DM-DI4MB2ET

Communication converter M-Bus to Ethernet with digital inputs

Operation manual

Version 1.01

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

Technical support: support@amit.cz

Contents

History of revisions

Document name: dm-di4mb2et_g_en_101.pdf

Revision	Date	Author of change	Changes
100	16. 02. 2011	Csörgő V.	New document.
101	11. 05. 2017	Říha Z.	Change in chapter 1, 2, added figures, change of manual structure.

Related documentation

1. **DM-DI4MB2ET** – Software in converter **DM-DI4MB2ET** – Programmers guide
   file: dm-mb2eta_ms_en_xxx.pdf
2. Application Note AP0010 – Communication in M-Bus Network
   file: ap0010_en_xx.pdf
3. Application Note AP0008 – Communication in MODBUS Network
   file: ap0008_en_xx.pdf
4. Application Note AP0030 – Use of Converter **DM-DI4MB2ET**
   file: ap0030_en_xx.pdf
5. Application Note AP0037 – Principles of Ethernet network usage
   file: ap0037_en_xx.pdf

1 Introduction

DM-DI4MB2ET is a communication converter M-Bus to Ethernet with four pulse inputs. The inputs are operated by stand-alone low-power processor powered by an internal battery. This solution allows counting even when a power supply is turned off.

Basic features

- MASTER-type M-Bus interface, up to 3 SLAVE-type units
- Ethernet interface 10/100 Mbps (communication MODBUS/TCP, APE, Direct)
- 4 digital inputs DI, passive contact
- Power supply +24 V DC or PoE
- Mounting on a rail DIN 35 mm

Note The communication MODBUS/TCP allows up to 6 clients to be connected.

2 Technical parameters

Communication CPU

CPU	STM32F107VCT6
FLASH	256 KB
SRAM	64 KB

Pulse inputs CPU

CPU	MSP430F2132
FLASH	8 KB
SRAM	512 B
Power supply	Lithium battery BR2477, Panasonic
Battery lifetime	Max. 10 years [1])

Note [1]) Battery lifetime depends on a way of use, see chapter “5.1.1 Battery lifetime”.

Digital inputs

Quantity	4
Configuration	1 × 4
Digital inputs type	Passive contact
Number of bits per counter	48
Pulse width – state closed	Min. 3 ms
Pulse width – state opened	Min. 7 ms
Galvanic isolation	No
Connection point	WAGO 231-305/102-000
Inlet wire cross section	0.08 mm^2 to 2.5 mm^2

Ethernet

Quantity	1
Communication speed	10/100 Mbps
Galvanic isolation	Yes
Insulation strength	500 V AC / 1 minute [2])
Operation indication	LED on mainboard
Connection point	Connector RJ45, according to IEEE802.3

Note [2]) Insulation must not be used for dangerous voltage separation.

M-Bus

Quantity	1
Interface type	MASTER
Transmission speed	150 bps to 9600 bps
Overvoltage protection	Transil 600 W
Interface short-circuits protection	Resettable thermal fuse 100 mA
M-bus interface power supply	From internal power supply
Galvanic isolation	No
Number of connectable units	1 to 3, SLAVE-type
Operation indication	LED on mainboard
Connection point	WAGO 231-302/102-000
Wire cross section	0.08 mm^2 to 2.5 mm^2

Power supply 24 V DC

Nominal power supply voltage	24 V DC
Power supply voltage range	19.2 V DC to 28.8 V DC
Maximum power consumption	210 mA at 24 V DC
Power dissipation (typical)	2.5 W
Galvanic isolation	Yes [3])
Insulation strength	500 V AC / 1 minute [4])

Connection point	WAGO 231-302/102-00
Wire cross section	0.75 mm^2 to 2.5 mm^2
Power supply system	The device must not be power supplied from DC distribution network of building [5])

Note [3]) Galvanically isolated from the internal electronics.
[4]) Isolation must not be used for dangerous voltage separation.
[5]) For detailed information, see the chapter “7.1 Installation rules” paragraph “Power supply”.

Power supply PoE

Nominal power supply voltage	48 V DC
Power supply voltage range	43.2 V DC to 52.8 V DC
Maximum power consumption	70 mA at 48 V DC
Galvanic isolation	Yes [6])
Insulation strength	500 V AC / 1 minute [7])
Connection point	Connector RJ45 (for Ethernet connection)

Note [6]) Galvanically isolated from the internal electronics.
[7]) Isolation must not be used for dangerous voltage separation.

