INSTALLATION AND CONFIGURATION MANUAL

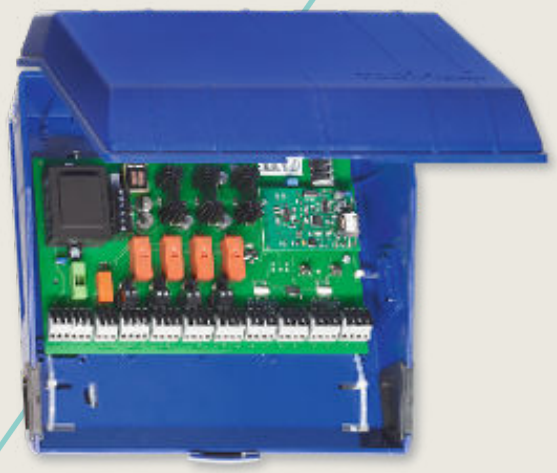
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TROXNETCOM

Functional module MB-BAC-WA1/4

For the control of up to four damper actuators

For use in EIA-485 networks (Modbus RTU and BACnet MS/TP)



TROX DOCU PORTAL

Read this manual before starting any work!

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1 General

1.1 About this manual

This manual enables operating or service personnel to correctly install the product described below and to use it safely and efficiently.

Functional module MB-BAC-WA1/4

This manual is intended for use by fitting and installation companies, in-house technicians, technical staff, instructed persons, and qualified electricians or air conditioning technicians.

It is essential that these individuals read and fully understand this manual before starting any work. The basic prerequisite for safe working is to comply with the safety notes and all instructions in this manual.

The local regulations for health and safety at work and general safety regulations also apply.

This manual must be given to the system owner when handing over the system. The system owner must include the manual with the system documentation. The manual must be kept in a place that is accessible at all times.

Illustrations in this manual are mainly for information and may differ from the actual design.

1.2 Symbols used in this manual

Safety notes

Symbols are used in this manual to alert readers to areas of potential hazard. Signal words express the degree of the hazard.

Comply with all safety instructions and proceed carefully to avoid accidents, injuries and damage to property.

DANGER

Imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Potentially hazardous situation which, if not avoided, may result in death or serious injury.

CAUTION

Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Potentially hazardous situation which, if not avoided, may result in property damage.

ENVIRONMENT

Environmental pollution hazard.

Tips and recommendations

Useful tips and recommendations as well as information for efficient and fault-free operation.

Specific safety notes

The following symbols are used in safety notes to alert you to specific hazards:

Warning signs	Type of danger
	Warning – danger zone.
	Warning – high-voltage.

Additional markers

In order to highlight instructions, results, lists, references and other elements, the following markers are used in this manual:

Marker	Explanation
1., 2., 3. ...	Step-by-step instructions
⇨	Results of actions
	References to sections in this manual and to other applicable documents
■	Lists without a defined sequence
[Switch]	Operating elements (e.g. push buttons, switches), display elements (e.g. LEDs)
'Display'	Screen elements (e.g. buttons or menus)

1.3 Limitation of liability

The information in this manual has been compiled with reference to the applicable standards and guidelines, the state of the art, and our expertise and experience of many years.

The manufacturer does not accept any liability for damages resulting from:

- Non-compliance with this manual
- Incorrect use
- Operation or handling by untrained individuals
- Unauthorised modifications

The actual scope of delivery may differ from the information in this manual for special constructions, additional order options or as a result of recent technical changes.

1.4 Copyright

This document, including all illustrations, photos, etc., is protected by copyright.

Any use of this document without the written consent of the manufacturer is an infringement of copyright; this applies in particular to disclosing this document to third parties, to publishing, copying, microcopying, or translating content, and to saving content on electronic systems or modifying it.

Violators will be held liable for any damage. We reserve the right to make further claims.

1.5 Replacement parts

WARNING

Safety risk due to incorrect replacement parts

Incorrect or faulty replacement parts may affect the safety of people and cause damage to property or even total failure of the system.

If you intend to use a replacement part that has not been approved by TROX, make sure beforehand that it is safe to use.

Buy replacement parts from TROX or from an authorised supplier. See the address on page 2.

1.6 Defects liability

For details regarding defects liability please refer to Section VI, Warranty Claims, of the Delivery and Payment Terms of TROX GmbH. The Delivery and Payment Terms of TROX GmbH are available at ➦ *www.troxtechnik.com*.

1.7 Customer service

TROX Technical Service

To ensure that your request is processed as quickly as possible, please keep the following information ready:

- Product name
- TROX order number
- Delivery date
- Brief description of the fault

Online	➦ *www.troxtechnik.com*
Phone	+49 2845 202-400

2 Security

2.1 Dangers and risks

DANGER

Risk to life from incorrect wiring!

Incorrect wiring can lead to dangerous electrical voltages on the PCB of the functional module and at the actuator.

- Have work on the electrical system carried out only by skilled qualified electricians.
- Do not connect a 230 V supply voltage if the connected actuators are designed for 24 V.
- Do not connect a 230 V supply voltage if the wire links for 24 V have been set.

NOTICE

Risk of damage to the module due to incorrect installation of the EIA-485 network cable!

If several modules are connected to one EIA-485 cable, overvoltage transients that result from phase shifts may damage the modules beyond repair. Be sure to follow the instructions in ➦ *Chapter 7.3 'Installing the EIA-485 network' on page 15*.

NOTICE

Risk of damage to property due to large temperature differences

If any electronic components have been kept in an unheated area, condensation may form and damage the electronic components beyond repair.

