AMR-IRC10/04

Programmable controller

Operation manual

Version 1.01

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Contents

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Revision	Date	Changes
100	22. 08. 2012	New document
101	28. 11. 2012	Chapter 10.5 correction

Related documentation

1. DetStudio development environment help
2. Application Note AP0005 – ARION Network Communication
   file: ap0005_en_xx.pdf
3. Application Note AP0016 – Principles of RS485 interface usage
   file: ap0016_en_xx.pdf
4. Application Note AP0025 – ARION Network Communication – definition by table
   file: ap0025_en_xx.pdf

1 Introduction

AMR-IRC10/04 is a small compact programmable controller intended for common use.

Basic features

- Power supply 24 V
- 1 analogue input 0 V to 10 V
- 4 analogue outputs 0 V to 10 V
- 1 digital dry input
- 2 digital outputs 24 V DC with galvanic isolation
- 2 RS485 serial interfaces (galvanic isolation: 1 × yes, 1 × no)
- IP55 protection rate
- On-wall mounting

2 Technical parameters

CPU

CPU	ST32F103
FLASH	512 KB
RAM	64 KB
EEPROM	2 KB

Analogue inputs

Number of inputs	1 ×
Type	Voltage, 0 V DC to 10 V DC
Accuracy	0.9 %
Input overvoltage protection	Diodes
Temporary derogation caused by conducted disturbances, induced by radio-frequency fields	Max. 15 %
Temporary derogation caused by high-frequency amplitude modulated electromagnetic field within 80 MHz to 1000 MHz band.	Max. 15 %
Temporary derogation caused by high-frequency amplitude modulated electromagnetic field caused by digital cell phones within 800 MHz to 2500 MHz band.	Max. 15 %
Galvanic isolation	No

Analogue outputs

Number of inputs	4 ×
Type	Voltage, 0 V DC to 10 V DC
Max. output current	1 mA
Accuracy	< 1.2 %
Temporary derogation caused by conducted disturbances, induced by radio-frequency fields	Max. 15 %
Temporary derogation caused by high-frequency amplitude modulated electromagnetic field within 80 MHz to 1000 MHz band.	Max. 15 %
Temporary derogation caused by high-frequency amplitude modulated electromagnetic field caused by digital cell phones within 800 MHz to 2500 MHz band.	Max. 15 %
Output resistance	120 Ω
Input overvoltage protection	Diodes
Galvanic isolation	No

Warning AGND terminals are internally connected with GND terminal.

Digital input

Number of inputs	1 ×
Type	dry contact
Input overvoltage protection	Diodes
R_{MAX} for log. 1	< 1000 Ω
R_{MIN} for log. 0	> 1300 Ω
Galvanic isolation	No

Digital outputs		
	Number of outputs	2 ×
	Type	MOS, 24 V DC ±20 %
	GI isolation strength	500 V AC *)
	Nominal switched voltage	24 V DC
	Maximum switched current	0.5 A DC (resistance load)
	Connection points	WAGO 256 cage clamp terminals

Power supply output		
	Voltage	24 V DC
	Maximum current consumption	200 mA
	Connection points	WAGO 256 cage clamp terminals

RS485		
	Quantity	2 ×
	Overvoltage protection	Transil 600 W
	Galvanic isolation *)	1 × Yes + 1 × 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	256 (interface with GI) / 31 (interface without GI)
	Operation indication	LED on the board
	Connection points	2 × WAGO 256 cage clamp terminals

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

**) Terminating resistor and idle state definition are connected concurrently. Interface without GI is terminated permanently; interface with GI can be terminated by user.

Power supply		
	Power supply	24 V DC
	Maximum power consumption	80 mA at 24 V DC

Mechanics		
	Mechanical design	Plastic box
	Mounting	On the wall
	Ingress protection rate	IP55
	Signal connection	WAGO 256 connectors
	Maximum wire cross section	2.5 mm^2
	Weight	400 g
	Dimensions (w × h × d)	(179 × 133 × 73) mm

Temperatures		
	Operating temperature range	0 °C to 50 °C
	Storage temperature range	-20 °C to 70 °C

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

2.1 Dimensions

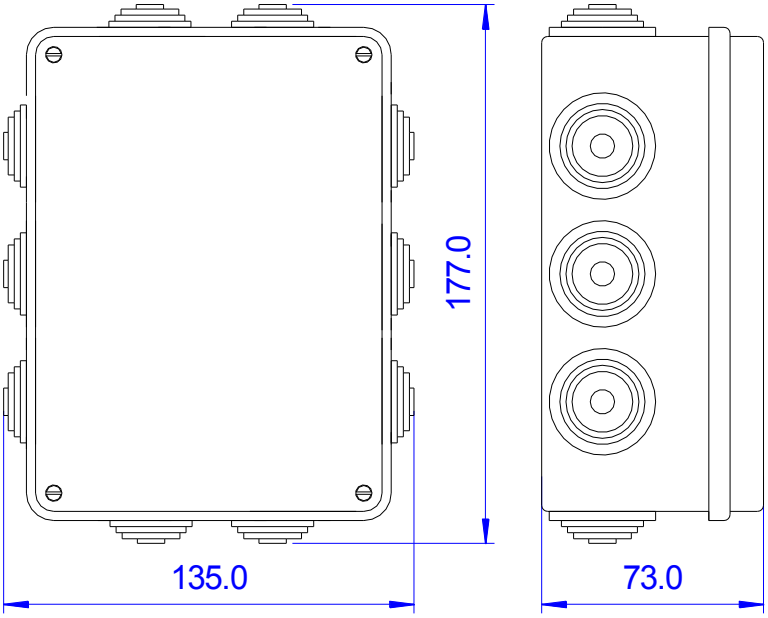

Fig. 1 – **AMR-IRC10/04** dimensions

2.2 Recommended drawing symbol

Following drawing symbol is recommended for the controller **AMR-IRC10/04**. Only part of it will be visible in following examples.

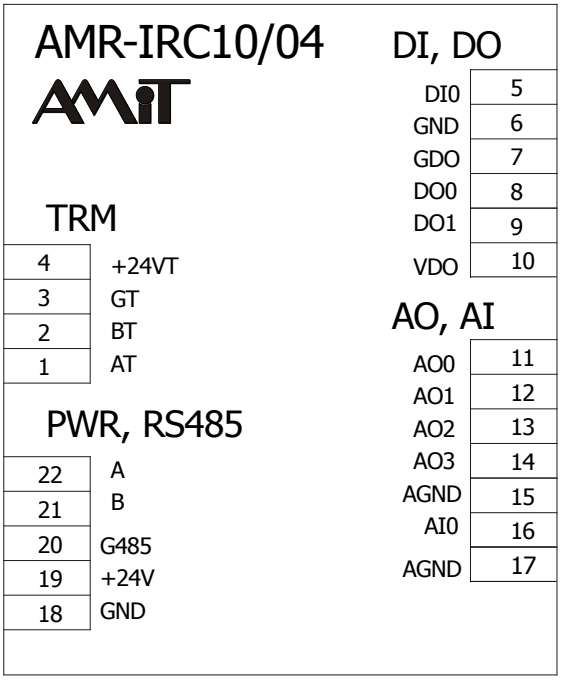

Fig. 2 – Recommended drawing symbol for **AMR-IRC10/04**

3 Conformity assessment

The equipment meets the requirements of NV616/2006 Czech Government 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	A *)
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	EMC - Part 4-3: 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	EMC - Electrical fast transient/burst immunity test, RS485	1 kV
EN 61000-4-4:2012	Electrical fast transient/burst immunity test, analogue inputs	1 kV
EN 61000-4-5:2014	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, power supply	2 kV
EN 61000-4-6:2014	Electromagnetic compatibility (EMC) – Part 4- 6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields	3 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.

