DM-OT2

Converter of OpenTherm/+ interface

Operation manual

Version 1.00

AMiT, spol. s r. o. does not provide any warranty concerning the contents of this publication and reserves the right to change the documentation without any obligation to inform anyone or any authority.

This document can be copied and redistributed under the following conditions:

1. The whole text (all pages) must be copied without making any modifications.
2. All redistributed copies must retain the AMiT, spol. s r. o. copyright notice and any other notices contained in the documentation.
3. This document must not be distributed for profit.

The names of products and companies used herein may be trademarks or registered trademarks of their respective owners.

AMiT is a registered trademark.

Copyright (c) 2020, AMiT, spol. s r. o.
Producer: AMiT, spol. s r. o.
Naskové 1100/3, 150 00 Prague, Czech Republic
amitomation.com

Technical support: support@amit.cz

Contents

Revision history

Document name: dm-ot2_g_en_100.pdf

Revision	Date	Changes by	Changes
100	04. 09. 2019	Taťák Martin	New document.

Related documentation

1. Application note AP0008 – Communication in MODBUS RTU network (PseDet)
   file: ap0008_en_xx.pdf
2. Application note AP0016 – Principles of RS485 interface usage
   file: ap0016_en_xx.pdf
3. Application note AP0025 – Communication in ARION network – table definition
   file: ap0025_en_xx.pdf
4. Application note AP0028 – OpenTherm devices in ARION network
   file: ap0028_cz_xx.pdf
5. www.opentherm.eu – OpenTherm Protocol

HW revision history

The HW revision is stated on the nameplate, see 3 “Product nameplate”, item HW.

Version	Date	Changes
–	04. 09. 2019	New product.

1 Introduction

DM-OT2 is an OpenTherm/+ (OT/+) interface converter with MODBUS RTU and ARION protocols. It connects to a superior control system through galvanically isolated RS485 serial interface. The converter acts as a room controller with OT/+ interface and therefore allows for control of certain types of boilers.

Basic features

- Controlling one boiler (with one or two independent heating lines) equipped with OT/+ interface
- 1× RS485 interface with galvanic isolation
- Communication indication (RS485, OT/+)
- DIN rail mounting
- Power supply 24 V DC

2 Technical parameters

OpenTherm

Surge protector	Transil 600 W
Galvanic isolation	No
Maximum wire length	30 m
Function indication	LED on the base plate
Connection point	Screw terminals
Wire cross-section	0.21 mm^2 to 4 mm^2

RS485

Surge protector	Transil 600 W
Communication speeds	9,600 bps to 115,200 bps
Galvanic isolation	Yes
GI strength [1])	500 V AC/2 s
Terminating resistance [2])	120 Ω on the converter
Idle state definition [2]) – to +5 V – to 0 V	 820 Ω on the converter 820 Ω on the converter
Maximum wire length	1,200 m/19,200 bps
Max. stations per network / segment	63
Function indication	LED on the base plate
Connection point	Screw terminals
Wire cross-section	0.21 mm^2 to 4 mm^2

Note [1]) Isolation must not be used for separation of dangerous voltages.
[2]) Terminating resistance and idle state definition are connected simultaneously.

Power supply

Nominal power voltage	24 V DC
Supply voltage range	20 V DC to 30 V DC
Maximum consumption	30 mA at 24V DC
Power dissipation (typ.)	0.1 W
Power supply indication	LED on the base plate
Connection point	Screw terminals
Wire cross-section	0.21 mm^2 to 4 mm^2
Power supply distribution	The device must not be powered from the DC distribution network of the building [3])

Note [3]) For more details, see chapter 7.1 “Installation rules”, paragraph “Power supply”.

Mechanics

Mechanical design	Plastic cover
Mounting	On a 35 mm DIN rail
Ingress protection rate	IP20
Weight – netto – brutto	0.09 kg ±5 % 0.12 kg ±5 %
Dimensions (w × h × d)	(54 × 92 × 61) mm

Temperatures

Operating temperature range	-40 °C to 70 °C
Storage temperature range	-40 °C to 70 °C

Other

Maximum ambient humidity	< 95 % non-condensing
Communication protocol	MODBUS RTU / ARION

2.1 Dimensions

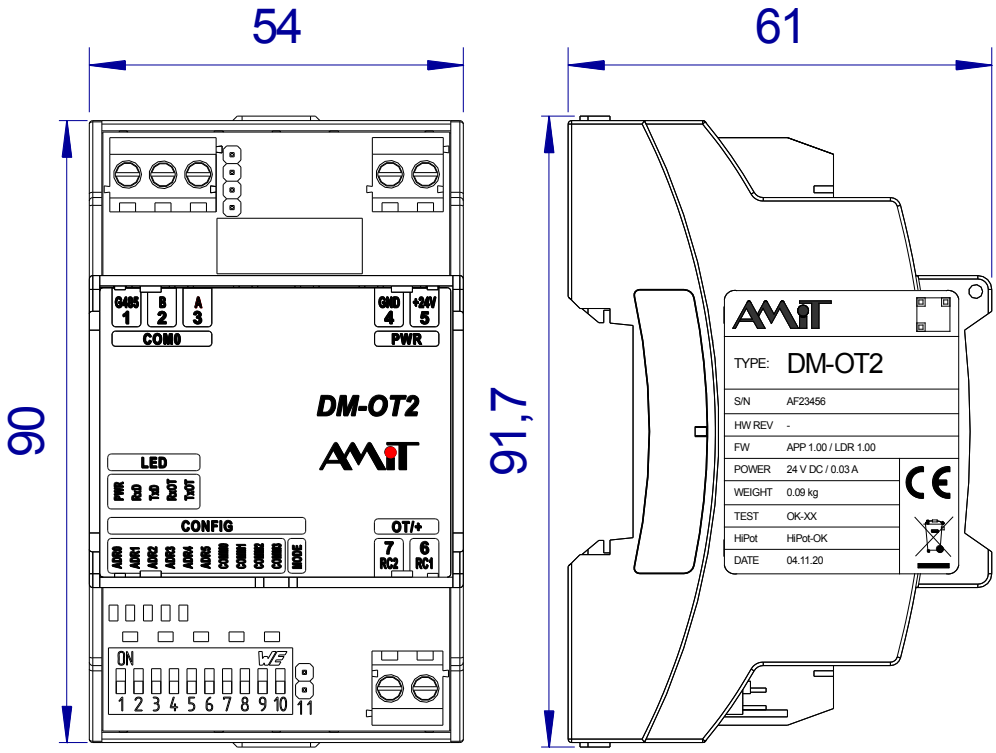

Fig. 1 **– DM-OT2** dimensions

2.2 Recommended drawing symbol

The following drawing symbol is recommended for the **DM-OT2** converter. Only part of it will be visible in following examples.