Mechanics

Mechanical design	Plastic box
Mounting	On DIN rail 35 mm
Ingress protection rate	IP20
Weight – netto – brutto	0.16 kg ±5 % 0.22 kg ±5 %
Dimensions (w × h × d)	(71 × 90 × 73) mm

Temperatures

Operating temperature range	-25 °C to 50 °C
Storage temperature range	-25 °C to 50 °C

Others

Maximum ambient humidity	< 95 % non-condensing

2.1 Dimensions

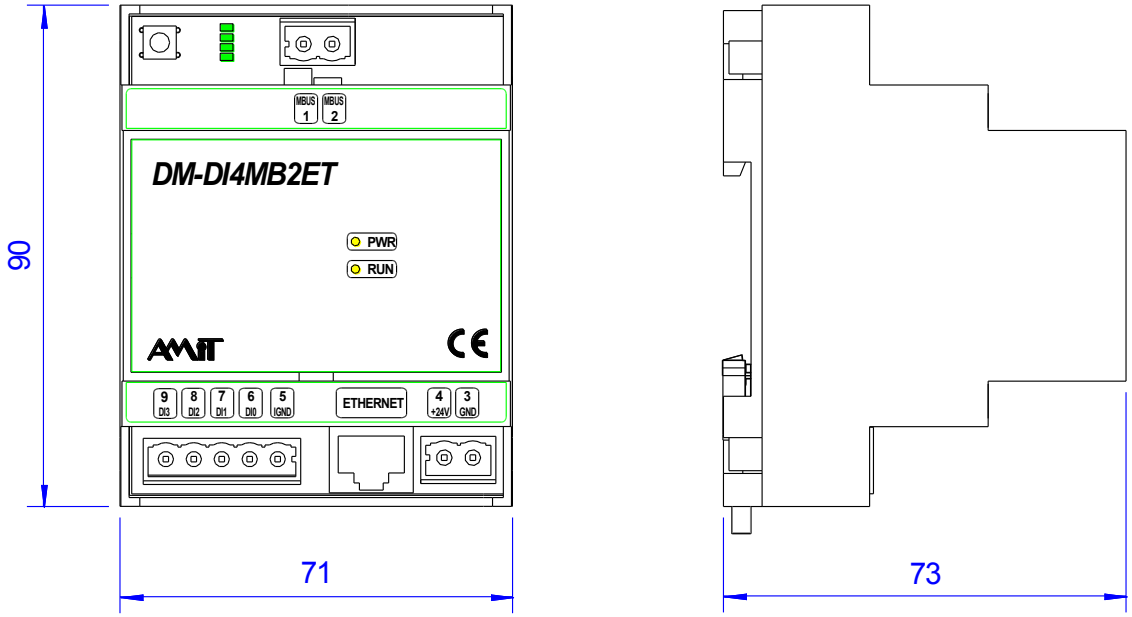

Fig. 1 – **DM-DI4MB2ET** dimensions

2.2 Recommended drawing symbol

Following drawing symbol is recommended for the communication converter **DM-DI4MB2ET**. Only part of it will be visible in following examples.

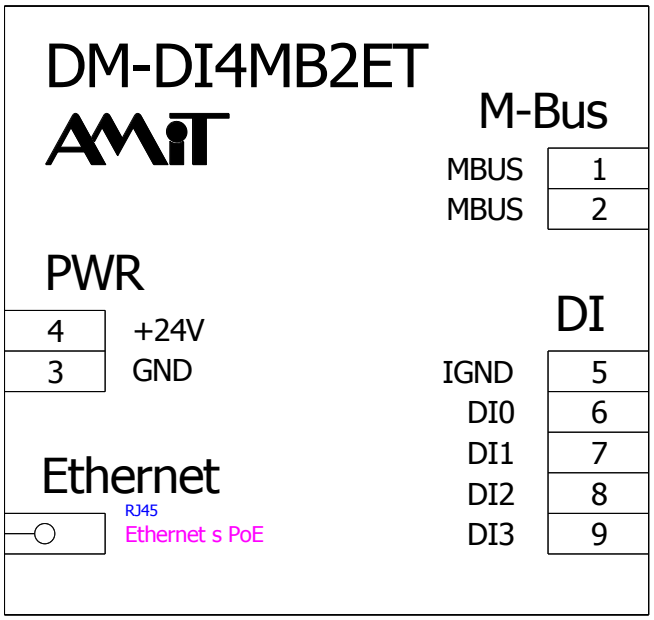

Fig. 2 – Recommended drawing symbol for **DM-DI4MB2ET**

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 61326-1:2013.

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 [8])
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Indirect electrostatic discharge immunity test, contact discharge	Complies (±8 kV)
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Indirect electrostatic discharge immunity test, air discharge	Complies (±16 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 GHz	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 1.4 GHz to 2 GHz	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 GHz to 1.7 GHz	Complies (1 V/m)
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, power supply, Ethernet, M-Bus	Complies (±4 kV)
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, power supply, M-Bus shielding, DI0 až DI3	Complies (±4 kV)
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, Ethernet shielding	Complies (±3 kV)

Tested in accordance with standard	Type of test	Class
EN 61000-4-6:2009	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields	Complies (3 V)

Note [8]) This is a class A device. This device can cause some radio disturbances in the internal environment. 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: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on DC input power port – Immunity test	Complies

4 Power supply

The communication converter **DM-DI4MB2ET** can be power supplied by DC power supply or through Ethernet (PoE). The power supply must meet requirements mentioned in the chapter “2 Technical parameters”.

Connection of power supply voltage is indicated by LED PWR.