3.1 Other tests

Tested in accordance with standard	Type of test	Classification
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: 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

4 Power supply

The controller **AMR-IRC10/04** is designed for 24 V DC power supply.

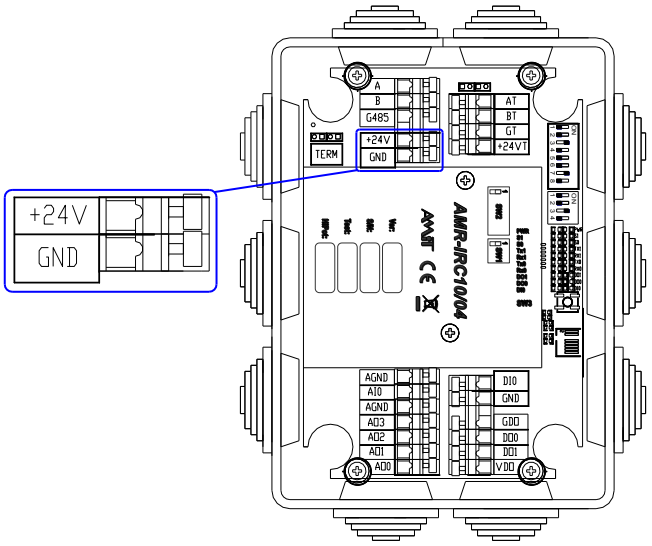

Fig. 3 – Power supply terminals location

Terminals labelling

Terminal	Label	Signification
19	+24V	Power supply voltage, 24 V
20	GND	Power supply voltage, ground

Note GND terminal must be connected to PE protective earthing conductor at a single point.

Indication A presence of controller power supply voltage is indicated by PWR LED.

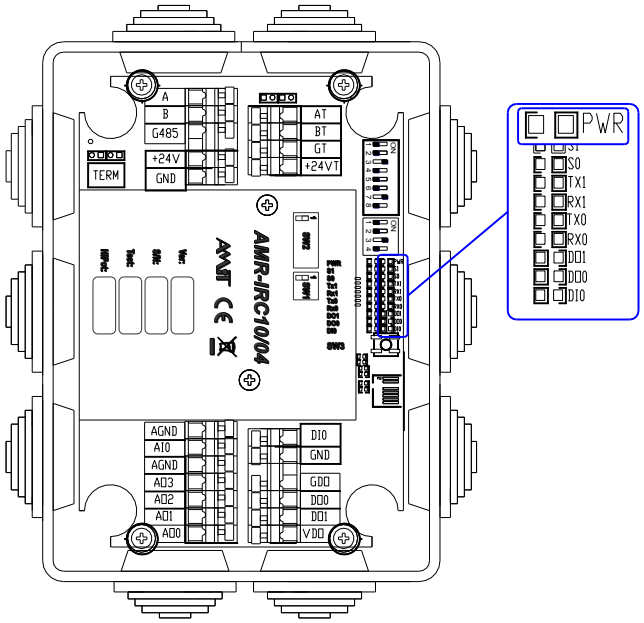

Fig. 4 – PWR status LED

5 Inputs / outputs

5.1 Analogue inputs

The controller **AMR-IRC10/04** contains one analogue input. Inputs can be used as voltage input with range of 0 V to 10 V.

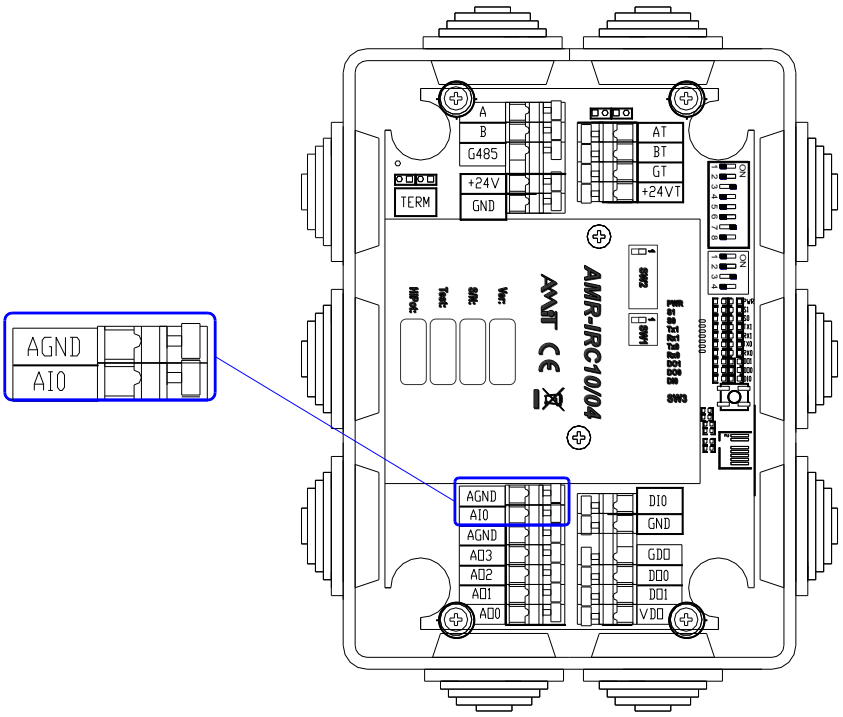

Fig. 5 – Analogue input terminals location

Terminals labelling

Terminal	Label	Signification
16	AI0	Analogue input
17	AGND	Analogue ground

Wiring example

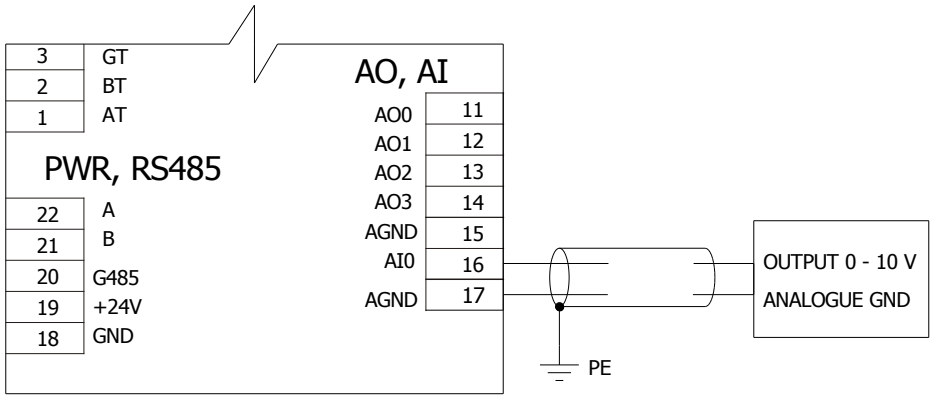

Fig. 6 – AI wiring example

5.2 Analogue outputs

The controller **AMR-IRC10/04** contains 4 analogue voltage outputs with range of 0 V to 10 V.