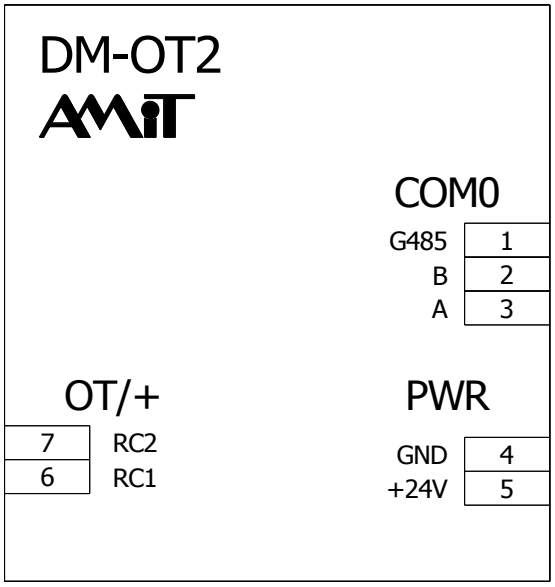

Fig. 2 – Recommended drawing symbol for **DM-OT2**

3 Product nameplate

Converter **DM-OT2** is fitted with a nameplate on the side. For nameplate location, see “Fig. 3 – Nameplate location”.

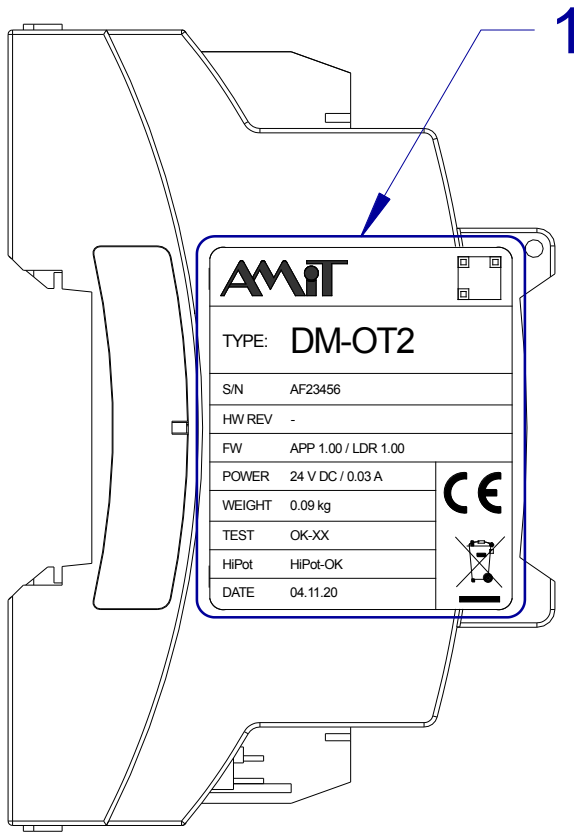

Fig. 3 – Nameplate location

Legend

Number	Significance
1	Nameplate

3.1 Manufacturer's product nameplate

The information on the nameplate is summarised in the table. For a sample, see "Fig. 4 – Example of an AMiT nameplate".

Description	Data	Note
–	AMiT logo	Manufacturer's logo
–	QR code	Manufacturer's QR code
TYPE	DM-OT2	Product type designation
S/N	xxxxxxx	Serial number
HW REV	–	Hardware revision
FW	APP x.xx / LDR x.xx	Software revision
POWER	24 V DC / 0.03 A	Power supply voltage / Consumption
WEIGHT	0.09 kg	Weight
TEST	OK-xx	Routine test result
HiPot	HiPot - OK	Isolation test result
DATE	dd.mm.yyyy	Production date
–	CE logo	The product is in accordance with EU legislation and directives
–	Crossed-out trash can logo	The product disposal is subject to regulations on disposal of electronic waste

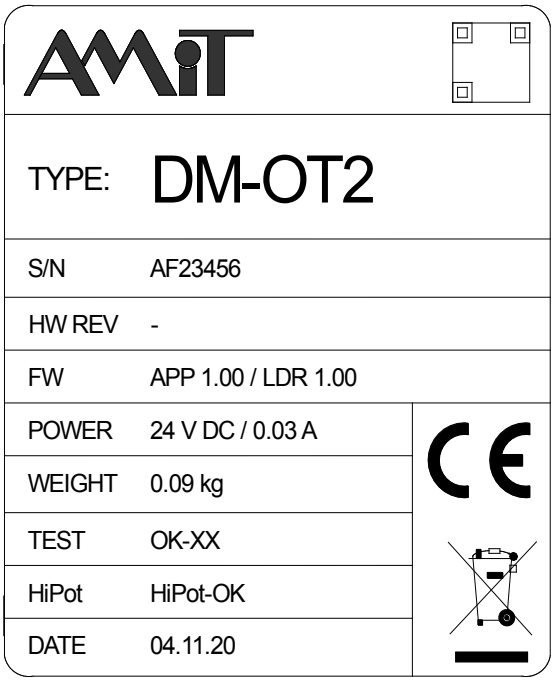

Fig. 4 – Example of an AMiT nameplate

4 Compliance assessment

The device is in compliance with requirements of NV616/2006. The compliance assessment with NV616/2006 has been performed in accordance with harmonised standard EN 61326-1:2006.

Tested in accordance with standards	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: Testing and measurement techniques – Electrostatic discharge immunity test, Direct air discharge	Complies (±8 kV)
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test, Indirect contact discharge	Complies (±4 kV)
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 1,000 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, 1,400 MHz to 2,000 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, 2,000 MHz to 2,700 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	Complies (±1 kV)
EN 61000-4-5:2014	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test	Complies (±1 kV)
EN 61000-4-6:2013	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields	Complies (3 V)

4.1 Other tests

The device has been tested in accordance with standards:

Tested in accordance with standards	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 tests	Complies

5 Power supply

Converter **DM-OT2** may be powered only from a DC power source. The power source must comply with all requirements specified in chapter 2 “Technical parameters”.