- Before you start commissioning, make sure that all devices have warmed up to ambient temperature. Only after about 2 hours will the system have reached room temperature.

NOTICE

Risk of damage to property due to electrostatic charge

Electrostatic charge can damage the electronics.

- Avoid skin contact with any components or printed circuits.
- Touch an equipotentially bonded metal surface before you touch any printed circuit boards.
- Wear conductive footwear and antistatic clothing.

NOTICE

Risk of damage to property due to foreign matter and liquids!

Foreign matter and liquids that get into the unit may damage the electronic parts.

- Do not use any liquids for cleaning.
- Remove foreign matter, if any.
- If the device emits a smell or smoke, have it checked by the manufacturer.
- If liquid gets into the module, let the module completely dry before commissioning.

NOTICE

Risk of damage to property!

Over tightening the fixing screws may damage the casing.

- Tighten the screws only hand-tight.

2.2 Correct use

Functional module MB-BAC-WA1/4 is used to monitor and control motorised fire dampers or smoke control dampers in EIA-485 networks. The module can be used for up to four fire dampers or smoke control dampers. The dampers then have to be fitted with a suitable 24 V or 230 VAC actuator (TROX or Belimo).

2.3 Incorrect use

Do not use the functional module for areas of application that are not described in this manual.

Do not use the functional module:

- outdoors
- in wet areas
- in areas with potentially explosive atmospheres

2.4 Residual risks

Failure of the EIA-485 interface does not affect the safety function of the fire dampers but does affect data exchange with the central BMS.

Smoke control dampers maintain the position that was last sent from the EIA-485 interface. Safety-related applications require further precautions.

2.5 Qualified staff

WARNING

Danger of injury due to insufficiently qualified individuals!

Incorrect use may cause considerable injury or damage to property.

- Only skilled qualified personnel may carry out work.

The following degrees of qualification are required for the work described in the operating manual:

Qualified electrician

Skilled qualified electricians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on electrical systems, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

3 Transport and installation

Supply package

Check delivered items immediately after arrival for transport damage and completeness.

Properly dispose of packaging material.

Supply package
MB-BAC-WA1/4
Installation and commissioning manual

3.1 Transport

- If possible, take the functional module in its transport packaging up to the installation location.
- Do not remove the protective wrapping until just before installation.

3.2 Storage

For temporary storage please note:

- Leave the product in its packaging and do not expose it to the effects of weather.
- Store the product in a dry place and away from direct sunlight.
- Temperature –10 °C to +70 °C, humidity 90% max. (no condensation)

4 Structure and functional description

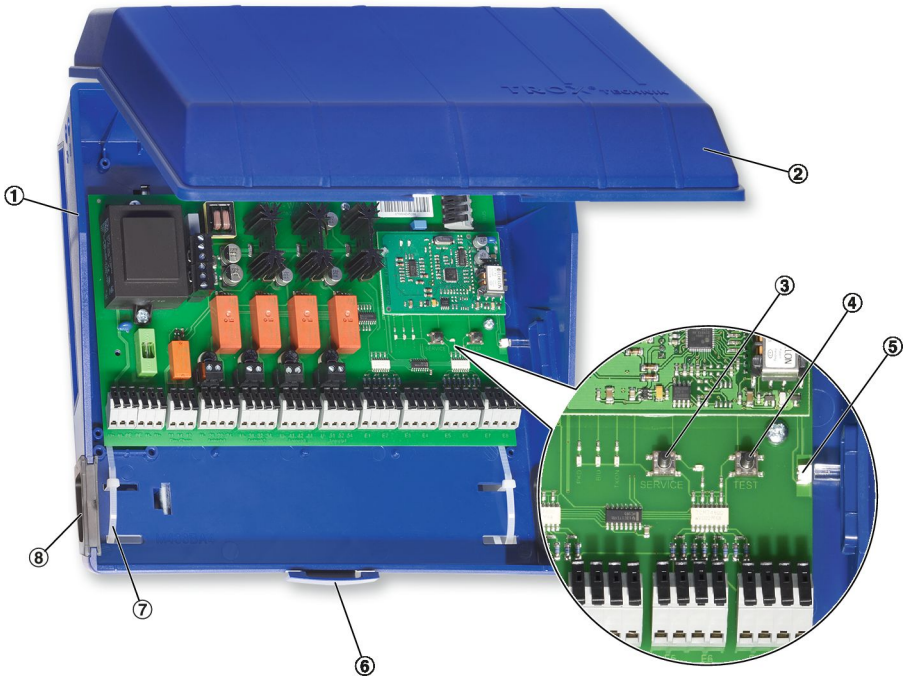


Fig. 1: Functional module MB-BAC-WA1/4

1	Casing
2	Cover
3	'Service' push button
4	'Test' push button
5	LED for heartbeat (illumination visible on the outside of the casing)
6	Cover lock
7	Strain relief (cable clips, both sides)
8	Cable entry points (both sides)
(not shown)	Rating plate

Tab. 1: Push buttons on the main PCB

Push button	Function
Test	Starts a functional test for the damper: The damper is moved from the 'Normal' position to the 'Fire' position and back to the 'Normal' position.
Service	Sends the neuron ID for system integration