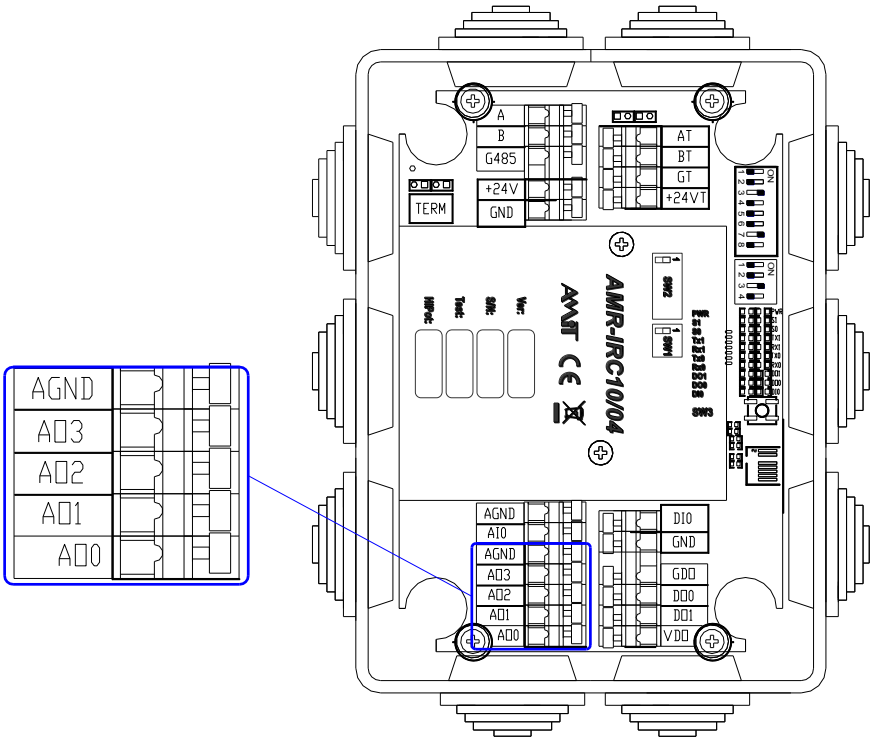

Fig. 7 – Analogue output terminals location

Terminals labelling

Terminal	Label	Signification
11	AO0	Analogue output 0
12	AO1	Analogue output 1
13	AO2	Analogue output 2
14	AO3	Analogue output 3
15	AGND	Analogue ground

Wiring example

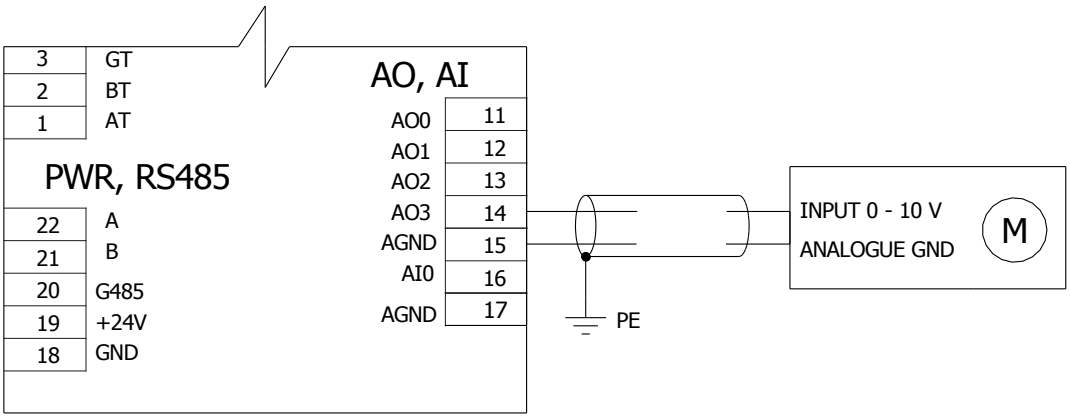

Fig. 8 – Example of wiring a drive to AO3 analogue output

5.3 Digital inputs

The controller **AMR-IRC10/04** contains one digital input 24 V.

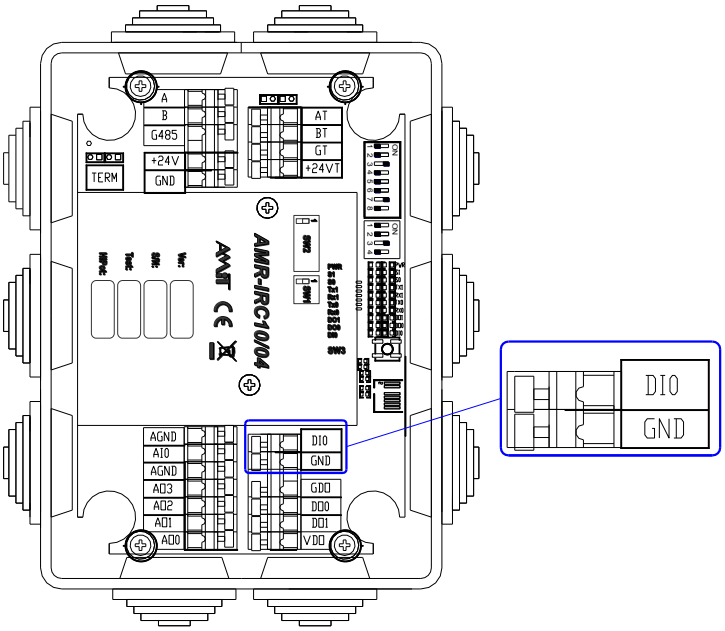

Fig. 9 – Digital input terminals location

Terminals labelling

Terminal	Label	Signification
5	DI0	Digital input
6	GND	Ground

Indication Digital input state is indicated by LED on the PCB board.

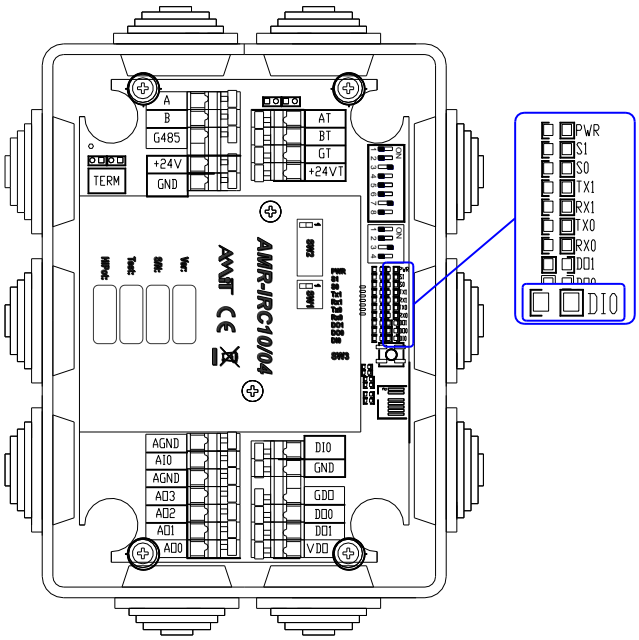

Fig. 10 – Digital input status LEDs

Wiring example

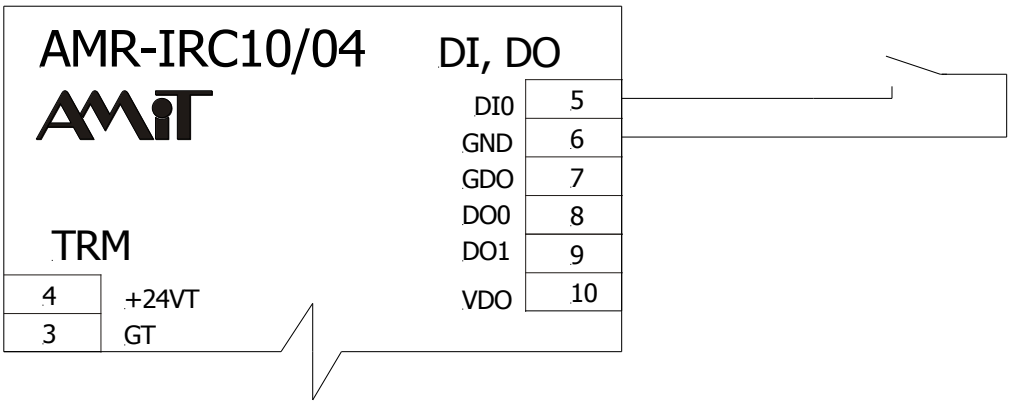

Fig. 11 – Example of contact wiring to DI0

5.4 Digital outputs

The controller **AMR-IRC10/04** contains 2 digital outputs 24 V with galvanic isolation.