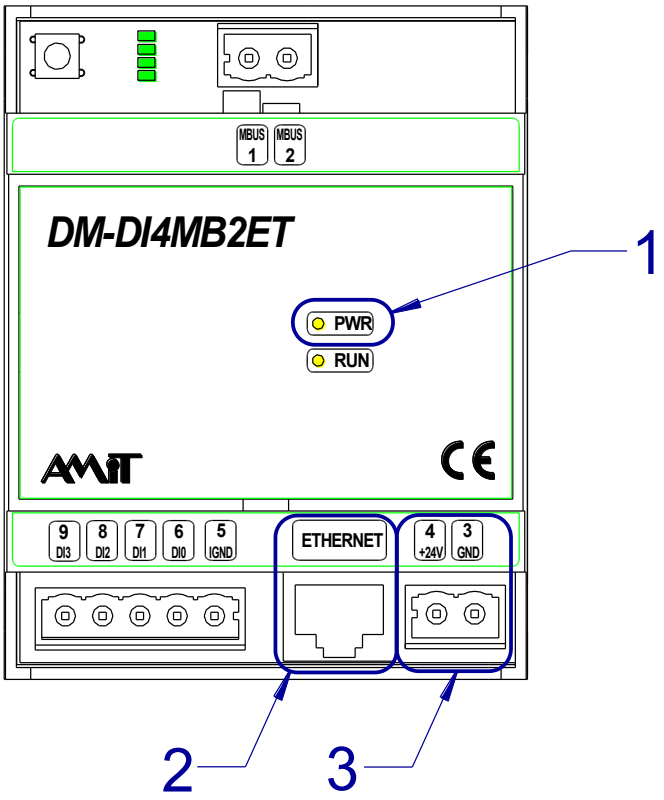

Fig. 3 – Power supply connector +24 V DC

Legend

Number	Description
1	LED PWR
2	Connector for Ethernet with PoE
3	Connector for power supply 24 V DC

Terminals marking

Terminal	Signal	Description
3	GND	Power supply, ground
4	+24V	Power supply, +24 V DC

LED states description

LED	Description
Lit	Power supply is connected
Not lit	Power supply is not connected

Wiring example

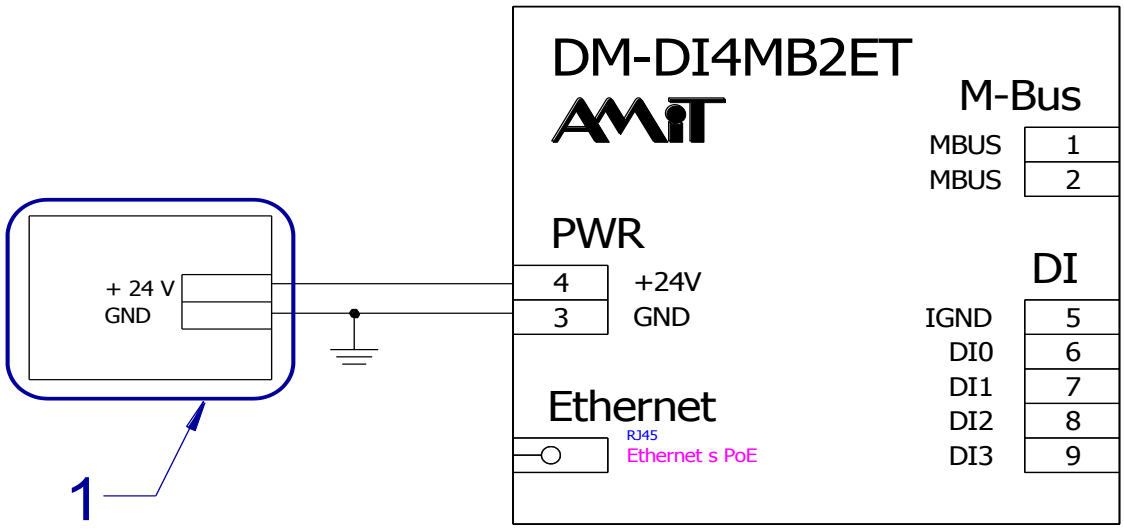

Fig. 4 – Example of power suppling from power supply +24 V DC

Legend

Number	Description
1	External power supply 24 V DC

Note It is recommended to connect the GND terminals with switchboard PE terminal during installation.

Power supply PoE The communication converter can be power supplied by PoE. For this power supply, e.g. standard PoE switches from AMiT production can be used.