4.1 Functional description

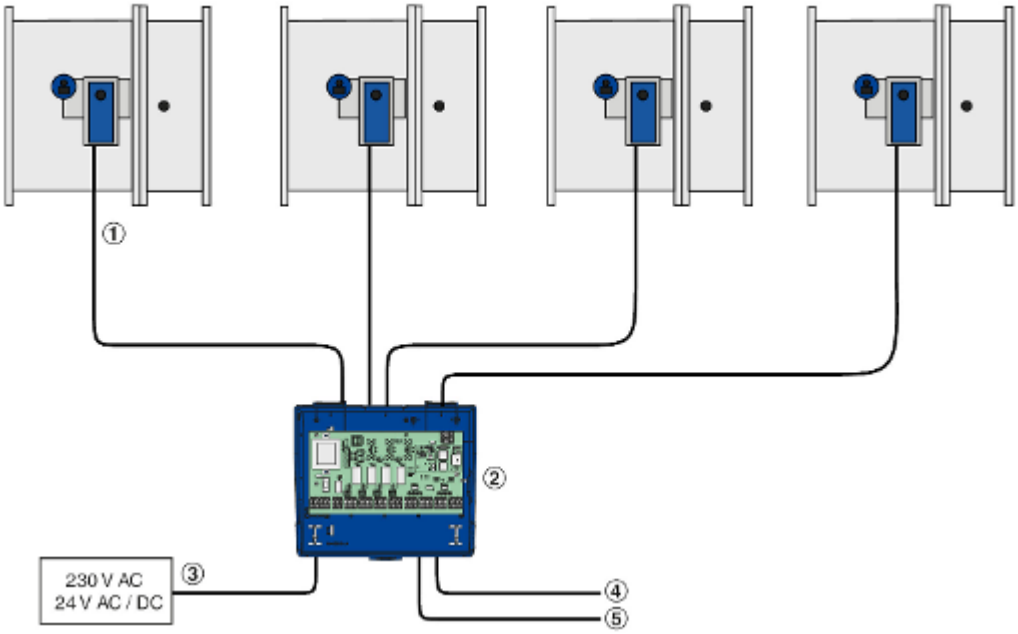


Fig. 2: Functional module MB-BAC-WA1/4 with 4 fire dampers

1 Actuators for fire dampers or smoke control dampers (up to four)
2 MB-BAC-WA1/4
3 Supply voltage, 230 V AC or 24 V AC/DC depending on the actuator voltage range
4 EIA-485 FTT twisted pair
5 FireChain

Functional module MB-BAC-WA1/4 is used to monitor and control motorised fire dampers or smoke control dampers in EIA-485 networks. The module can be used for up to four fire dampers or smoke control dampers.

Safe positions

In case of an error, the following safe positions apply, based on VDMA sheet 24200-1 (Automated fire protection and smoke extract systems):

Fire damper	- Closed
Smoke control damper	- Last position is maintained

5 Technical data

Dimensions

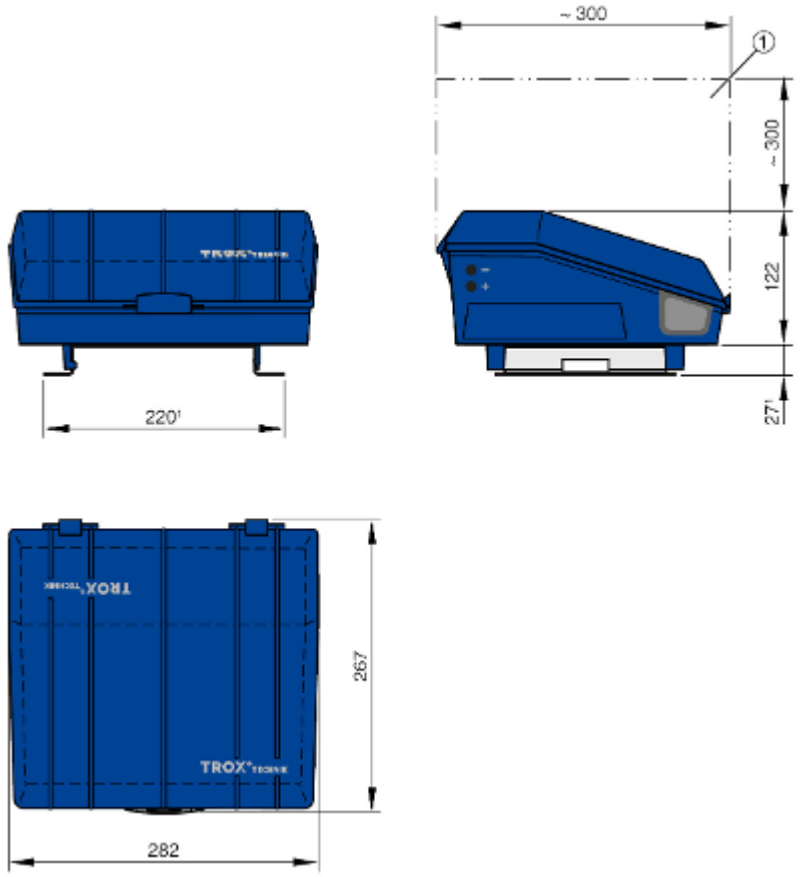


Fig. 3: Dimensions

Tab. 2: Technical data

Supply voltage 230 V	230 Volt AC ±10%, 50/60 Hz
Supply voltage 24 V	24 V AC or 24 V DC ± 10%
Power consumption without actuators	Approx. 12 VA without actuators (4.8 VA or W)
Max. switch rating for Damper 1 relay (24 V AC)	Max. switch rating 5 A with 24 V AC/DC
Max. switch rating for Damper 2 relay (24 V AC)	Max. switch rating 5 A with 24 V AC/DC
Max. switch rating for Damper 3 relay (24 V AC)	Max. switch rating 5 A with 24 V AC/DC
Max. switch rating for Damper 4 relay (24 V AC)	Max. switch rating 5 A with 24 V AC/DC
Max. switch rating for FireChain relay	Max. switch rating 5 A with 24 V AC/DC
EIA-485 interface	4 terminals, LON; FTT free topology
Operating temperature	+10 to +60 °C
Storage temperature	-10 to +70 °C
Relative humidity (no condensation)	20 to 95%, no condensation
IEC protection class with 230 V	II
IEC protection class with 24 V (extra low voltage)	III
Protection level	IP 20