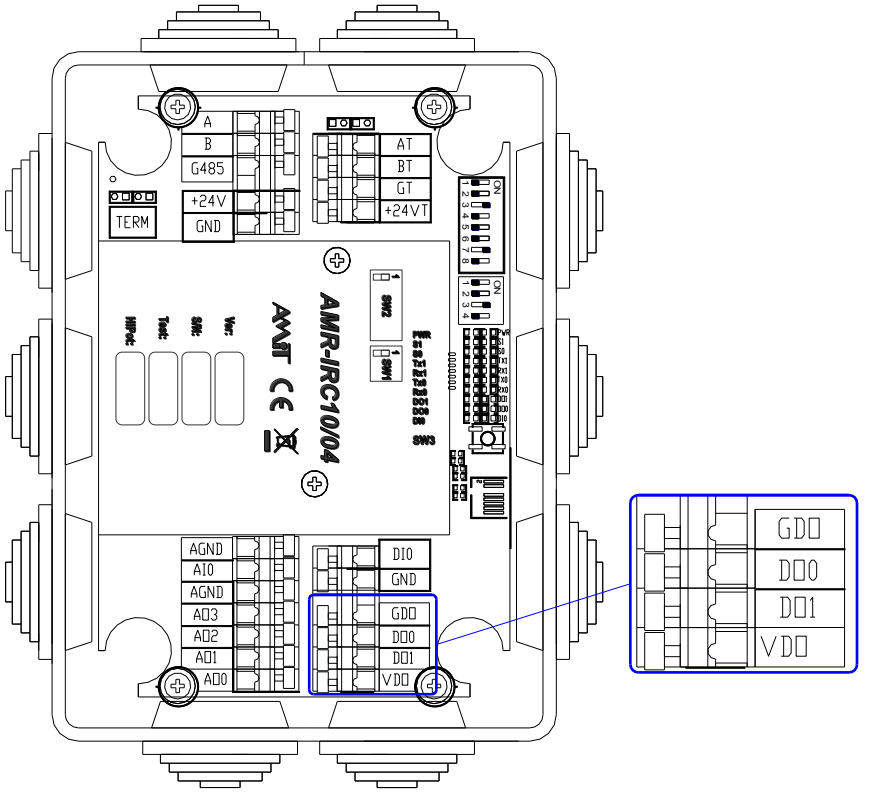

Fig. 12 – Digital output terminals location

Terminal	Label	Signification
7	GDO	Digital outputs, ground
8	DO0	Digital output 0
9	DO1	Digital output 0
10	VDO	Digital outputs, power supply

Indication Digital outputs state is indicated by DO0 and DO1 LEDs located on PCB board.

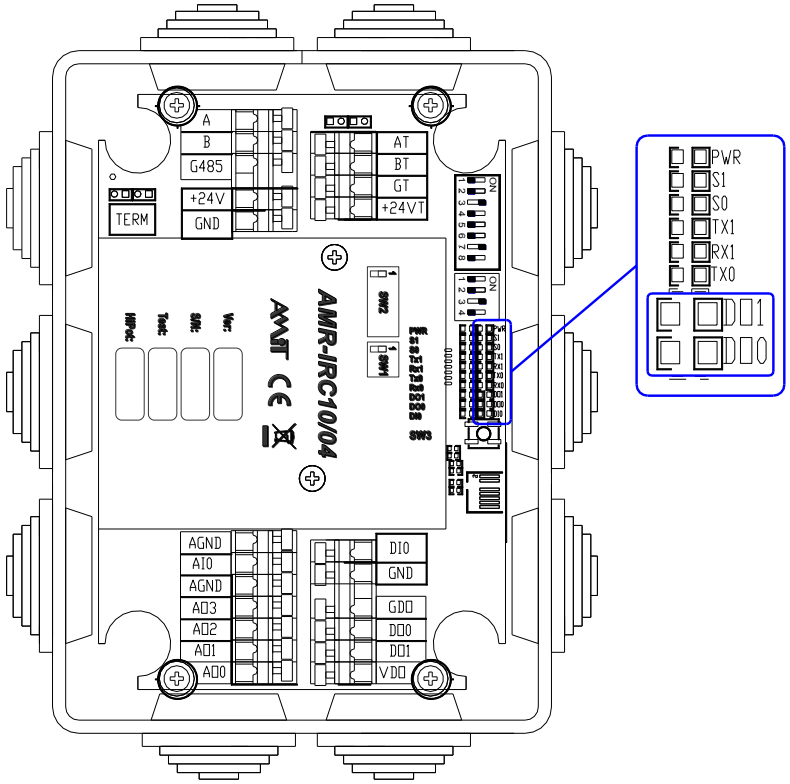

Fig. 13 – Location of digital output status LEDs

Wiring example

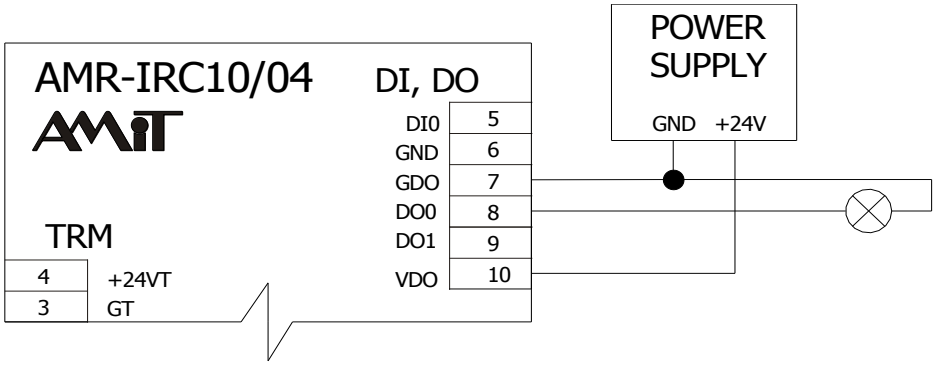

Fig. 14 – Signal light wiring to DO0 output

6 Communication interfaces

The controller **AMR-IRC10/04** contains two RS485 communication interfaces.

6.1 RS485 without galvanic isolation (COM0)

RS485 without GI is used for communication with room controller **AMR-OPxx** type. Interface is not galvanically isolated. The room controller power supply (24 V DC) is also located on terminals of this interface.

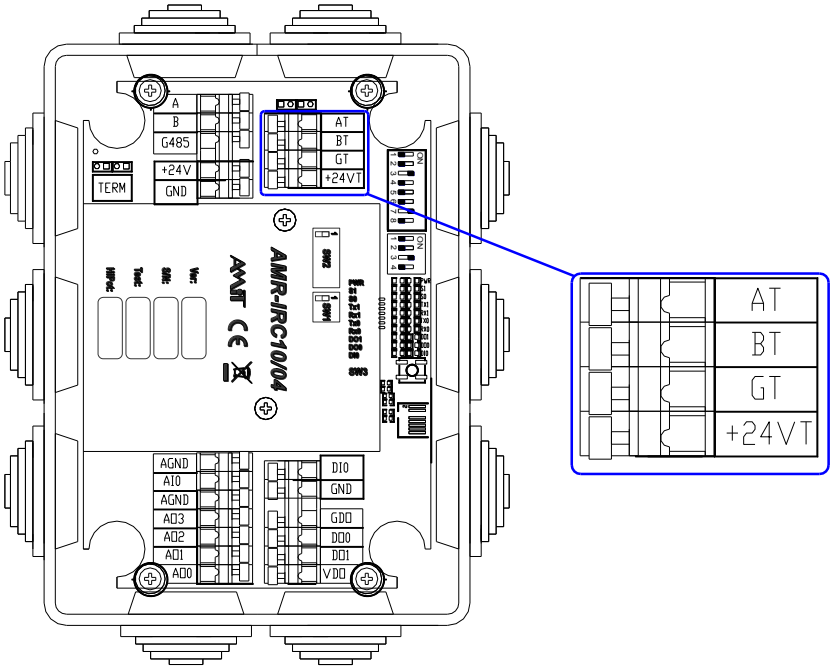

Fig. 15 – RS485 interface terminals location

Connector wiring

Terminal	Label	Signification
1	AT	RS485 interface, signal A
2	BT	RS485 interface, signal B
3	GT	Interface and room controller common ground
4	+24VT	Room controller power supply output +24 V

RS485 interface activity for room controller is indicated by LEDs located on PCB board.

