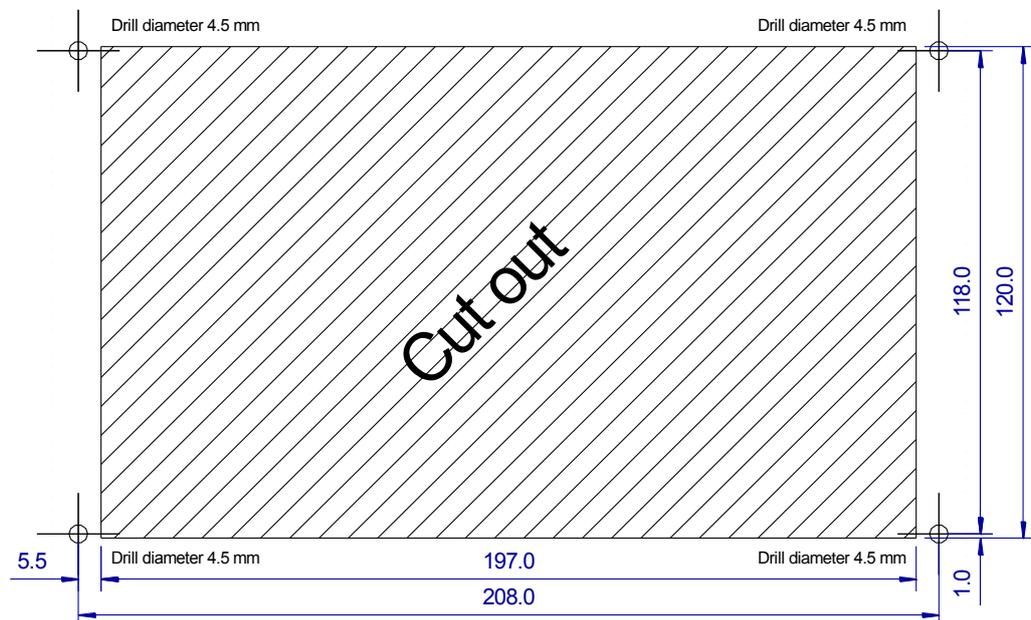


Fig. 12 - Mounting apertures

7.2. Setting the terminal

AMR-OP87/G control terminal has only RS485 line termination and idle state definition setting. Line termination and idle state definition is set by two DIP switches. There is no need to take of the cover during normal operation.

7.3. Installation rules

EMC filter Use an EMC filter on 230 V AC supply voltage input. Based on environment character and wiring layout this requirement can be revised.

Connecting to PE Negative supplying terminal (GND) of the device is internally connected with PE.

If the wires are led outside the building, the appropriate communication lines must be overvoltage protected.

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

Ethernet line It is necessary to perform connecting of Ethernet line according to recommendations presented in Application Note *AP0037 – Principles of using Ethernet network*.

Note All connections to PE terminal must be realized with impedance as low as possible. Technical parameters of terminal are guaranteed only when these wiring principles are applied.

8. Programming, setting

Programming of **AMR-OP87/G** control terminal is done through the Ethernet interface, using DetStudio / EsiDet development environment.

Follow the instructions from Help of DetStudio – EsiDet development environment.

“Landscape” and “Portrait” orientations are supported (needs to be selected in development environment during creation of user application).

Not all graphical elements are supported in both orientation versions.

8.1. Service mode

Service mode allows:

- Setting control terminal basic parameters,
- Restoring system to “Factory settings”,
- Putting the system into “Loader” mode.

Service mode can be activated by following procedure:

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

8.2. Setting terminal basic parameters

Basic parameters can be set in menu, displayed on terminal after service mode activation. Menu is always displayed with Landscape orientation, regardless of assembly, or selected in user application Portrait / Landscape orientation.



Fig. 13 - Service mode menu, called-out by touching the screen

Following information can be set or displayed in this menu:

- Display and Battery
 - Calibration – calibration of the touchscreen sensitive layer,
 - Display brightness adjustment,
 - Battery status check.
 - RS485 – setting communication parameters *)
 - Parity,
 - Speed.
 - IP parameters
 - IP Address,
 - Network mask,
 - Default gateway.
 - Factory setting.
 - Service mode language selection.
- *) Can be set only in case they are not “permanently” given by the user application.

To exit service mode it is necessary to press the button “Return to application”. Then the system restarts automatically.

8.3. Factory setting

Factory settings can be restored from the basic parameters menu,



Fig. 14 - Factory settings item in the Service mode menu

or by using *RESTORE* button on the rear side of the terminal.

RESTORE button can be pushed by suitable blunt tool anytime during user application run. System status is indicated by period of LED S0 flashing. This LED flashes with 1 Hz period during normal operation.

The system does not react on press shorter than 3 s.

If button is press for more than 3 s – the system resets. This state is indicated by LED S0 flashing with 10 Hz period, the display is dark. If the button is released in this moment, the system goes to “Loader” mode, message on the display says: “Load application” with correct IP address and mask settings. If you do not want to update the application, the only way how to exit this mode is to switch the device off and on.