Material	ABS plastic, blue (RAL 5002)
Software application	xif/apb-files under ➦ *www.trox.de*

Tab. 3: Terminals

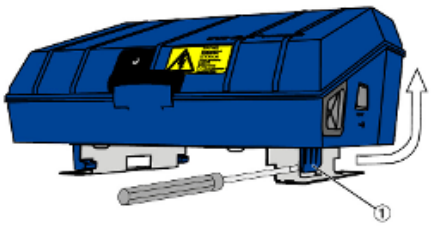
Supply voltage	2 × 3-pole for 0.08 – 2.5 mm² Double terminals for looping through
Actuator control	4 x 4-pole spring-loaded terminals for 0.08 – 2.5 mm²
Actuator end positions	4 x 4-pole spring-loaded terminals for 0.08 – 2.5 mm²
EIA-485 network	4-pole spring-loaded terminals for 0.08 – 2.5 mm²; FT5000 free topology Double terminals for looping through
FireChain signal	3-pole for 0.08 – 2.5 mm²

6 Installing the functional module

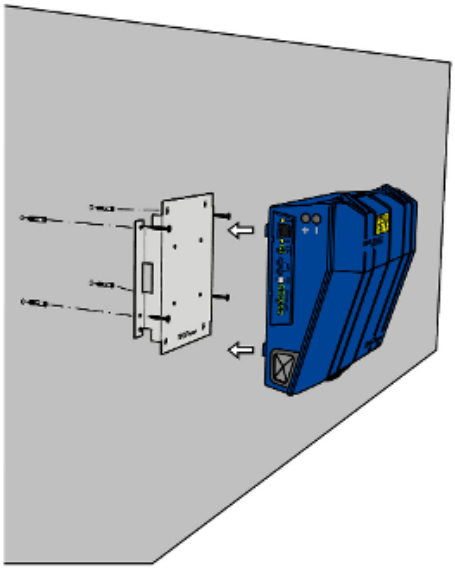
Retrofitting

If you retrofit a functional module for a fire damper, you can choose any installation location; in the event of a fire, the damper blade will be moved to its safe position (closed) even if the module fails. We recommend you to use the TROX universal mounting bracket for fixing the module to a wall, for example.

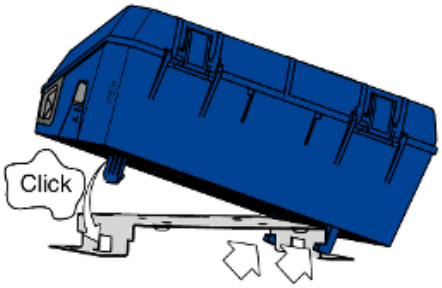
Installation



1. Detach MB-BAC-WA1/4 from the mounting bracket. To do so, use a screwdriver to flip up the lug (1), then lift the module up.



2. Use suitable screws ∅4 mm to fix the mounting bracket to a wall or duct.



3. Press MB-BAC-WA1/4 as shown onto the mounting bracket until it clicks into place.

7 Wiring

7.1 Safety instructions

Personnel:

- Qualified electrician

DANGER

Danger of death due to electric current!

Danger of electric shock! Do not touch any live components!

- Switch off the supply voltage and secure it against being switched on accidentally before working on the unit.
- Ensure that no voltage is present.
- Work on the electrical system must only be carried out by skilled qualified electricians.

7.2 Notes on wiring

Use only cables that are designed for the supply voltage for which they will be used. The length and cross section as well as any contact resistance may increase voltage losses. The power rating of each unit must also be considered. A skilled qualified electrician has to select the correct cable types and sizes. This job must only be carried out by specialist electrical companies.

- For the electrical connection comply with any applicable regulations and follow the code of good practice. Be sure to comply with the applicable guidelines for working on electrical and electronic equipment as well as with any applicabe local regulations.
- For electrical connection data refer to the 'Technical data' chapter.
- Protect any connections from physical damage.
- Feed cables through the cable entry points into the casing. Feeding the cable may be easier if you pull out the side parts of the casing.

7.3 Installing the EIA-485 network

If several modules are connected to one EIA-485 cable, the modules could become damaged beyond repair. This may happen if the secondary winding of the transformers that supply voltage to the modules have been connected to the earth; the EIA-485 cable to which the modules are connected is fairly long, and the transformers are supplied with voltage by different phases. The EIA-485 bus cables are usually used for 0 V to 5 V. The communication modules can even be used with -13 V to +13 V without becoming damaged. If, however, several phases are used, possible phase shifts between these phases may lead to voltages of up to 67 V (!) on the bus cable, which will eventually destroy the modules.

For the correct installation of an EIA-485 network please note:

- When you connect a module to a 2-wire bus (EIA-485), use an additional wire for equipotential bonding to divert currents caused by different potentials and prevent them from affecting the two data wires.
- Do not connect the secondary winding to the earth, if at all possible.
- If you use only one phase to supply voltage to the entire system, the additional wire for equipotential bonding is not required.