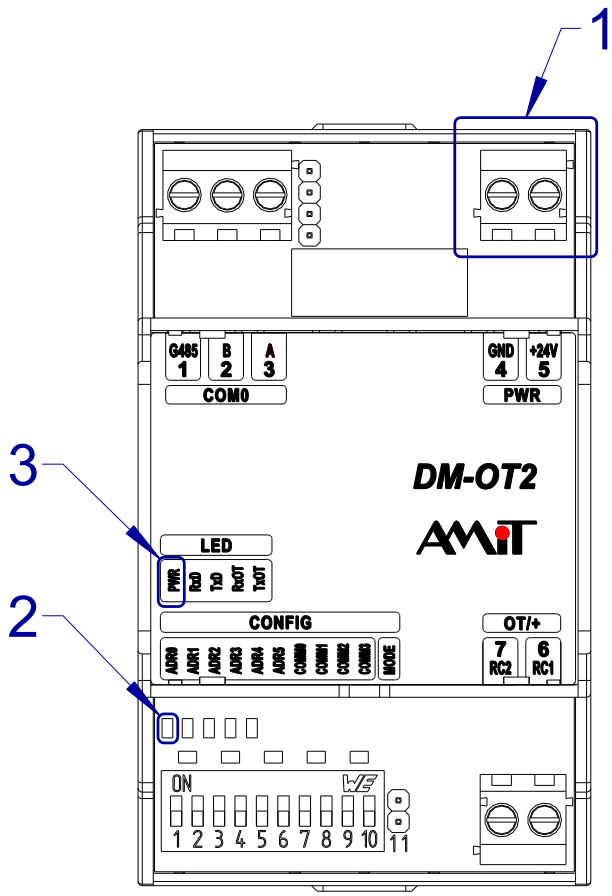

Fig. 5 – LED PWR and power supply terminal locations

Legend

Number	Significance
1	Power supply terminals
2	LED PWR
3	LED PWR Description

Terminal labels

Terminal	Signal	Significance
4	GND	Power supply, ground
5	+24V	Power supply, +24 V DC

LED PWR description

Status	Significance
LED on	Power supply connected
LED off	Power supply not connected

Wiring example

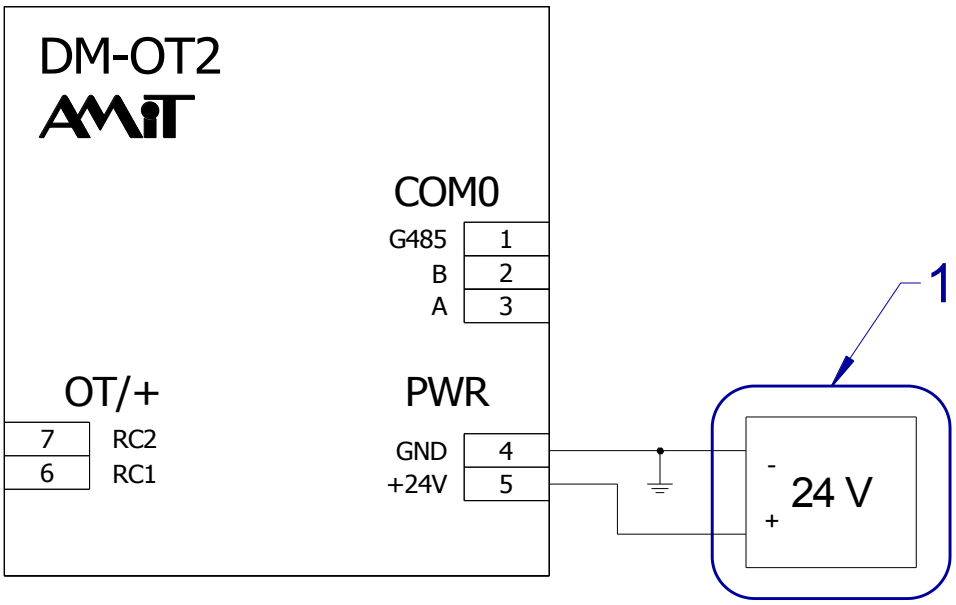

Fig. 6 – Power supply wiring example

Legend

Number	Significance
1	External power supply source

Note The GND terminal must be connected with the switchboard PE terminal during installation.

6 Communication interface

The **DM-OT2** converter is equipped with interfaces:
- RS485,
- OpenTherm/+.

6.1 RS485

Converter features the RS485 interface with galvanic isolation. RS485 is used to connect the converter to the superior system. RS485 interface activity is indicated by LEDs located on the base plate.

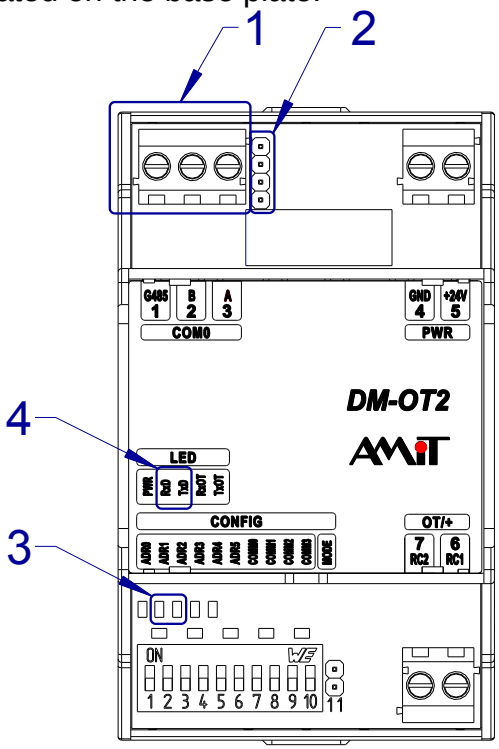

Fig. 7 – Locations of terminals and RS485 LEDs

Legend

Number	Significance
1	RS485 terminals
2	Configuration jumpers for interface RS485
3	Indication RS485 LEDs
4	Description of RS485 LEDs

Terminal labels

Terminal	Signal	Significance
1	G485	RS485, ground
2	B	RS485, signal B
3	A	RS485, signal A

LED communication description

LED	Significance
RxD	The converter is receiving data
TxD	The converter is transmitting data

Jumpers description

Jumpers	Significance
Fitted	Terminal station – idle states and termination are active
Not fitted	Intermediate station – idle states and termination are inactive

More information about the use of the RS485 interface is available in Application note *AP0016 – Principles of RS485 interface usage*.