Wiring example

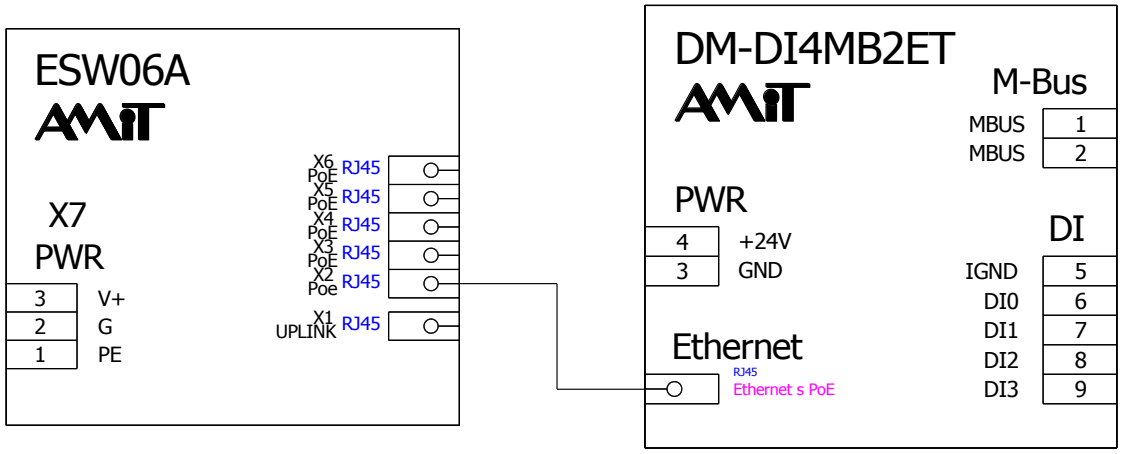

Fig. 5 – Example of power supplying from power supply PoE

5 Inputs/outputs

5.1 Digital inputs

The communication converter **DM-DI4MB2ET** includes 4 pulse inputs, which are determined for the connection of contact inputs.

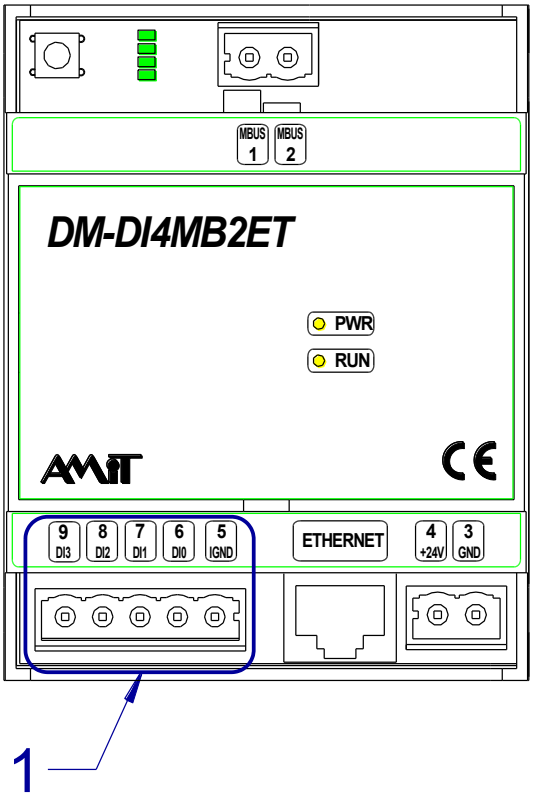

Fig. 6 – Connector position for digital inputs

Legend

Number	Description
1	Connector for digital inputs

Numbering of connector DI0 to DI3

Terminal	Signal	Description
5	IGND	Common ground for DI0 to DI3
6	DI0	Pulse input with the pulses counter
7	DI1	Pulse input with the pulses counter
8	DI2	Pulse input with the pulses counter
9	DI3	Pulse input with the pulses counter

Note DI0 to DI3 and IGND are galvanically isolated from the power supply +24 V and the power supply PoE, DI0 to DI3 and IGND are not galvanically isolated from internal electronics.

Wiring example

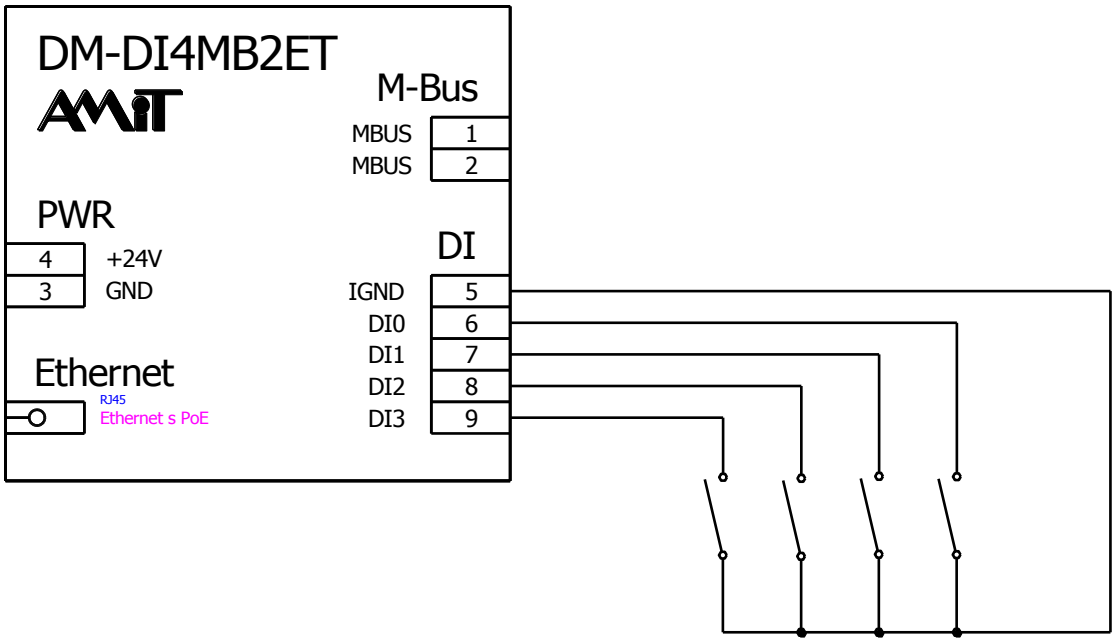

Fig. 7 – Example of inputs DI0 to DI3 wiring

The inputs DI0 to DI3 are operated by stand-alone processor MSP430, which has stand-alone counter for each input. The states of these counters are reset only during their production. The counters are incremented only during their operation, cannot be reset. The processor, which includes the counters, is power supplied from the battery.