- If you use several phases to supply voltage to the system, take precautions to avoid the overvoltage transients described above. For example, you could use power supply units with so called "floating potentials". For systems in which each power supply unit has to be connected to the earth for some reason, you can use a commercially available repeater in the bus cable for galvanic isolation.
- If there are any sources of disturbance in the system that could affect the bus communication, use shielded cables.
- Designing and making earth connections have to be performed by others.

7.4 Voltage supply for a limited number of modules

If the supply voltage is 24 V AC/DC, you must not connect more than two MB-BAC-WA1/4 modules with the double stack terminals as otherwise the load current on the PCB and the terminals will become too high.

7.5 Polarity of the power supply

Be sure to maintain the correct polarity when you wire up modules to a 24 V DC supply.

7.6 Strain relief

Use a wire clamping bracket or other type of strain relief for all cables. You may use the cable clips provided in the casing (*Fig. 1*/7).

7.7 Terminal connections

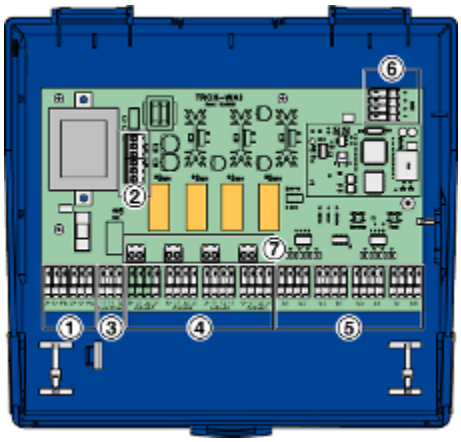


Fig. 4: MB-BAC-WA1/4

1 Connection for the supply voltage
2 Wire links to set the supply voltage
3 FireChain relay
4 Connections for fire damper or smoke control damper actuators (up to four)
5 Connections for limit switches on fire damper or smoke control damper actuators
6 EIA-485 network
7 Output wire links (output is volt-free if no wire link is attached)

Connecting the supply voltage

Functional module MB-BAC-WA1/4 can be connected to a supply voltage of 230 V AC or 24 V AC/DC. Choose the supply voltage according to the actuators, then use two wire links to set the voltage on the functional module. You have to set the voltage on the terminal block (*Fig. 4*/2); refer to the tables below for the position of the wire links.

DANGER

Risk to life from incorrect wiring!

Incorrect wiring can lead to dangerous electrical voltages on the PCB of the functional module and at the actuator.

- Do not connect a 230 V supply voltage if the connected actuators are designed for 24 V.
- Do not connect a 230 V supply voltage if the wire links for 24 V have been set.

Tab. 4: 230 V AC (Fig. 4/1)

Terminal	Used for	Position of wire links (Fig. 4/2)
U+	L	
U–	N	
PE	PE	

Tab. 5: 24 V AC / DC (Fig. 4/1)

Terminal	Used for		Position of wire links (Fig. 4/2)
	24 AC	24 DC	
U+	L	+24 V	
U–	N	0 V	
PE	PE	–	

Connection of the FireChain relay (Fig. 4/3)

Terminal	Description
11	The relay can be used to switch off a ventilation system, for example.
14	
12	

Connection of actuators (Fig. 4/4)

Terminal	Description
U-	Output, control signal to the actuator of fire damper 1 or smoke control damper 1
24	
U-	Output, control signal to the actuator of fire damper 2 or smoke control damper 2
34	
U-	Output, control signal to the actuator of fire damper 3 or smoke control damper 3
44	
U-	Output, control signal to the actuator of fire damper 4 or smoke control damper 4

Terminal	Description
54	

If no wire links are set (*Fig. 4*/7), the outputs are volt-free; common contact (21, 31, 41, 51) = U+

Connection of limit switches (*Fig. 4*/5)

Limit switches	Terminal Actuator	Terminal MB-BAC-WA1/4	Damper blade position
Actuator 1	S4+S6	E1	OPEN
	S1+S2	E2	CLOSED
Actuator 2	S4+S6	E3	OPEN
	S1+S2	E4	CLOSED
Actuator 3	S4+S6	E5	OPEN
	S1+S2	E6	CLOSED
Actuator 4	S4+S6	E7	OPEN
	S1+S2	E8	CLOSED

Terminals for damper blade position OPEN (E3, E5, E7) that are not used must have a wire link; this applies, for example, if you connect only two dampers. Otherwise an alarm message will be output.

Tab. 6: Connection of the EIA-485 network (Fig. 4/6)

Terminal	BAC-net	Modbus
NA	BUS +	DI
NB	BUS –	DO
NA	BUS +	DI
NB	BUS –	DO

Connection of data cables

MB-BAC-WA1/4 has terminals for two EIA-485 data bus cables.

- Strip the insulation from the bus cable (at least two wires), insert the bare wires into the terminals and tighten the screws by hand.
- Make sure that the polarity of the conductor pairs is correct. Incorrect polarity will result in inverted data signals and hence communication errors.
- Support the bus cables with a wire clamping bracket or other strain relief (by others).
- A maximum of 32 units can be operated on one network segment.
- To avoid cable reflections, network segments must be terminated at both ends with 120 Ω bus terminal resistors.

8 Commissioning the functional module

Configuration

Before you use MB-BAC-WA1/4 as a BACnet or Modbus interface module, you have to configure it to the actual application. To do so, use the switches on the PCB.