Note During installation, it is recommended to use structured cabling for the power supply and RS485. When connecting the power supply, it is recommended to use one pair of conductors for the positive terminal and another pair for the negative terminal. Cable shielding must be connected with the PE terminal of the installation in one place.

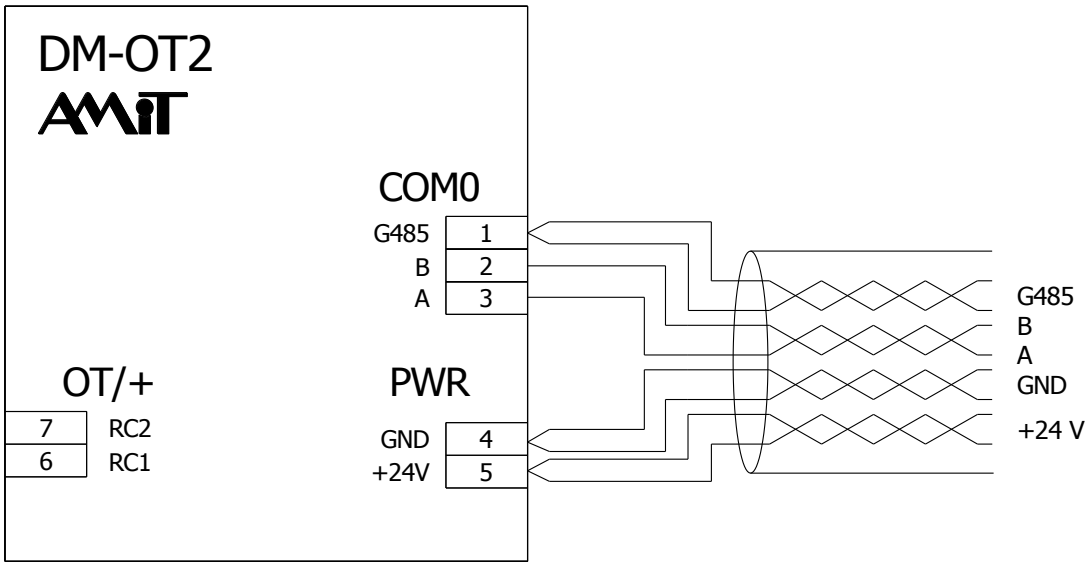

Fig. 8 – Example of structured cabling usage

6.2 OpenTherm/+

The interface OT/+ is designed for communication with boiler electronics using the protocol OT/+. The converter always acts as a thermostat. More information on communication using the OT/+ protocol is available in Application note *AP0028 – OpenTherm devices in ARION network*, or at the website of the OpenTherm protocol producer (www.opentherm.eu). The converter features LEDs for indication of communication with the boiler.

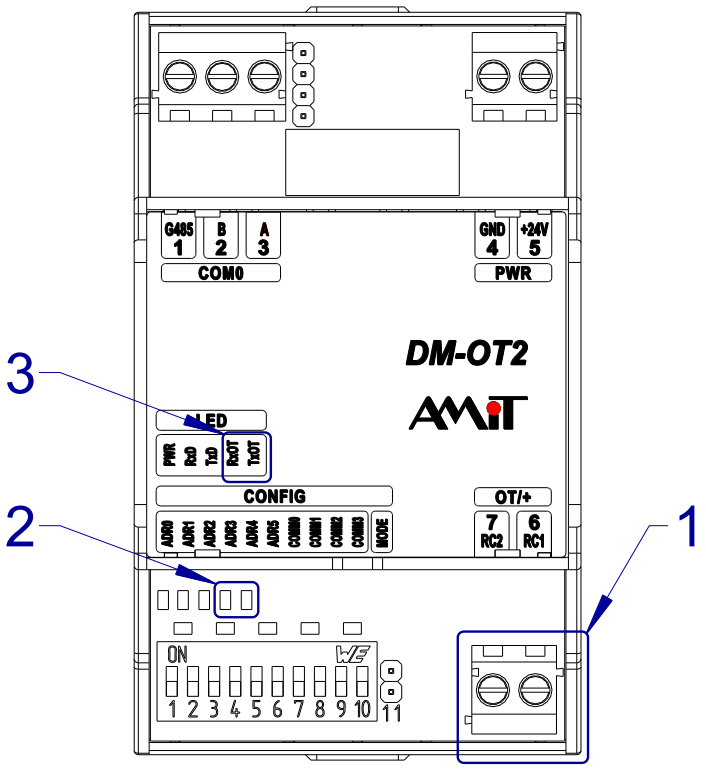

Fig. 9 – Locations of terminals and OpenTherm LEDs

Legend

Number	Significance
1	Terminal OT/+
2	OT/+ indication LEDs
3	Description of OT/+ LEDs

Terminal labels

Terminal	Signal	Significance
1	RC1	Interface OT/+
2	RC2	Interface OT/+

Indication LEDs description

LED	Significance
RxOT	Is on when data is received from OT/+ network
TxOT	Is on when data is being transmitted into OT/+ network

7 Mounting

Converter **DM-OT2** mounts on a 35 mm DIN rail vertically or horizontally. The position on the DIN rail is secured by a lock in the lower and upper part of the converter.