Pulses counter takes place without external power supply (24V or PoE). The processor MSP430 is power supplied from internal battery in this state. The processor is in counting mode for about 30 hours from power-off or from last input pulse and it immediately notices each pulse. If the power supply is not restored for about 30 hours or no input pulse comes, the processor switches to a mode of very low power. The processor is switched back to the counting mode either by the connection of power supply voltage or by coming of pulse on arbitrary input. On the first received pulse in the mode of very low power, this processor can react with a delay or it may not capture the pulse.

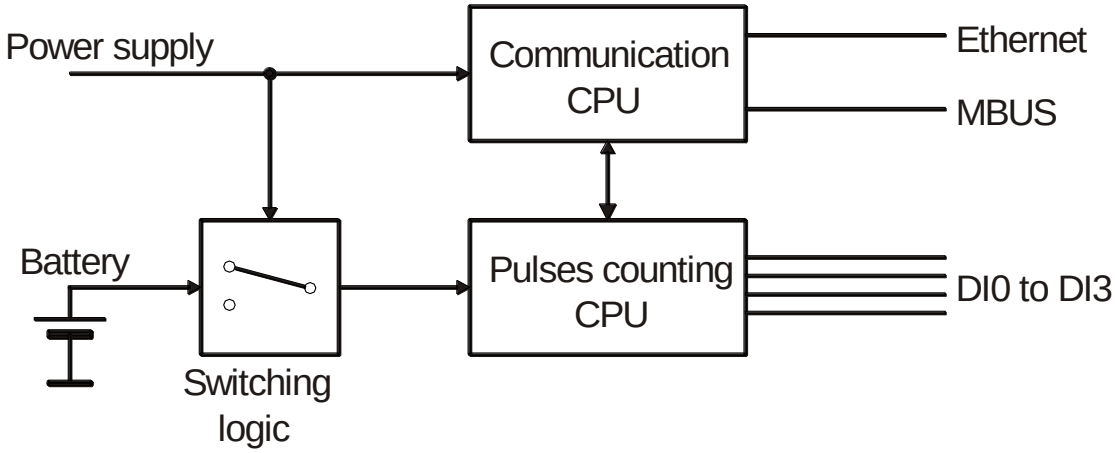

Fig. 8 – Block scheme of internal wiring

5.1.1 Battery lifetime

Guaranteed battery lifetime without a discharge is 10 years. The lifetime can be greatly reduced depending on a way how the communication converter is used. An auxiliary processor, which counts the pulse, is permanently power supplied form the battery. If the communication converter is connected to the power supply voltage, the battery consumption is negligible, so the battery lifetime will be close to 10 years in this mode. If the communication converter is without the power supply voltage, the discharge will depend on the inputs state. If these inputs are inactive (The communication converter does not count the pulses), the auxiliary processor is in the state of very low power and the battery lifetime is 8 years in this mode. In a case that the inputs are active (the communication converter counts the pulses), the auxiliary processor is in the mode of lower power and the battery lifetime is only 200 days. It is expected in the real-life operation that the communication converter is permanently connected with short-time power supply failures, and then the battery lifetime is close to 10 years. The battery state can be read from the communication converter and it is also described in the programmers guide dm-di4mb2et_ms_en_xxx.pdf. Battery replacement is necessary when the voltage drops below 2.9 V.

6 Communication interfaces

The communication converter **DM-DI4MB2ET** has two communication interfaces:

- M-Bus interface,
- Ethernet interface.

6.1 M-Bus interface

The communication converter **DM-DI4MB2ET** works on M-Bus interface as MASTER. The device supports up to 3 SLAVE-type stations on M-Bus interface.

M-Bus interface activity is indicated by LEDs on the mainboard.

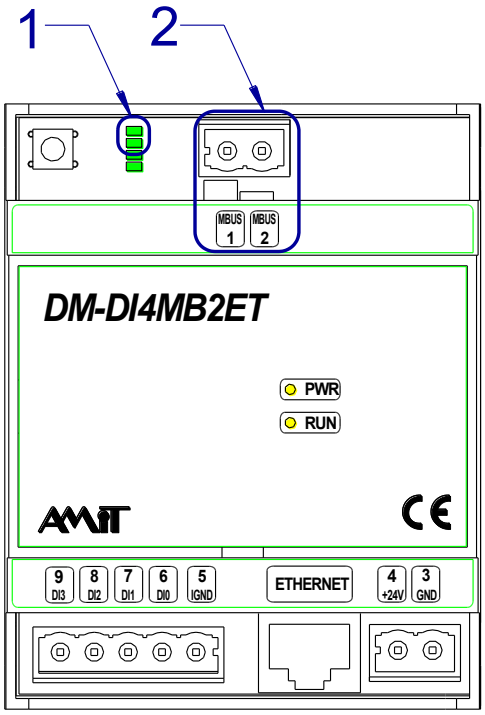

Fig. 9 – Location of LEDs and terminals for M-Bus

Legend

Number	Description
1	Status LEDs
2	Terminals for M-Bus

Terminals marking

Terminal	Signal	Description
1	MBUS	Terminal for M-Bus interface
2	MBUS	Terminal for M-Bus interface