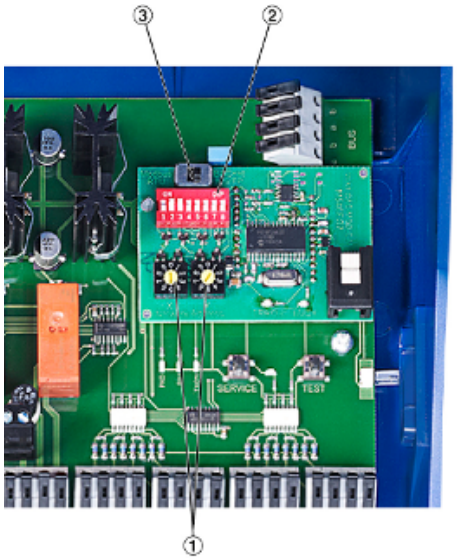


Fig. 5: MB-BAC-WA1/4

1 Switches to set the network addresses, 01-99
2 DIP switch to set communication parameters
3 Switch to select BACNet MS/TP or Modbus RTU protocol

Setting the protocol type

Use the slide switch to select either BACnet MS/TP or Modbus RTU. When you change the protocol, an initialisation procedure starts after about 1 s.

Setting the network address

Use the two switches X and Y to set a network address between 01 and 99. Address 00 is reserved for broadcast mode. A maximum of 32 devices (network addresses) can be operated on one network segment. Each device requires a unique network address. When you change the protocol, an initialisation procedure starts after about 1 s.

Settings for BACnet

Tab. 7: Transmission speed

BACnet	S2	S3
9600 Bd	Off	Off
19200 Bd	On	Off
38400 Bd	Off	On
76800 Bd	On	ON

Settings for Modbus

Tab. 8: Transmission speed

Modbus	S2	S3
9600 Bd	Off	Off
19200 Bd	On	Off
38400 Bd	Off	On
57600 Bd	On	ON

Tab. 9: Setting parity

Parity	S5	S6
None	Off	Off
None	On	Off
Odd	Off	On
Even	On	ON

9 Removal and disposal

Removal

If the device is no longer used, it has to be removed and disposed of in an environmentally friendly manner.

1. Remove the mains cable.
2. Remove any other cables.

Disposal

If no return or disposal agreement is in place, any disassembled components should be recycled:

- Have electronic waste and electronic components disposed of by an approved specialist disposal company.

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A BACnet interface

A.1 BACnet objects

BACnet objects

Test

With this object a test run is started, is stopped and is signalled.
All flaps are first brought into the safe position and then into the normal position. The test run ends for the flaps immediately, for those ActuDrive1...4 in safe position . Values:
No_Test_Active (0), Test_Active (1), default setting 0.

FireChain

With this object the position of the fire chain relay is signalled. Values:
Relay_Off (0), Relay_On (1).

Damper1...4

With this object the operating mode of the respective channel isset.
Depending on according to operating mode the BACnet objects used for this are visible or invisible. Values:
Inactive (1)no flap connected, factory setting
Motorised_Damper (2) motor-driven damper Limit_Switches_Open_and_Closed (3)
mechanical damper with Open- and Close limit switch Only_Limit_Switch_Open (4) 2
mechanical dampers only with Open limit switch Only_Limit_Switch_Closed (5) 2
mechanical dampers only with Close limit switch

SafetyPos1...4

Only with operating mode Motorised_Damper.
With this object the safe flap position is specified in the error case . A distinction is made at between a fire damper (close) and a smoke extraction damper (open).
Values: open (1), close (2), factory setting 2.

ActuDrive1...4

Only with operating mode Motorised_Damper.
With this object the flap position iscontrolled.
Values: open (1), close (2), basic setting after reset is opposite of SafetyPos1...4.

ActuPos1...4

Operating modes Motorised_Damper and
Limit_Switches_Open_and_Closed: This object is used to report the damper position.
The feedback comes from limit switches at the inputs E1...E8 (NO contact). COV messages are possible if the status changes.
Values: open (1), close (2), running (3).

Operating modes Only_Limit_Switch_Open and
Only_Limit_Switch_Closed: This object is used to report the damper blade position.
The feedback comes from limit switches at the inputs E1, E3, E5, E7 (normally open contact at Only_Limit_Switch_Open, normally closed contact at Only_Limit_Switch_Closed). COV messages are possible if the status changes.
Values: open (1), close (2).

2

ActuPos1a...4a

Operating modes Only_Limit_Switch_Open and
Only_Limit_Switch_Closed: This object is used to report the damper blade position.
The feedback comes from limit switches at the inputs E2, E4, E6, E8 (normally open contact at Only_Limit_Switch_Open, normally closed contact at Only_Limit_Switch_Closed). COV messages are possible if the status changes.
Values: open (1), close (2).

Alarm1...4

With this object error statuses are reported. The first error code (2...7) remains stored until it is eliminated, only then is another error message possible.
The values and the reset of errors are described below . COV messages are possible if the status changes.

Values at Operating mode Motorised_Damper:
OK (1), System_Error (2), Runtime_Error (3), Manipulation (4), Update_Error (5), Alarm (6).

Values at Operating mode Limit_Switches_Open_and_Closed:
OK (1), Manipulation (4), Alarm (6).

Values for operating modes Limit_Switches_Open and Limit_Switches_Closed:
OK (1), Alarm (6) for inputs E1, E3, E5, E7, Alarm_a (7) for inputs E2, E4, E6, E8. Alarm (6) has priority over Alarm_a (7) if both flaps are in the alarm position.