RS485 status LEDs

LED	Signification
RX0	Controller is reading data
TX0	Controller is transmitting data

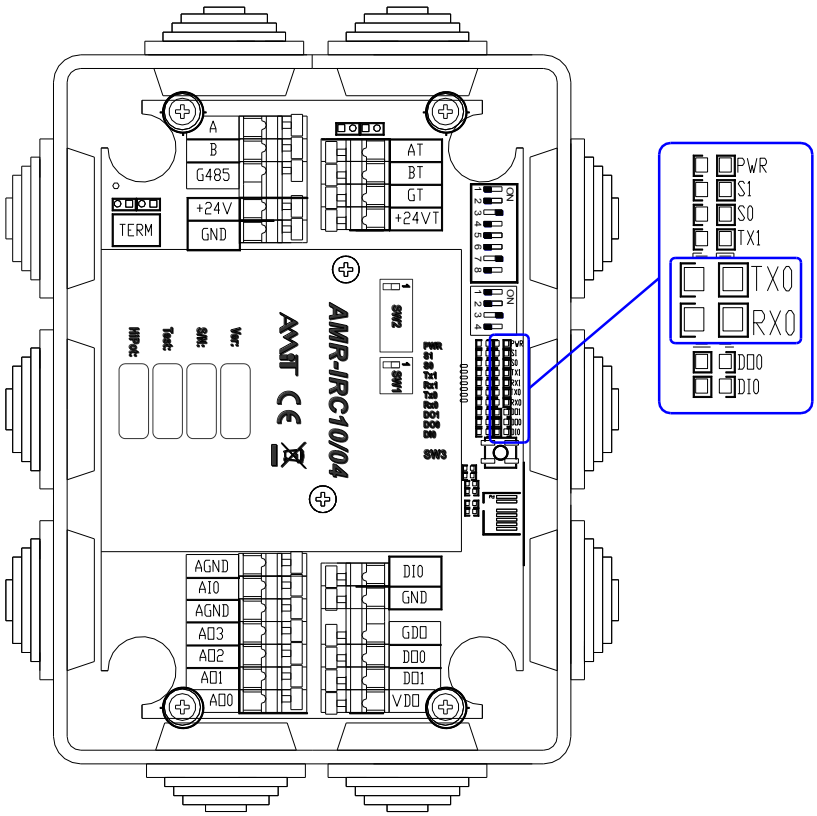

Fig. 16 – Location of RS485 interface status LEDs for room controller

Terminating resistor and idle state definition are permanently connected by assembled components by manufacturer.

Wiring example

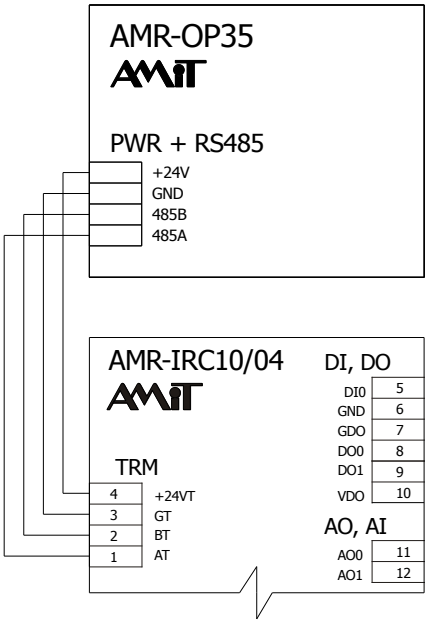

Fig. 17 – Wiring example of the room controller **AMR-OP35**

6.2 RS485 with galvanic isolation (COM1)

RS485 is a half-duplex serial interface that can be used to connect multiple stations to the controller. Up to 256 stations can be connected to one segment. All stations communicate through single signal pair.

This interface is also used for uploading the application into the controller.

RS485 interface circuitry is galvanically isolated from other controller **AMR-IRC10/04** electronics.

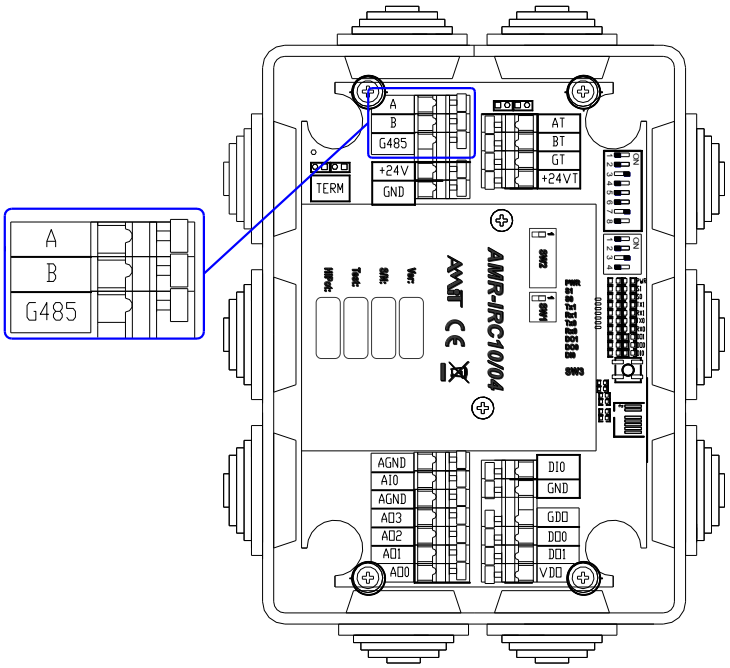

Fig. 18 – RS485 terminals location

Connector wiring

Terminal	Label	Signification
20	G485	RS485 interface with GI, ground
21	B	RS485 interface with GI, signal B
22	A	RS485 interface with GI, signal A

RS485 interface activity is indicated by LEDs located on PCB board.

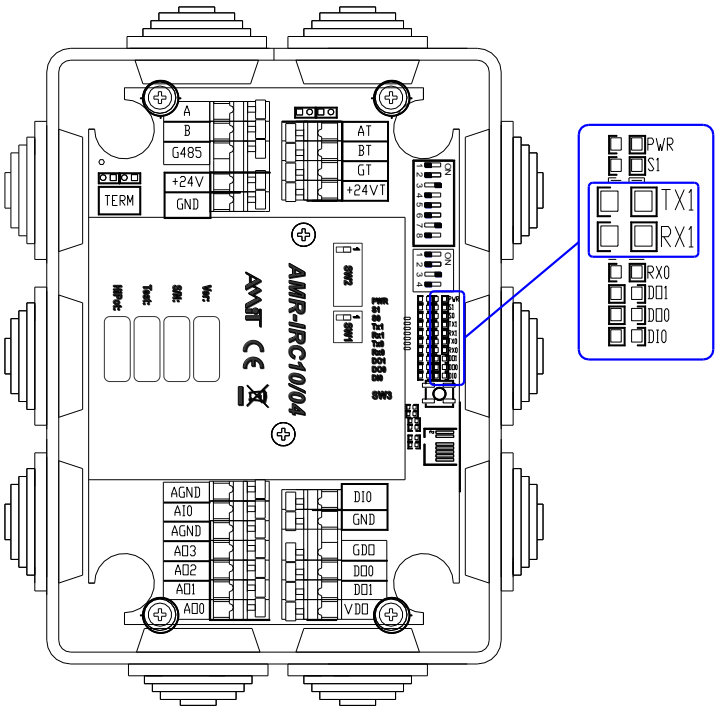

Fig. 19 – Status LEDs of RS485 interface without GI

RS485 status LEDs

LED	Signification
Rx1	Controller is reading data
Tx1	Controller is transmitting data

Each station on RS485 network must have wires termination resistors properly set. Configuration jumpers located near the RS485 connector are used for termination setting. When jumpers are set, wires termination is connected. The terminal stations must have always connected terminating resistors, intermediate stations – disconnected.