LEDs description

LED	Description
MBUS Rx	Converter is receiving data
MBUS Tx	Converter is transmitting data

Note M-Bus interface is galvanically separated from power supply +24 V and from power supply PoE. M-Bus interface is not galvanically separated from internal electronics.

Wiring example

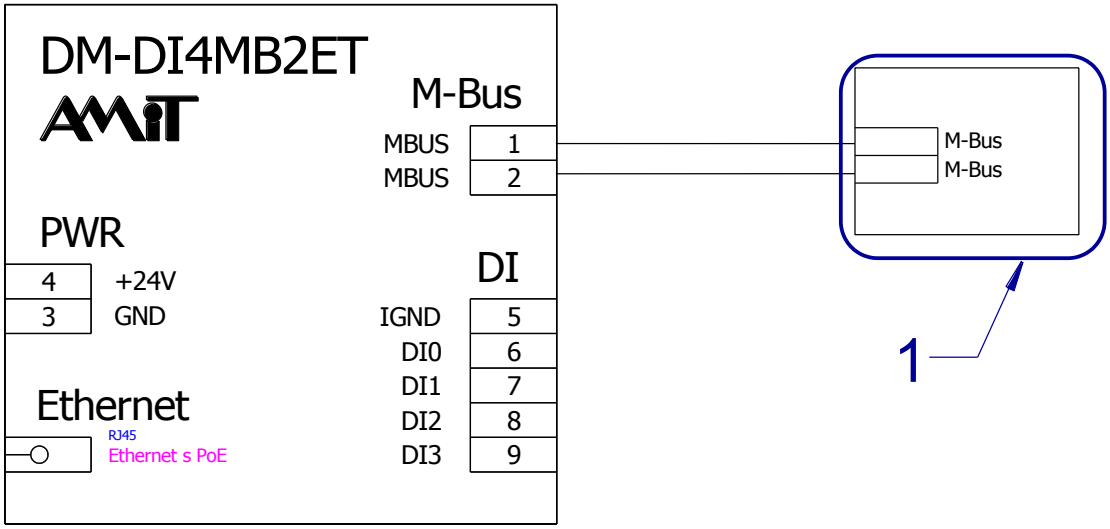

Fig. 10 – Wiring example of M-Bus interface

Legend

Number	Description
1	Periphery (slave) in network M-Bus

More information about M-Bus interface wiring can be found in Application Note *AP0010 – Communication in M-Bus Network*.

6.2 Ethernet interface

- Speed 10/100 Mbps
- Half-duplex or Full-duplex support
- Direct and crossover cable support
- Interface state indication by LED LINK and LED ACT

Ethernet interface activity is indicated by of LEDs on the mainboard.

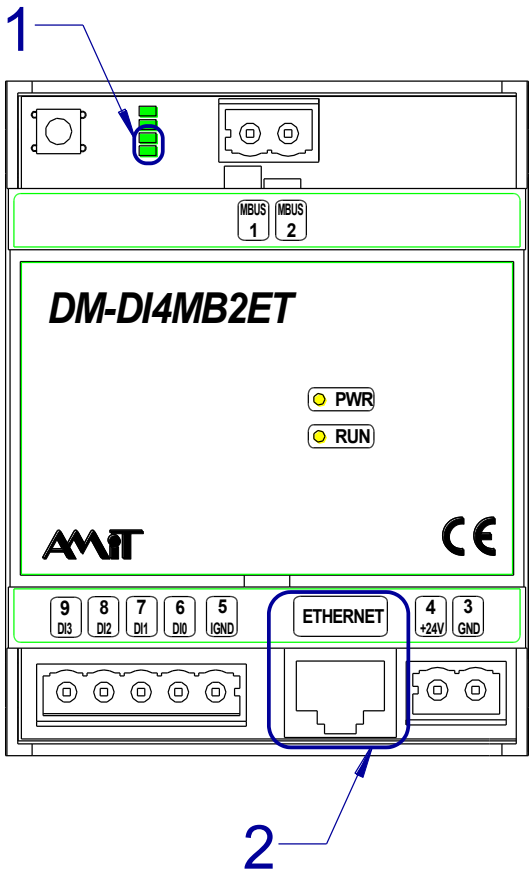

Fig. 11 – Location of LEDs and connector for Ethernet

Legend

Number	Description
1	Status LEDs
2	Connector for Ethernet

The order of connector RJ 45 PINs is shown in the following figure.