DriveTime1...4

Only with operating mode Motorised_Damper.
With this object the maximum duration of the opening of the flap is set. If the value is 0, the time measurement is switched off.
Values: 0...6553.4 seconds, resolution 0.1 seconds, factory setting 240 seconds.

TurnOffTime1...4

Only with operating mode Motorised_Damper.
With this object the maximum duration of the closing of the flap is set. If the value is 0, the time measurement is switched off.
Values: 0...6553.4 seconds, resolution 0.1 seconds, factory setting 35 seconds.

RcvHrtBt1...4

Only with operating mode Motorised_Damper.
With this object the maximum duration between write accesses is set to ActuDrive1...4. The Update_Error alarm is signalled for longer pauses.
With the value 0 the time measurement isswitched off.
Values: 0...6553.4 seconds, resolution 0.1 seconds, factory setting 0 seconds.

COV messages with BACnet

The change of the value of of multistate value objects can be reported with change-of-value (COV) messages.

COV is used for the objects ActuPos1...4, ActuPos1a...4a and Alarm1...4. The generation of the messages must be commissioned with the service Subscribe-COV . Confirmed and unconfirmed messages are possible.
For the parameter Lifetime the values 0...65535 seconds arepossible.

Addresses of the ModbusRegisters

The designations and purposes of the register are the same as for BACnet, see above.
The registers are read out and updated within 100ms.

Address	Description	Values * Resolution Unit
0…3	Damper1...4	1…5
4…7	SafetyPos1...4	1…2
8…11	ActuDrive1...4	1…2
12…15	ActuPos1...4	1…3
16…19	ActuPos1a...4a	1…2
20…23	DriveTime1...4	0...65534 * 0,1 s
24…27	TurnOffTime1...4	0...65534 * 0,1 s
28…31	RcvHrtBt1...4	0...65534 * 0,1 s
32…35	Alarm1...4	1…7
36	Test	0...1 (for Write applies Bit 0)
37	FireChain	0…1

Recognition of Errors

There are 4 error sources, which are reported as alarm code in to the alarm objects and partly lead to automatic control of the fire damper.

System_Error (operating mode Motorised_Damper)

The relays have 2 switching contacts. One switches the motor of the fire damper, the other is used to check the switching status of the relay every 100ms . If the switching status is not as expected, this error is signalled. Apart from the error message, there is no further error handling; the switching status of the relay is not affected.

Possible causes: relay defective, driver transistor defective, operating voltage too low.

To simulate the error with intact circuit to , the NC contact or NO contact on the relay can be bridged . This means that only a simple intervention in the circuit is necessary.

Runtime_Error (operating mode Motorised_Damper)

The time, during of the flap opens or closes, can be measured . If the permitted duration is exceeded, this error is signalled.

The time measurement with DriveTime1...4 starts, when the relay is switched on (open flap), and ends when the limit switches signal the OPEN position.
The time measurement with TurnOffTime1...4 begins, when the relay is switched off (close flap), and ends when the limit switches signal the CLOSED position.

The 2 time measurements can be switched off with the value 0 individually .
A error remains stored , the relay switches then in the safe position.

Possible causes: flap jammed, limit switch defective, input for limit switch defective, cable to limit switch interrupted, cable to motor interrupted, motor defective.

Manipulation (operating mode Motorised_Damper and Limit_Switches_Open_and_Closed)

If both limit switches are switched on at the same time, this error is reported.
In ActuPos1...4, the value running is reported at the same time.
A error remains stored , the relay is switched off then .

Possible causes: limit switch defective, input for limit switch defective, cable to limit switch short-circuited.

Update_Error (operating mode Motorised_Damper)

The time interval of write accesses to ActuDrive1...4 can be monitored. If the permitted duration (RcvHrtBt1...4) is exceeded , this error is reported. The monitoring also starts when the error is reset or RcvHrtBt is not equal to 0.
The time measurement can be switched off with the value 0 .
A error remains stored , the relay switches then in the safe position.

Possible causes: Remote station on bus out of operation, bus connection interrupted (e.g. cable, repeater, switch).

Several simultaneous errors

Even if several errors are present on a channel at the same time, only the error handling for the error recognised first takes place. Only when this has been confirmed and has been reset can another error be recognised.

Error messages

The multistate value Alarm1...4 is used to report errors (value 2...5) or the fire position (value 6...7, has priority). This displays the alarm that occurred first. The alarm can be reset , by OK (value 1) in the object is written . Within 100ms after the write the error handling ends. From now canbe displayed again other errors .

Errors	OK	System_Error	Runtime_Error	Manipulation	Update_Error	Alarm	Alarm_a
Value	1	2	3	4	5	6	7

Limit switch

The limit switches areconnected to the terminals at as follows: :

Terminal	Operating modes Motorised_Damper, Limit_Switches_Open_and_Closed (normally open contact in each case)	Operating modes Only_Limit_Switch_Open (normally open contact), Only_Limit_Switch_Closed (normally closed contact)
E1	Flap 1 open	Flap 1
E2	Flap 1 to	Flap 1a
E3	Flap 2 open	Flap 2
E4	Flap 2 to	Flap 2a
E5	Flap 3 open	Flap 3
E6	Flap 3 to	Flap 3a
E7	Flap 4 open	Flap 4
E8	Flap 4 to	Flap 4a

The operating modes Only_Limit_Switch_Open and Only_Limit_Switch_Closed only differ in their names and are otherwise completely identical.

Fire position

The fire position isderived per according to operating mode from the limit switches .