If the *RESTORE* button is pressed for more than 10 seconds, “Factory settings” are restored. This state is indicated by permanent light of LED S0, the display is dark. After the factory settings are restored, actual application is launched by the default.

If the user application in the system constantly goes thru the reset, it might be not possible to enter “Service mode” by pressing the touchscreen during power-on. By pressing *RESTORE* button you can always enter “Loader” mode.

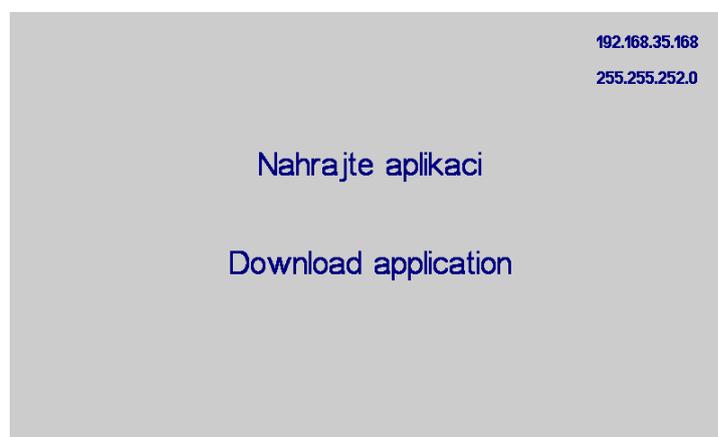


Fig. 15 - Request to load application

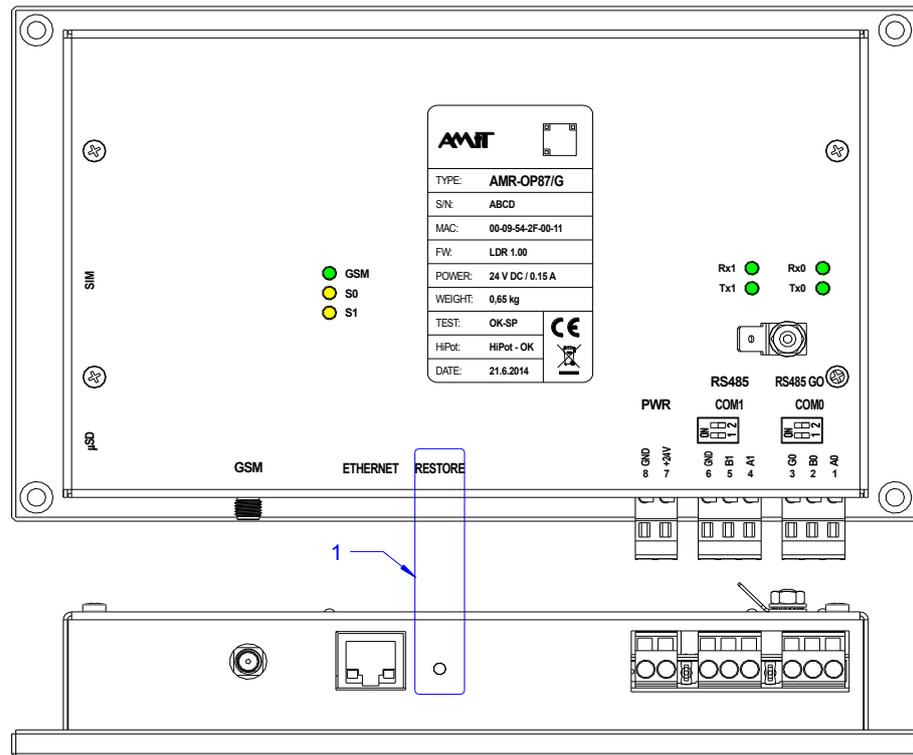


Fig. 16 - The RESTORE button

Legend

Number	Description
1	Location of RESTORE button

Ethernet factory setting

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/pass	root / amit
Service login/pass	service / amit
User login/pass	user / amit

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

Factory settings can be restored from “Service mode”, or by long press of the *RESTORE* button.

Web server factory settings has significance only in case the server is included in user application.

8.4. Battery check

“Battery check” screen can be called-out from the Service mode menu.



Fig. 17 - “Battery check“ screen

If the battery voltage is lower than 2.1 V, OK sign is replaced with warning “LOW!” in a red array. If the voltage is lower than 1 V, warning “MISSING” is displayed in a red array.

8.5. Factory setting, jumpers

RS485 configuration Both RS485 lines have DIP switches ON, which activates the line termination and idle state definition.

9. Ordering information and completion

<i>Graphical terminal</i>	AMR-OP87/G	Unit complete – see chapter 9.1. Completion
	<i>Others</i>	
	MB247720	Battery module (spare part)
	GSM-ANT-U1S	GSM – Rod antenna, angled, 1 dB, without cable, SMA
	GSM-ANT-M5S	GSM – Magnetic antenna, 5 dB, cabel 3 m, SMA
	GSM-ANT-L2S	GSM –Self-adhesive antenna, 2.5 dB, cabel 3 m, SMA

9.1. Completion

<i>AMR-OP87/G</i>	Part	Quantity
	Graphical industrial terminal	1
	WAGO 231-303/102-000	2
	WAGO 231-302/102-000	1

10. Maintenance

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

Backup battery For backing-up program, clock and parameters in RAM memory is used a backup battery. Its nominal voltage is 3.0 V DC; nominal capacity is 1 Ah. If battery voltage drops under 2.1 V DC, then it is considered to be discharged. When it happens, it is necessary to change the battery module.