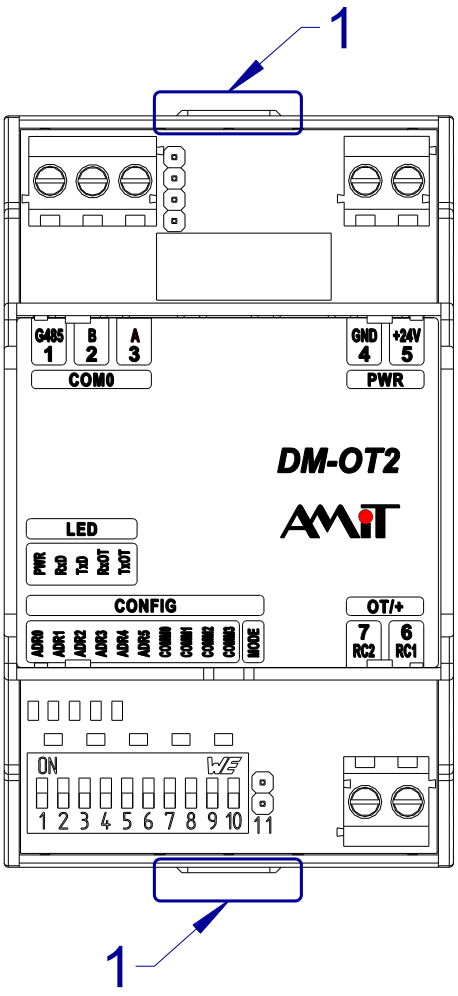

Fig. 10 – Location of the DIN rail lock

Legend

Number	Significance
1	DIN rail mounting locks

The converter is cooled by natural air circulation, provided the maximum temperature is not exceeded. The converter is designated to be mounted into a switchboard.

7.1 Installation rules

EMC filter It is recommended to use an EMC filter on the power supply input. This requirement can be revised based on environment nature, power source properties and wiring layout.

Power supply The device must not be powered from the DC distribution network of the building. More devices can be powered from a single power supply unit assuming it is a similar-type equipment and the same building location.

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

Connection with PE It is necessary to connect the negative power supply terminal of the device GND to the PE at the switchboard input.

RS485 It is necessary to connect the RS485 interface according to recommendations in Application note *AP0016 – Principles of RS485 interface usage.*

OpenTherm It is necessary to perform OpenTherm interface connection according to recommendations in Application note *AP0028 – OpenTherm devices in ARION network.*

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

8 Converter settings

To set communication parameters and the protocol on the RS485 interface, there are DIP switches and a jumper on the bottom part of the converter.

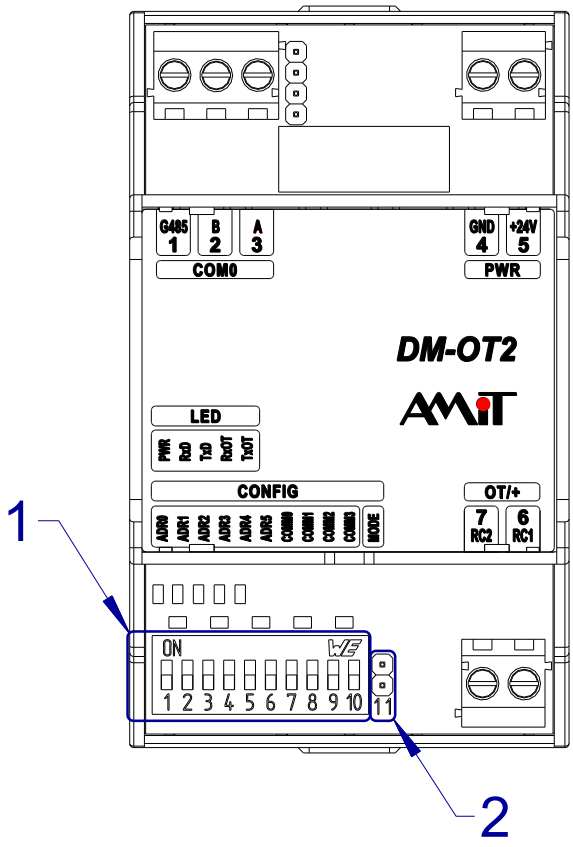

Fig. 11 – Locations of DIP switches and the MODE jumper used to set communication parameters

Legend

Number	Significance
1	DIP switches
2	MODE jumper

Description of switches and the jumper

Number	Name	Significance
1	ADR0	Converter address settings
2	ADR1	Converter address settings
3	ADR2	Converter address settings
4	ADR3	Converter address settings
5	ADR4	Converter address settings
6	ADR5	Converter address settings
7	COMM0	Communication speed and parity settings
8	COMM1	Communication speed and parity settings
9	COMM2	Communication speed and parity settings
10	COMM3	Communication speed and parity settings
11	MODE	Communication protocol settings

8.1 Address settings

All devices in the network must have unique address. The address can be set by using switches ADR0 to ADR5 and its value can be between 1 and 63.
Address 0 is not permitted!

DIP	Value
ADR0	Value 1
ADR1	Value 2
ADR2	Value 4
ADR3	Value 8
ADR4	Value 16
ADR5	Value 32

Address example: address = 40, switches ADR3 and ADR5 (8 + 32) are in position ON. A change in the address settings manifests immediately.

8.2 Setting communication speed and parity

All devices in the network must have identical communication speed and parity. It is possible to set communication speed settings and parity settings by DIP combinations according to the following tables.

COMM0	COMM1	COMM2	Baud speed	Parity
OFF	OFF	OFF	9,600	According to COMM3
ON	OFF	OFF	19,200	According to COMM3
OFF	ON	OFF	38,400	According to COMM3
ON	ON	OFF	57,600	According to COMM3
OFF	OFF	ON	9,600	**No parity**, status COMM3 insignificant
ON	OFF	ON	19,200	**No parity**, status COMM3 insignificant
OFF	ON	ON	38,400	**No parity**, status COMM3 insignificant
ON	ON	ON	115,200	According to COMM3

COMM3	Parity
OFF	Even
ON	Odd

The number of stop bits is set automatically according to the parity set:

Even parity 1 stop bit,
Odd parity 1 stop bit,
No parity 2 stop bits.

Change in communication speed settings and parity settings manifest immediately.

8.3 Setting the protocol

Set the MODBUS RTU / ARION by using the MODE jumper.

MODE jumper	Significance
Fitted	ARION protocol
Not fitted	MODBUS RTU protocol

The protocol change takes effect after the converter restarts (power is disconnected and re-connected).

8.4 Setting error signalisation

In the case of wrong settings, the state is signalised by flashing converter LEDs. In such a case, the converter sends the last know settings into the OT/+ network.

9 Programme operation – MODBUS RTU protocol

The converter enables the MODBUS RTU protocol communication via functions listed below.

Communication failure

The converter supports communication failure monitoring (**GuardTime** register). Its value is pre-set to 10,000 ms. If the converter does not receive any valid MODBUS RTU frame by the time set in the register **GuardTime** (the frame can even have an address of another device in the network), the converter leaves the last known setting for the connected peripheral.