More information about using the RS485 interface can be found in Application Note AP0016 – Principles of RS485 interface usage.

Jumpers signification

Jumper		Signification / Position
	Jumpers are not installed	Termination resistors and idle state definition are not connected, intermediate unit (inside the segment).
	Jumpers are installed	Termination resistors and idle state definition are connected, terminal unit (on the segment ends).

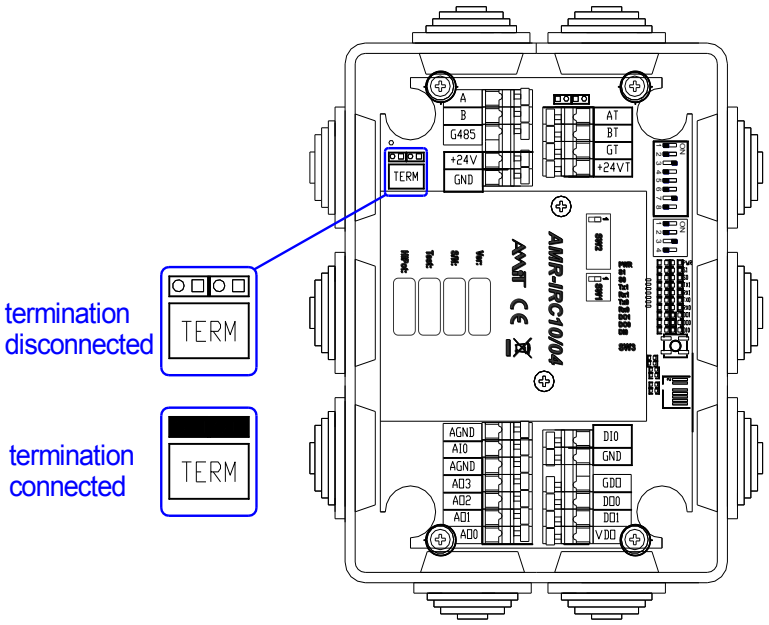

Fig. 20 – RS485 configuration jumpers location (COM1)

7 Connector and terminal layouts

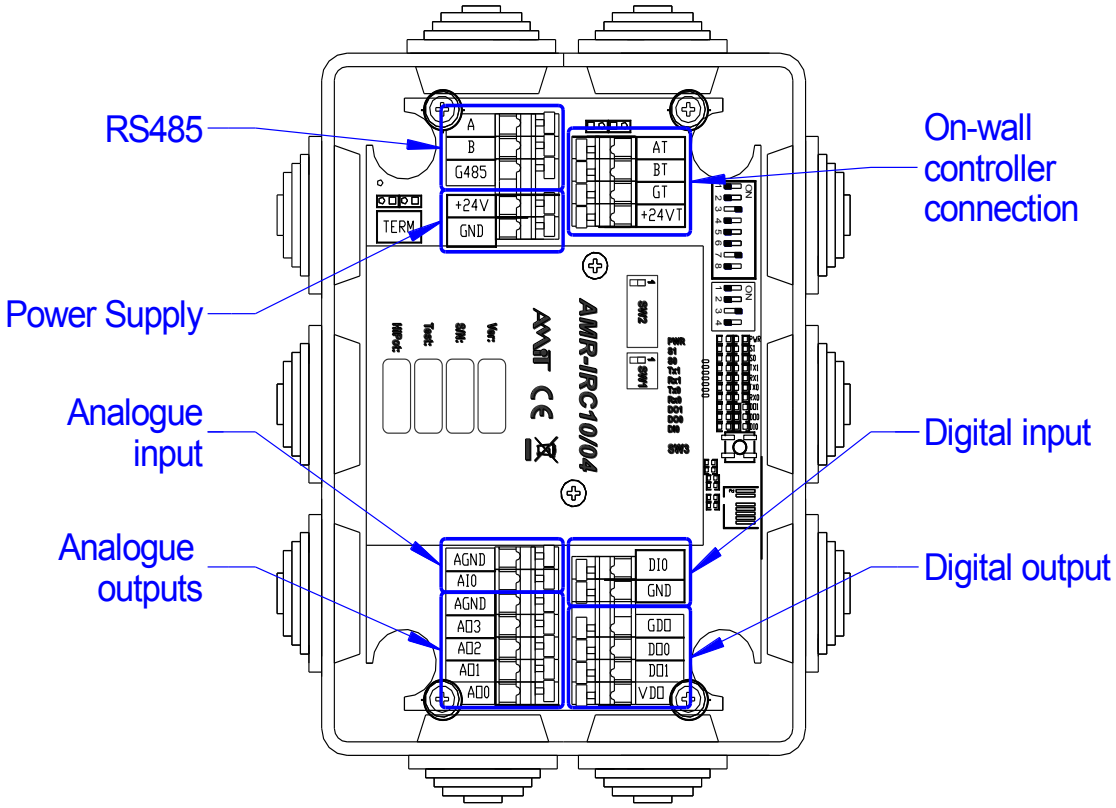

Fig. 21 – Connector location

Terminals labelling

Terminal	Label	Signification
1	AT	RS485 without GI, signal A (room controller connection)
2	BT	RS485 without GI, signal B (room controller connection)
3	GT	Power supply ground for the room controller
4	+24VT	Power supply output for the room controller
5	DI0	Digital input
6	GND	Ground
7	GDO	Digital outputs ground
8	DO0	Digital output 0
9	DO1	Digital output 1
10	VDO	Power supply voltage for digital outputs
11	AO0	Analogue output 0
12	AO1	Analogue output 1
13	AO2	Analogue output 2
14	AO3	Analogue output 3
15	AGND	Analogue ground
16	AI0	Analogue input
17	AGND	Analogue ground
18	GND	Power supply, ground
19	+24V	Power supply, +24 V
20	G485	RS485 with GI, ground
21	B	RS485 with GI, signal B
22	A	RS485 with GI, signal A