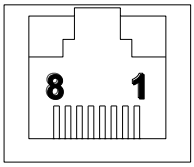

Fig. 12 – Order of RJ45 connector PINs

Ethernet connector wiring

Pin	Signal	Description
1	Tx+ / PoE A	Signal Tx+ / wire for PoE switch
2	Tx- / PoE A	Signal Tx- / wire for PoE switch
3	Rx+ / PoE A	Signal Rx+ / wire for PoE switch
4	+48V PoE B	Power supply PoE +48 V
5	+48V PoE B	Power supply PoE +48 V
6	Rx- / PoE A	Signal Rx- / wire for PoE switch
7	0V PoE B	Power supply PoE 0 V
8	0V PoE B	Power supply PoE 0 V

LEDs description

LED	Description
ETH ACT	Communication takes place on Ethernet interface
ETH LNK	Established connection on Ethernet interface

More information about Ethernet interface connection can be found in Application Note *AP0037 – Principles of Ethernet network usage*.

7 Mounting

The communication converter **DM-DI4MB2ET** must be mounted in the switchboard. It is intended for mounting on DIN rail 35 mm.

7.1 Installation rules

Power supply The equipment must not be power supplied from DC distribution network of building. More equipment can be power supplied from a single power supply assuming the similar-type equipment and the same building location.

Connecting to PE It is recommended to connect the GND terminals with switchboard PE terminal during installation.

Pulse inputs To connect the relay contacts and pulse inputs of unit **DM-DI4MB2ET,** a 4-wire shielded cable is required. The cable must not be longer than 30 meters and must not come out of building. Connect the cable shielding to the PE terminal immediately on switchboard input. The cable FTP or STP is recommended, one pair will create one input DI, the cable shielding is connected to IGND.

Connecting cable	Terminal
1st wire / 1st pair	DI0
2nd wire / 2nd pair	DI1
3rd wire / 3rd pair	DI2
4th wire / 4th pair	DI3
5th wire – shielding	IGND

M-Bus It is necessary to use 2-wire cable with the shielding for M-Bus interface connection. The cable must not be longer than 30 m and must not come out of building. Connect the cable shielding to the PE terminal immediately on switchboard input. The cable FTP or STP is recommended, two pairs will create one input M-Bus.

Ethernet Ethernet interface can be connected through a cabling Cat5 with shielding.

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

Filtration All cables, leading to the communication converter, must be pulled through a filter ferrite. The ferrites must be placed as closed as possible to the converted. Two cables can be pulled through one ferrite filter. The ferrites must be used because of radio interference. If they are not used, the manufacturer does not provide the guaranteed radiation parameters. Recommended ferrites are listed in ordering information.

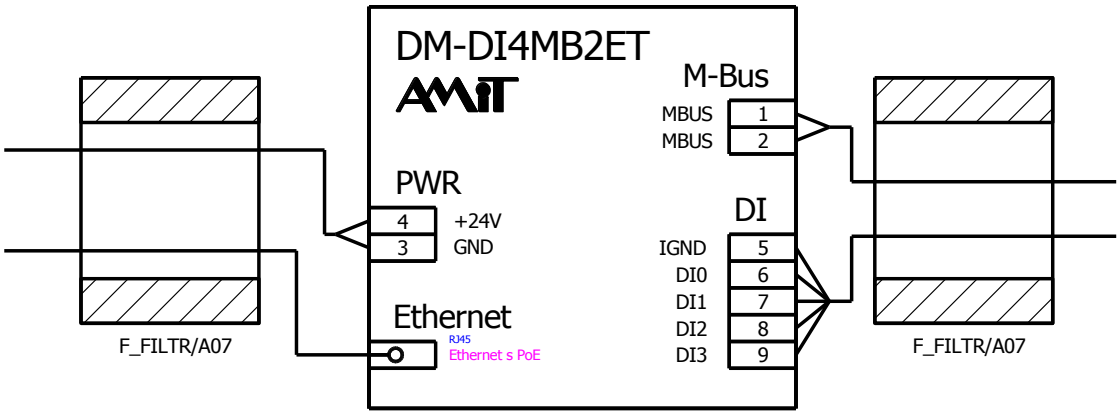

Fig. 13 – Ferrite filters wiring on the cables

8 Converter configuration

It is necessary to switch the converter to service mode for converter communication. The converter can be switched to service mode using the service button.

8.1 Service button

The service button is located in upper left corner of converter.

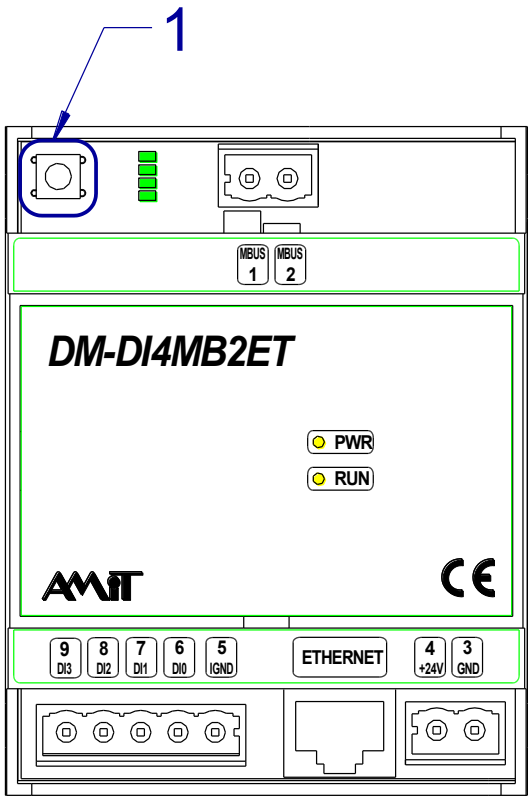

Fig. 14 – Service button location

Legend

Number	Description
1	Service button

8.2 LED RUN

The converter state is indicated by LED RUN.