This behaviour is firmly set in the converter and cannot be changed.

9.1 MODBUS protocol functions supported by the converter

The following functions can be used for communication via MODBUS RTU protocol:

Functions	Description
3	Read one/multiple holding registers
4	Read one/multiple input registers
6	Write one holding register
16	Write multiple holding registers

When the values are represented in the Float format, it is necessary to communicate the value as a couple of registers at the same time. Otherwise the converter will report a failure of an illegal data address (MODBUS error n. 2)! In case of holding registers, it means the necessity of using Modbus function 16.

9.2 System registers

Supported functions:

Functions	Description
3	Read one/multiple system registers
6	Write one system register
16	Write multiple system registers

All values are saved in the big endian order.

Name	Address	Type	Description
ID	0	R	Hardware identification. The number represents the hardware type. 197 = DM-OT2.
FW	1	R	Firmware version.
Time	2 3	R	Time.
GuardTime	4	R/W	Number [ms] for MODBUS RTU communication failure evaluation. Zero value results into permanent disconnection. GuardTime = 10,000 ms
BaudRate	5	R	Communication speed.
Parity	6	R	Parity.

Name	Address	Type	Description
Address	7	R	Address.
Reset counter	8	R/W	Reset counter.
MODBUS messages	9	R/W	MODBUS messages counter.
DIP state	10	R	DIP switch setting.

9.3 Application registers

All values are saved in the big endian order.

9.3.1 Input registers

It is possible to read the following data from input registers:

- information on the boiler status,
- latest error code,
- hot water temperature in HL1,
- hot water temperature in HL2,
- DHW temperature,
- return water temperature,
- outdoor temperature,
- heating source performance,
- pressure in the heating system,
- flowrate,
- exhaust temperature,
- value of a custom ID in the OT/+ network,
- state of read/write of a custom ID in the OT/+ network.

Supported functions:

Functions	Description
4	Read one/multiple input registers

Layout of input registers:

<table>
<tr><th>Address</th><th>Type</th><th>Description</th></tr>
<tr><td>100</td><td>R (Int)</td><td>Register of states. Individual bits have the following significance:
<table>
<tr><th>Bit</th><th>Significance</th></tr>
<tr><td>0</td><td>Communication with an OT/+ line device OK.</td></tr>
<tr><td>1</td><td>OT/+ line device faulty.</td></tr>
<tr><td>2</td><td>Heating HL1 active.</td></tr>
<tr><td>3</td><td>Heating of DHW active.</td></tr>
<tr><td>4</td><td>Burner turned on.</td></tr>
<tr><td>5</td><td>Heating of DHW present.</td></tr>
<tr><td>6</td><td>Heating HL2 active.</td></tr>
<tr><td>7</td><td>HL2 present.</td></tr>
<tr><td>8</td><td>Heating HL1 enabled.</td></tr>
<tr><td>9</td><td>DHW enabled.</td></tr>
<tr><td>10</td><td>Writing maximum boiler power permitted.</td></tr>
<tr><td>11</td><td>Heating HL2 enabled.</td></tr>
<tr><td>12</td><td>Boiler summer mode.</td></tr>
</table></td></tr>
</table>

Address	Type	Description
101	R (Int)	Latest error code.
102 103	R (Float)	Heating water temperature HL1 [°C].
104 105	R (Float)	Heating water temperature HL2 [°C].
106 107	R (Float)	DHW temperature [°C]
108 109	R (Float)	Return temperature [°C]
110 111	R (Float)	Outdoor temperature [°C].
112 113	R (Float)	Heating source performance [%].
114 115	R (Float)	Pressure [bar].
116 117	R (Float)	Flowrate [l/s].
118 119	R (Float)	Exhaust temperature [°C].
120	R (Int)	The value read from register OT/+, the ID of which is entered via the MODBUS holding register 216 [4]).
121	R (Int)	The state of reading of register 120 [5]).
122	R (Int)	Writing status for the OT/+ register entered via the MODBUS holding register 213 [5]).

[4]) In case the ID type of the OT/+ register is f88, the read value from the OT/+ is multiplied by 10 and saved to MODBUS register 120. To get the correct value, it is necessary to divide the MODBUS register value by 10. When the MODBUS register value is equal to “231”, the value transferred from OT/+ is equal to “23.1”.

5) Can acquire values according to the table:

Value	Significance
0	Not processed
1	Value read
2	Value written
3	OT/+ related communication failure

9.3.2 Holding registers

It is possible to read the following data from holding registers:

- information on the boiler status,
- latest error code,
- hot water temperature in HL1,
- hot water temperature in HL2,
- DHW temperature,
- return water temperature,
- outdoor temperature,
- heating source performance,
- pressure in the heating system,
- flowrate,

- exhaust temperature,
- value of a custom ID register in the OT/+ network,
- state of read/write of a custom ID register in the OT/+ network.

Supported functions:

Functions	Description
3	Read one/multiple holding registers
6	Write one holding register
16	Write multiple holding registers

Layout of holding registers:

Address	Type	Description
100	R (Int)	Register of states. Individual bits have the following significance: **Bit** / **Significance** 0 – Communication with an OT/+ line device OK. 1 – OT/+ line device faulty. 2 – Heating HL1 active. 3 – Heating of DHW active. 4 – Burner turned on. 5 – Heating of DHW present. 6 – Heating HL2 active. 7 – HL2 present. 8 – Heating HL1 enabled. 9 – DHW enabled. 10 – Writing maximum boiler power permitted. 11 – Heating HL2 enabled. 12 – Boiler summer mode.
101	R (Int)	Latest error code.
102 103	R (Float)	Heating water temperature HL1 [°C].
104 105	R (Float)	Heating water temperature HL2 [°C].
106 107	R (Float)	DHW temperature [°C]
108 109	R (Float)	Return temperature [°C]
110 111	R (Float)	Outdoor temperature [°C].
112 113	R (Float)	Heating source performance [%].
114 115	R (Float)	Pressure [bar].
116 117	R (Float)	Flowrate [l/min].
118 119	R (Float)	Exhaust temperature [°C].
120	R (Int)	The value read from the OT/+ register the ID of which is entered via the MODBUS holding register 216 [6]).