8 Status LEDs

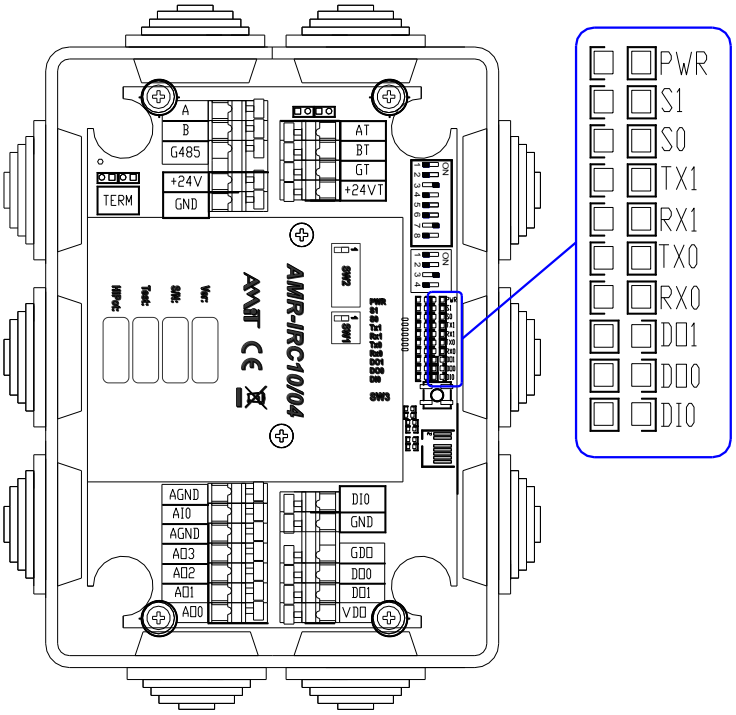

Fig. 22 – Status LEDs location

Label	Signification
PWR	Power supply voltage connected
S1	Reserved
S0	Program state
TX1	Transmitting to RS485 with GI, (COM1)
RX1	Receiving from RS485 with GI, (COM1)
TX0	Transmitting to RS485 without GI, (COM0)
RX0	Receiving from RS485 without GI, (COM0)
DO1	Digital output 1 is switched on
DO0	Digital output 0 is switched on
DI0	Digital input is active

9 Mounting

The controller **AMR-IRC10/04** is intended to be mounted on wall or into ceiling. Device can be mounted in any position. Four indicated holes in the unit corners (accessible after top cover removal) are used for mounting. M4 screws or bolts can be used for mounting.

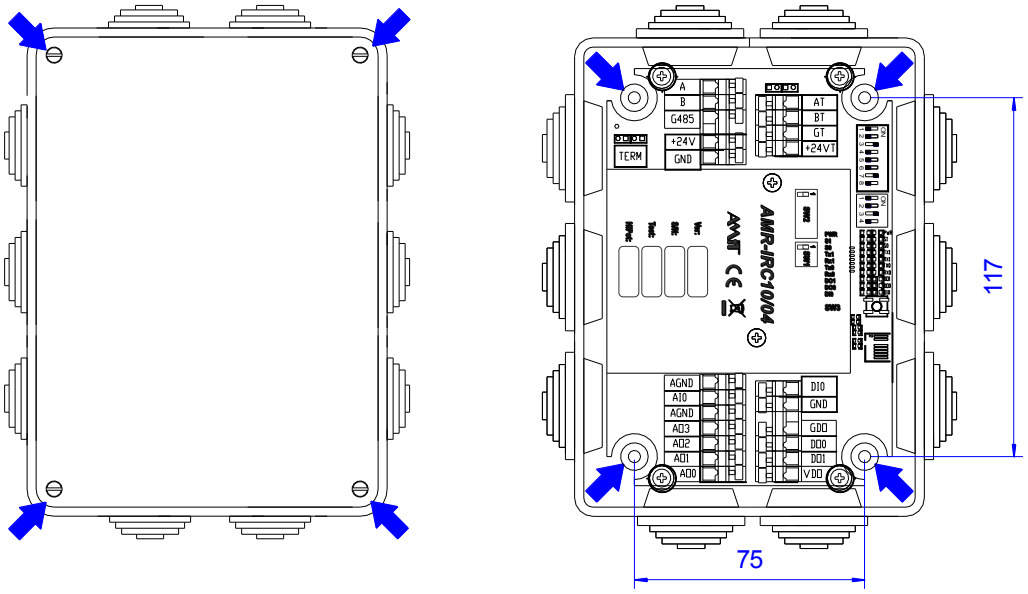

Fig. 23 – Unit cover removal, mounting hole dimensions

9.1 Installation rules

Connecting to PE Negative power supply terminal (GND) of the device must be connected to PE in single point of installation.

Inputs / outputs Use the shielded signal cables for wiring. Connect the cable shielding to the PE terminal immediately on switchboard input.

If the wires are led outside the building, the appropriate inputs and outputs need to be overvoltage protected.

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

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

10 Programming

Loader is implemented into the controller **AMR-IRC10/04** by manufacturer. The communication parameters are defined by configuration DIP switches.

New application program can be created using:
- DetStudio / EsiDet development environment

Application program can be downloaded into module using:
- DetStudio development environment
- AMRconfig service and programming utility
- AMRdownload multiprogramming utility

Programs can be downloaded from www.amitomation.com, Download section.

10.1 Communication parameters setting

Two DIP switches are used for communication parameters setting:

SW1 communication speed and parity setting
SW2 controller address setting

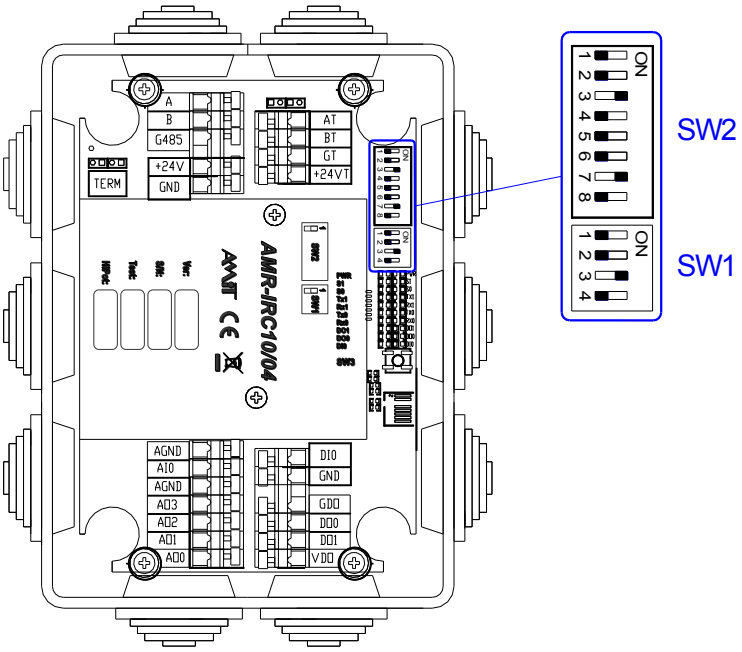

Fig. 24 – Configuration DIP switches location

10.2 DIP switches

Each expansion module connected in MODBUS network must have properly set
- address,
- communication speed,
- parity.

Controller occupies a single address, which must be non-zero and unique for each module on the network. All expansion modules must have the parity and communication speed identical.

The parity, address and communication speed is set by two DIP switches.

10.3 SW1 setting of communication speed and parity

Stop bits number is set automatically according to selected parity:

Even parity 1 stop bit
Odd parity 1 stop bit
Without parity 2 stop bits

SW1.1	SW1.2	SW1.3	Speed	Parity
OFF	OFF	OFF	9 600	According to SW1.4
ON	OFF	OFF	19 200	According to SW1.4
OFF	ON	OFF	38 400	According to SW1.4
ON	ON	OFF	57 600	According to SW1.4
OFF	OFF	ON	9 600	Without parity, SW1.4 setting is meaningless
ON	OFF	ON	19 200	Without parity, SW1.4 setting is meaningless
OFF	ON	ON	38 400	Without parity, SW1.4 setting is meaningless
ON	ON	ON	115 200	According to SW1.4

SW1.4	Parity
OFF	even
ON	odd

10.4 SW2 controller address setting

The switches SW2.1 to SW2.8 serve for module address setting into MODBUS network. Available address values are 1 to 246. Address 0 and addresses from 247 to 255 cannot be used (if set, the device will not respond).