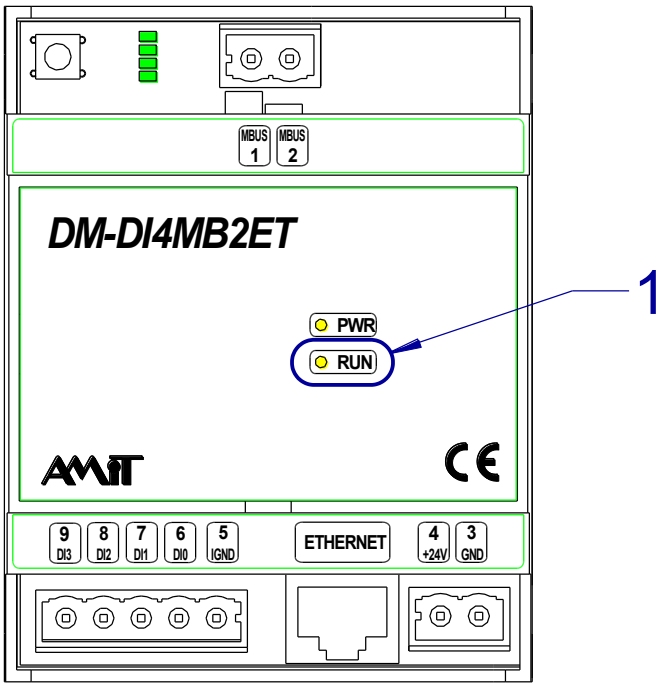

Fig. 15 – LED RUN location

Legend

Number	Description
1	LED RUN

LED description

LED	Description
Flashing with period 0.5 s	Converter is in service mode.
Flashing, period 2 s	Converter is in application mode (standard operation).
Lit	Converter has switched to factory settings.

8.3 Service mode

It is possible to change the device communication parameters in service mode. Details regarding individual parameters setting are mentioned in the programmer manual dm-mb2et_ms_en_xxx.pdf.

The converter can be switched to service mode, as follows:

- Disconnect **DM-DI4MB2ET** from the power supply voltage.
- Connect the power supply voltage while holding the service button.
- Hold the button for 5 s, then release. LED RUN is flashing with the period 0.5 s (the button must be pressed within 10 s, otherwise **DM-DI4MB2ET** will pass into the factory setting).

Device setting is performed using web interface. It is necessary to turn the device off and on for its launching with new setting.

9 Factory settings

Ethernet factory settings

Parameter	Default value
Converter IP address	192.168.1.1
Network mask	255.255.0.0
Default gateway	192.168.1.254
DHCP	Activated

M-Bus factory settings

Parameter	Default value
Port M-Bus	2000
M-Bus communication speed	2400 bps
Mode	1 – Direct
Direct timeout	500

9.1 Factory setting restoring

Factory settings can be restored using the service button (see the chapter “8.1 Service button”).

Restoring procedure

- Disconnect **DM-DI4MB2ET** from the power supply voltage.
- Connect the power supply voltage while holding the service button.
- Hold the button for at least 10 s (until LED RUN will not light permanently), then release the button.
- Disconnect and connect the power supply voltage of converter.

Attention **DHCP settings cannot be switched to the factory settings!** DHCP factory settings cannot be restored after manual settings change. The parameter can only be changed manually (see the programmers guide dm-mb2et_ms_en_xxx.pdf).

10 Ordering information and Package contents

Communication converter	**DM-DI4MB2ET**	Complete, see the chapter “10.1 Package contents”
Others	**F_FILTR/A07**	Ferrite filter on cable, cable diameter 6.0 mm to 7.5 mm

10.1 Package contents

DM-DI4MB2ET

Part	Quantity
Communication converter M-Bus to Ethernet with digital inputs	1
WAGO 231-302/102-000	2
WAGO 231-305/102-000	1

11 Maintenance

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

Backup battery Backup battery is used for digital inputs counters. Its nominal voltage is 3.0 V; nominal capacity is 1 Ah. If battery voltage drops under 2.9 V, it is considered as discharged. If is occurs to this state, it must be replaced. The battery state can be find out by software, see the programmers guide dm-mb2et_ms_en_xxx.pdf. An assumed battery lifetime is 10 years according to manufacturer.

Cleaning Time after time it is necessary to remove a dust from the device according to the way of use. The device can be cleaned by dry soft brush or vacuum cleaner, only when turned-off and disassembled.

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

12 Waste disposal

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

Battery disposal The device 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.