Address	Type	Description
121	R (Int)	The state of reading of register 120 [7]).
122	R (Int)	Writing status for the OT/+ register entered via the MODBUS holding register 213 [7]).

[6]) In case the ID type of the OT/+ register is f88, the read value from the OT/+ is multiplied by 10 and saved to MODBUS register 120. To get the correct value, it is necessary to divide the MODBUS register value by 10. When the MODBUS register value is equal to “231”, the value transferred from OT/+ is equal to “23.1”.

7) Can acquire values according to the table:

Value	Significance
0	Not processed
1	Value read
2	Value written
3	OT/+ related communication failure

It is possible to write the following into holding registers:
- request for blocking writing of the HL1 temperature setpoint,
- request for blocking writing of the HL2 temperature setpoint,
- request for blocking writing of the DHW temperature setpoint,
- request for blocking writing of the HL1 room temperature setpoint,
- request for blocking writing of the HL2 room temperature setpoint,
- request for enabling heating in HL1,
- request for enabling heating in HL2,
- request for enabling DHW,
- request for enabling writing of maximum permitted boiler power,
- request for setting boiler summer mode,
- HL1 hot water temperature setpoint,
- HL2 hot water temperature setpoint,
- DHW temperature setpoint,
- HL1 room temperature setpoint,
- HL2 room temperature setpoint,
- maximum permitted boiler power,
- register ID that is to be read/written to the OT/+ network,
- data type of the OT/+ register ID that is to be read/written,
- value that is to be written into the set register ID in OT/+.

<table>
<tr><th>Address</th><th>Type</th><th>Description</th></tr>
<tr><td>200</td><td>R/W (Int)</td><td>Register of states. Individual bits have the following significance:
<table>
<tr><th>Bit</th><th>Significance</th></tr>
<tr><td>0</td><td>Block writing of the HL1 temperature setpoint.</td></tr>
<tr><td>1</td><td>Block writing of the HL2 temperature setpoint.</td></tr>
<tr><td>2</td><td>Block writing of the DHW temperature setpoint.</td></tr>
<tr><td>3</td><td>Block writing of the room temperature setpoint for HL1.</td></tr>
<tr><td>4</td><td>Block writing of the room temperature setpoint for HL2.</td></tr>
<tr><td>5</td><td>Enable HL1.</td></tr>
</table></td></tr>
</table>

Address	Type	Description
		6 Enable DHW. 7 Enable writing of maximum boiler power permitted. 8 Enable HL2. 9 Set summer mode. 10 Enable reading from OT/+ register the ID of which is in the holding register 216. 11 Enable writing into OT/+ register the ID of which is in the holding register 213.
201 202	R/W (Float)	HL1 temperature setpoint [°C].
203 204	R/W (Float)	HL2 temperature setpoint [°C].
205 206	R/W (Float)	DHW temperature setpoint [°C].
207 208	R/W (Float)	Room temperature setpoint for HL1 [°C].
209 210	R/W (Float)	Room temperature setpoint for HL2 [°C].
211 212	R/W (Float)	Maximum permitted boiler power [%].
213	R/W (Int)	ID of OT/+ register – the value set in the holding register 215 is written into it.
214	R/W (Int)	Data type of OT/+ register – the value set in the holding register 215 is written into it [8]).
215	R/W (Int)	Enable writing into OT/+ register the ID of which is in the holding register 213 [9]).
216	R/W (Int)	ID of OT/+ register – the value set in the holding register 120 is written into it.
217	R/W (Int)	Data type of OT/+ register – the value set inside is read into the holding register 120 [8]).

[8]) Can acquire values according to the table:

Value	Data type in the OT/+ network
0	u8, flag8
1	s8
2	f88
3	u16
4	s16

[9]) In case the OT/+ register ID type is f88, it is necessary to write an integer value into the register. This value needs to be the result of the following expression: “value to be written × 10”. When it is necessary to write “23.1” to a peripheral, the value entered into the register needs to be “231”.

10 Programme operation – ARION protocol

The converter enables the ARION protocol communication via all channel types (DI, DO, AI, AO).

Communication failure

The converter supports communication failure control (**GuardTime** parameter in ARION network). The **GuardTime** parameter value determines the time the system waits before signalling a failure of communication with the converter. When the converter detects the communication failed, it leaves the last known settings of the OT/+ network peripheral.

This behaviour is firmly set in the converter and cannot be changed.

To operate one **DM-OT2** converter connected into ARION communication network as an autonomous node (see Application note *AP0025 – Communication in ARION network – table definition*), use an item in the "DM-OT" table in DetStudio.

A sample application showing communication with a **DM-OT** converter is available in Application note *AP0028 – OpenTherm devices in ARION network*.

Warning

Functionality of individual signals depends on the boiler automation applied. Therefore, certain signals may not be supported. Contact your boiler manufacturer for more information on boiler automation options.

10.1 Digital inputs

Digital inputs transfer information on the state of the boiler.

To read individual digital inputs, use the **ARI_DigIn** function module. The module can read multiple signals at the same time.

Number of signals	8
Signal type	bit

Individual signal descriptions:

Parameter Signal of the module ARI_DigIn	**Significance**
0	Status of communication with slave.
1	Boiler failure.
2	Heating in the first circuit active.
3	Heating of DHW.
4	Burner turned on.
5	Heating of DHW present.
6	Heating in the second circuit active.
7	A second heating circuit present.

Logical level description:

The bit value in the digital inputs channel	Significance
0	No
1	Yes

10.2 Digital outputs

Digital outputs make it possible to set:

- blocking writing of HL1 hot water temperature setpoint,
- blocking writing of HL2 hot water temperature setpoint,
- blocking writing of DHW temperature setpoint,
- blocking writing of the room temperature setpoint for HL1,
- blocking writing of the room temperature setpoint for HL2,
- enabling heating in HL1,
- enabling heating in HL2,
- enabling DHW,
- enabling writing of maximum permitted boiler power,
- setting boiler summer mode.

To write individual digital outputs, use the **ARI_DigOut** function module. The module is able to write multiple signals at once.