Inspection must be carried out once per year. With reference to manufacturer, the assumed battery lifetime is 5 years. We recommend to implement the procedure of backup battery measuring direct into application.

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

Note User can change MB247720 battery module after removing the case.

10.1. Battery module change

No Micro SD card can be plugged-in during battery change procedure!

To change the battery module – take off the cover.

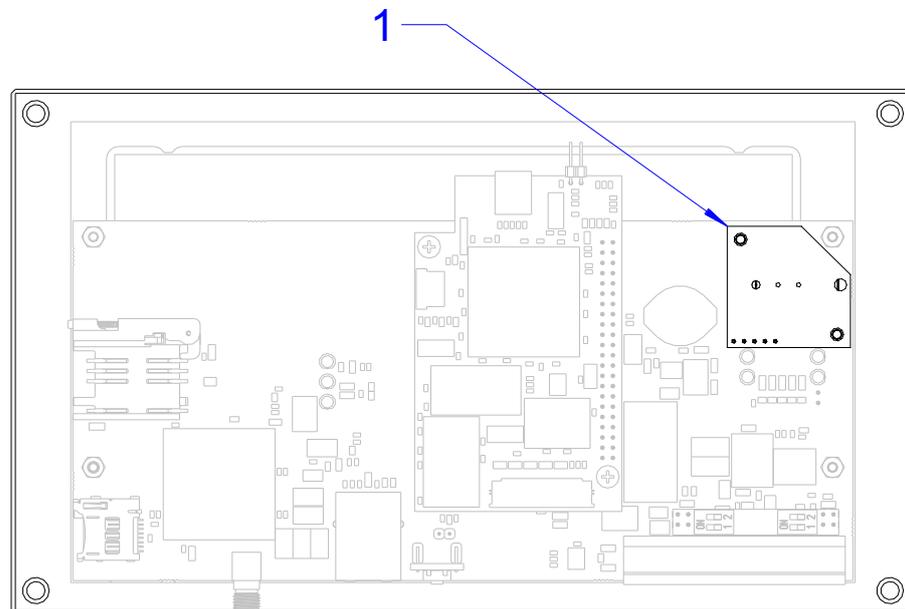


Fig. 18 - Location of battery module

<i>Legend</i>	Number	Description
	1	MB247720 battery module

Slide the module out in the direction of the arrow. Battery type: BR2477.

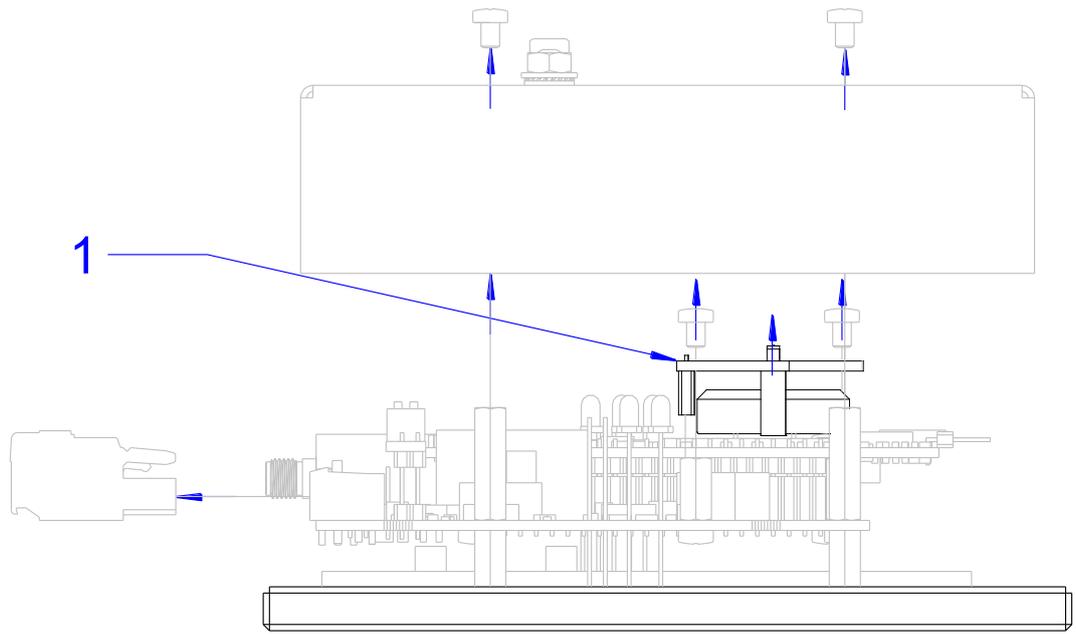


Fig. 19 - Ejecting battery module

Legend

Number	Description
1	MB247720 battery module

11. 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.

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.