				SW2.8	OFF	OFF	OFF	OFF	ON	ON	ON	ON
				SW2.7	OFF	OFF	ON	ON	OFF	OFF	ON	ON
				SW2.6	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW2.1	**SW2.2**	**SW2.3**	**SW2.4**	**SW2.5**	**Module address in MODBUS network**							
OFF	OFF	OFF	OFF	OFF	**X**	32	64	96	128	160	192	224
ON	OFF	OFF	OFF	OFF	1	33	65	97	129	161	193	225
OFF	ON	OFF	OFF	OFF	2	34	66	98	130	162	194	226
ON	ON	OFF	OFF	OFF	3	35	67	99	131	163	195	227
OFF	OFF	ON	OFF	OFF	4	36	68	100	132	164	196	228
ON	OFF	ON	OFF	OFF	5	37	69	101	133	165	197	229
OFF	ON	ON	OFF	OFF	6	38	70	102	134	166	198	230
ON	ON	ON	OFF	OFF	7	39	71	103	135	167	199	231
OFF	OFF	OFF	ON	OFF	8	40	72	104	136	168	200	232
ON	OFF	OFF	ON	OFF	9	41	73	105	137	169	201	233
OFF	ON	OFF	ON	OFF	10	42	74	106	138	170	202	234
ON	ON	OFF	ON	OFF	11	43	75	107	139	171	203	235
OFF	OFF	ON	ON	OFF	12	44	76	108	140	172	204	236
ON	OFF	ON	ON	OFF	13	45	77	109	141	173	205	237
OFF	ON	ON	ON	OFF	14	46	78	110	142	174	206	238
ON	ON	ON	ON	OFF	15	47	79	111	143	175	207	239
OFF	OFF	OFF	OFF	ON	16	48	80	112	144	176	208	240
ON	OFF	OFF	OFF	ON	17	49	81	113	145	177	209	241
OFF	ON	OFF	OFF	ON	18	50	82	114	146	178	210	242
ON	ON	OFF	OFF	ON	19	51	83	115	147	179	211	243
OFF	OFF	ON	OFF	ON	20	52	84	116	148	180	212	244
ON	OFF	ON	OFF	ON	21	53	85	117	149	181	213	245
OFF	ON	ON	OFF	ON	22	54	86	118	150	182	214	246
ON	ON	ON	OFF	ON	23	55	87	119	151	183	215	247
OFF	OFF	OFF	ON	ON	24	56	88	120	152	184	216	**X**
ON	OFF	OFF	ON	ON	25	57	89	121	153	185	217	**X**
OFF	ON	OFF	ON	ON	26	58	90	122	154	186	218	**X**
ON	ON	OFF	ON	ON	27	59	91	123	155	187	219	**X**
OFF	OFF	ON	ON	ON	28	60	92	124	156	188	220	**X**
ON	OFF	ON	ON	ON	29	61	93	125	157	189	221	**X**
OFF	ON	ON	ON	ON	30	62	94	126	158	190	222	**X**
ON	ON	ON	ON	ON	31	63	95	127	159	191	223	**X**

Note All switch setting changes take their effect only after extension module restarting (i.e. power supply disconnection and connection).

10.5 Status LEDs and service button

S0 LED serves for module program state indication.

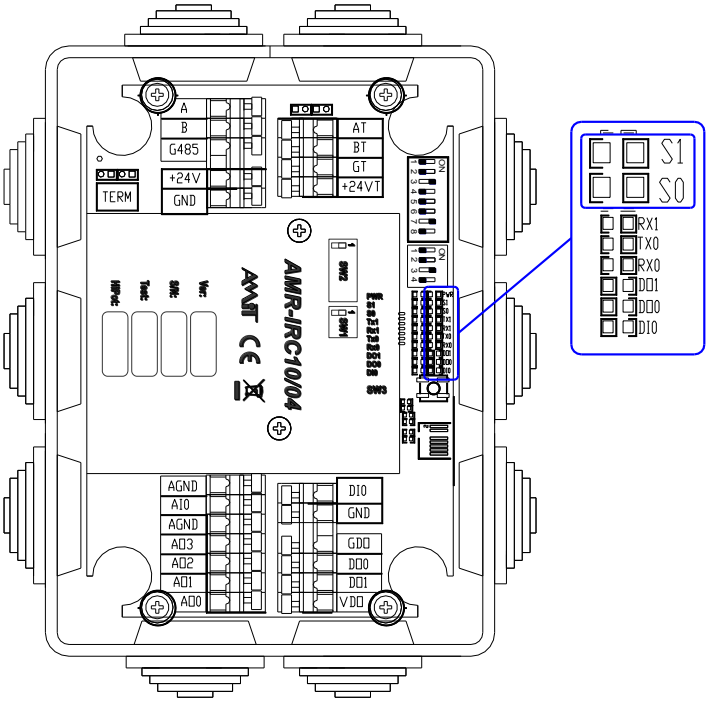

Fig. 25 – Service LEDs location

Status LEDs

LED	Light	Signification
S0	0.1 s flashing for 1 s period	Reset passage indication
	Regular flashing with 0.2 s period	Loader is launched
	Regular flashing with 1 s period	Application is launched
	Irregular flashing with 0.5 s period	Running application is indicating error. Irregular flashing means that 2 s pause follows after a particular number of flashes. Number of flashes between two pauses indicates numeric error code: 1 – BackUp RAM reading error 2 – eeprom reading error 3 – suspiciously frequent writing to eeprom 15 – unknown error
S1		Reserved for future usage

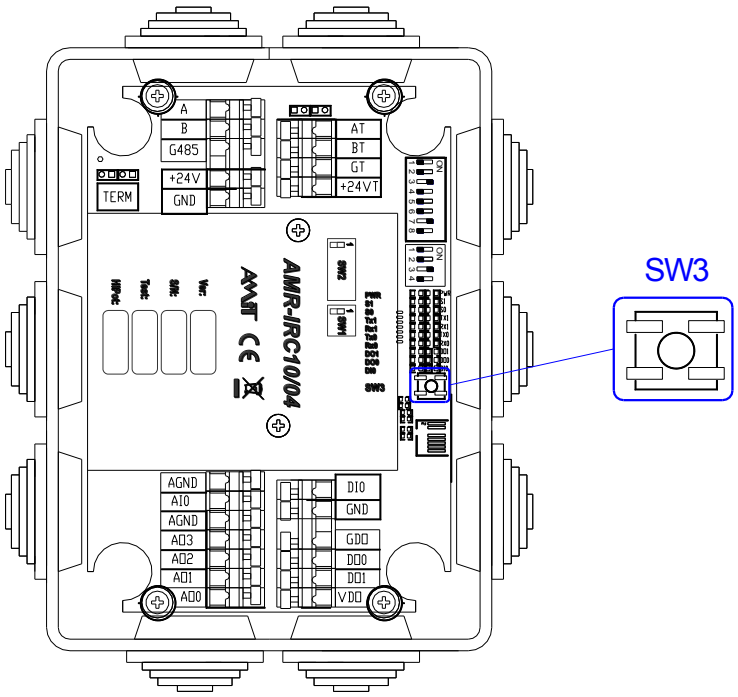

Fig. 26 – SW3 service button location

Service button

Button pressing	Action
> 1 s After switching-on	Loader with communication parameters set on DIP switches (SW1 a SW2) is launched.
> 1 s During application run	Loader with communication parameters set on DIP switches (SW1 a SW2) is launched.

If any new application is loaded after the Loader is initiated, the original application can be started by switching the unit off and on again.

11 Ordering information and completion

AMR-IRC10/04	Controller, operation manual, warranty certificate

11.1 Factory settings

RS485 configuration The galvanically isolated RS485 interface is fitted with jumpers that activate wires termination and idle state definition. RS485 interface without galvanic isolation is terminated permanently by components mounted on the board.

12 Maintenance

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

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 **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 in common public waste. It must be delivered to places specified for that purpose and recycled.