Number of signals	10
Signal type	bit

Individual signal descriptions:

Parameter Signal of the module ARI_DigOut	Significance
0	Block writing of the setpoint HW temperature of the first circuit.
1	Block writing of the DHW temperature setpoint.
2	Block writing of the setpoint room temperature of the first circuit.
3	Enable heating of the first circuit.
4	Enable DHW.
5	Enable writing of maximum boiler power permitted.
6	Enable heating of the second circuit.
7	Set boiler summer mode.
8	Block writing of the setpoint HW temperature of the second circuit.
9	Block writing of the setpoint room temperature of the second circuit.

Logical level description:

Value of bits 0 to 2	Significance
0	No
1	Yes

Note *Signals 0 to 2, 8 and 9 make it possible to block writing of temperature setpoints (see chapter 10.4 "Analogue outputs") to the boiler, in case the boiler does not support the relevant parameters.*

10.3 Analogue inputs

Analogue inputs transfer:
- hot water temperature in HL1,
- hot water temperature in HL2,
- DHW temperature,
- return water temperature,
- outdoor temperature,
- heating source performance,
- water pressure,
- flowrate,
- exhaust fumes temperature,
- boiler failure number.

To read individual analogue inputs, use the **ARI_AnIn** function module. The module can read multiple signals at the same time.

Number of signals	10
Signal type	float

Individual signal descriptions:

Parameter Signal	Significance	Range of valid values [10])
0	HW temperature of the first circuit.	(-40 to 127) °C
1	TUV temperature.	(-40 to 127) °C
2	Return water temperature.	(-40 to 127) °C
3	Outdoor temperature.	(-40 to 127) °C
4	Heating source performance.	(0 to 100) %
5	Water pressure.	(0 to 5) bar
6	Flowrate.	(0 to 16) l/min
7	Exhaust temperature.	(-40 to 500) °C
8 [11])	Latest error code.	0 to 255
9	HW temperature of the second circuit.	(-40 to 127) °C

[10]) Applies when the **Range** parameter and **Conversion parameters** are set according to the aforementioned table.

[11]) The number of boiler failure is an integral value that may hold several meanings in various boilers. It is also possible to use the ARI_NumAI module to read the failure number.

The Range parameter needs to be set based on the selected signal:

Signals	Value entered
0 to 4	127
5	5
6	16
7	500 / 8192 [12])
8 [13])	8192
9	127

[12]) Alternative value for selected boilers.

[13]) The number of boiler failure is an integral value that may hold several meanings in various boilers. It is also possible to use the ARI_NumAI module to read the failure number.

Settings of parameters ElMin / ElMax, PhysMin / PhysMax depend on what units are required for the measured value from the ARI_AnIn module.

For signals 0 to 3 and 9:

Parameter	Value
ElMin	-40
ElMax	127
PhysMin	-40
PhysMax	127

For signal 4:

Parameter	Value
ElMin	0
ElMax	100
PhysMin	0
PhysMax	100

For signal 5:

Parameter	Value
ElMin	0
ElMax	5
PhysMin	0
PhysMax	5

For signal 6:

Parameter	Value
ElMin	0
ElMax	16
PhysMin	0
PhysMax	16

For signal 7:

Parameter	Value
ElMin	-40 / 8191 [14])
ElMax	500 / -8191 [14])
PhysMin	-40 / -32764 [14])
PhysMax	500 / 32764 [14])

For signal 8 [15]):

Parameter	Value
ElMin	-8191
ElMax	8191
PhysMin	-8191
PhysMax	8191

[14]) Alternative value for selected boilers.

[15]) The number of boiler failure is an integral value that may hold several meanings in various boilers. It is also possible to use the ARI_NumAI module to read the failure number.

Note *If a sensor error occurs or the connected boiler does not provide the analogue value measured, the relevant signal sets a value lower than the lower limit of the transferred value.*

10.4 Analogue outputs

Analogue inputs make it possible to set:
- HL1 hot water temperature setpoint,
- HL2 hot water temperature setpoint,
- DHW temperature setpoint,
- room temperature setpoint for HL1,
- room temperature setpoint for HL2,
- maximum boiler power permitted.

To write individual analogue outputs, use the **ARI_AnOut** function module. The module is able to write multiple signals at once.

Number of signals	6
Signal type	float

Assigning signals to terminals:

Parameter Signal	Significance	Range of valid values [16])
0	Setpoint HW temperature of the first line.	(0 to 100) °C
1	DHW temperature setpoint.	(0 to 100) °C
2	Room temperature setpoint.	(0 to 100) °C
3	Maximum permitted boiler power.	(0 to 100) %
4	HW temperature setpoint of the second line.	(0 to 100) °C
5	Room temperature setpoint of the second line.	(0 to 100) °C

[16]) Applies when the **Range** parameter and **Conversion parameters** are set according to the aforementioned table.

The Range parameter needs to be set based on the selected signal:

Output	Value entered
0 to 5	127

Settings of parameters ElMin / ElMax, PhysMin / PhysMax depend on what units are required for the measured value from the ARI_AnOut module.

For signals 0 to 5:

Parameter	Value
ElMin	0
ElMax	100
PhysMin	0
PhysMax	100

Caution When it is necessary to set the temperature setpoint (and the connected boiler supports this setting), it is necessary to enable writing of the setpoint temperature by means of relevant digital outputs (see chapter 10.2 “Digital outputs”).

11 Factory settings

RS485 configuration Jumpers to activate termination and idle state definition are fitted on the interface RS485.

DIP switch All DIP switches are in the OFF position. It is necessary to set communication parameters, application and protocol, see chapter 8.1 “Address settings”, chapter 8.2 “Setting communication speed and parity”.

MODE jumper Fitted (ARION protocol), see chapter 8.3 “Setting the protocol”.

12 Ordering information and package contents

Converter	**DM-OT2**	Complete set, see chapter 12.1 “Package contents”

12.1 Package contents

DM-OT2	**Part**	**Quantity**
	Converter of OpenTherm/+ interface	1

13 Maintenance

With exception of cleaning, the device requires no periodic inspections or maintenance.

Cleaning Depending on the device usage, it is necessary to clean the dust out of the device from time to time. The device can be cleaned with a dry, soft brush or a vacuum cleaner and only while turned-off and disassembled.

Note **The maintenance mentioned above may be performed by manufacturer or authorised service only!**

14 Waste disposal

Electronics disposal

The product disposal is subject to regulations on disposal of electronic waste. The equipment must not be disposed together with common public waste. It has to be delivered to relevant facilities and recycled.