Operating mode	Fire position when
Motorised_Damper, SafetyPos = close	Flap not OPEN
Motorised_Damper, SafetyPos = open	Flap not CLOSED
Limit_Switches_Open_and_Closed	Flap not OPEN
Only_Limit_Switch_Open	min. 1 Flap not OPEN
Only_Limit_Switch_Closed	min. 1 Flap CLOSED

Fire chain relay

The fire chain relay, the fire chain object and the red-green LED on the basic device are controlled together:

- If neither an Alarm nor a Fire position exists, then is the Fire-Chain-Relay is switched on and the LED lights up green.

- When an Alarm or a Fire position exists, then is the Fire chain relay is switched off and the LED lights up red.

Fire damper (Motorised_Damper, SafetyPos1...4 = close)

Depending on from test status, alarm reset, fire position, ActuDrive1...4 and the error status , the relay is switched as follows (evaluation from top to bottom):

other	ActuDrive1...4	Alarm1...4	Relay1...4
Alarm reset	open (1)	OK (1)	On
Test safe	open (1)	either direction	OFF
Test normal	open (1)	either direction	On
Fire position	either direction	either direction	OFF
-	either direction	Runtime_Error (3)	OFF
	either direction	Update_Error (5)	OFF
	either direction	Manipulation (4)	OFF
	open (1)	System_Error (2)	On
	close (2)	System_Error (2)	OFF
	open (1)	OK (1)	On
	close (2)	OK (1)	OFF

Initialisation after the switch-on / reset:
ActuDrive is set to open . Alarm is set to OK . The alarm reset starts, at to interrupt the latching action via the fire position in the safe state.

Smoke extraction damper (Motorised_Damper, SafetyPos1...4 = open)

Depending on from test status, alarm reset, fire position, ActuDrive1...4 and the error status , the relay is switched as follows (evaluation from top to bottom):

other	ActuDrive1...4	Alarm1...4	Relay1...4
Alarm reset	close (2)	OK (1)	OFF
Test safe	close (2)	either direction	On
Test normal	close (2)	either direction	OFF
Fire position	either direction	either direction	On
-	either direction	Runtime_Error (3)	On
	either direction	Update_Error (5)	On
	either direction	Manipulation (4)	OFF
	open (1)	System_Error (2)	On
	close (2)	System_Error (2)	OFF
	open (1)	OK (1)	On
	close (2)	OK (1)	OFF

Initialisation after the switch-on / reset:
ActuDrive is set to close . Alarm is set to OK . The alarm reset starts, at to interrupt the latching action via the fire position in the safe state.

Operating modes without Relay

In operating mode Inactive the relay is switched on.
The relay is switched off in operating mode Limit_Switches_Open_and_Closed, Only_Limit_Switch_Open and Only_Limit_Switch_Closed.

A.2 BACnet protocol

BACnet Protocol Implementation Conformance Statement

Date:	15.08.2013
Vendor Name:	TROX GmbH
Product Name:	MB-BAC-WA1/4
Product Model Number:	M546FG7
Application Software Version:	1.0
Firmware Revision:	1.0
BACnet Protocol Revision:	12

Product Description:

Controller module for WA1 with Fire Smoke Damper Application providing a BACnet MS/TP Interface.

BACnet Standardized Device Profile (Annex L):

☐ **BACnet Operator Workstation (B-OWS)**
☐ **BACnet Advanced Operator Workstation (B-AWS)**
☐ **BACnet Operator Display (B-OD)**
☐ **BACnet Building Controller (B-BC)**
☐ **BACnet Advanced Application Controller (B-AAC)**
☒ **BACnet Application Specific Controller (B-ASC)**
☐ **BACnet Smart Sensor (B-SS)**
☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Blocks Supported (Annex K):

Data Sharing-ReadProperty-B (DS-RP-B)
Data Sharing-WriteProperty-B (DS-WP-B)
Data Sharing-COV-B (DS-COV-B)
Device Management-Dynamic Device Binding-B (DM-DDB-B)
Device Management-Dynamic Object Binding-B (DM-DOB-B)
Device Management-DeviceCommunicationControl-B (DM-DCC-B)
Device Management-ReinitializeDevice-B (DM-RD-B)

Segmentation Capability:

☐ Able to transmit segmented messages Window Size _____
☐ Able to receive segmented messages Window Size _____

Standard Object Types Supported:

An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data:

1) Whether objects of this type are dynamically creatable using the CreateObject service: No
2) Whether objects of this type are dynamically deletable using the DeleteObject service: No
3) List of the optional properties supported
4) List of all properties that are writable where not otherwise required by this standard
5) List of all properties that are conditionally writable where not otherwise required by this standard
6) List of proprietary properties and for each its property identifier, datatype, and meaning
7) List of any property range restrictions

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Data Link Layer Options:

☐ BACnet IP, (Annex J)
☐ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7)
☐ ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s) _____
☒ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800
☐ MS/TP slave (Clause 9), baud rate(s): _____
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):_____
☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____
☐ LonTalk, (Clause 11), medium: _____
☐ BACnet/ZigBee (ANNEX O)
☐ Other: _____

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ☒ No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
☐ Annex H, BACnet Tunneling Router over IP
☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No
Does the BBMD support network address translation? ☐ Yes ☐ No

Network Security Options:

☒ Non-secure Device - is capable of operating without BACnet Network Security
☐ Secure Device - is capable of using BACnet Network Security (NS-SD BIBB)
☐ Multiple Application-Specific Keys:
☐ Supports encryption (NS-ED BIBB)
☐ Key Server (NS-KS BIBB)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒ ISO 10646 (UTF-8)	☒ IBM™/Microsoft™ DBCS	☒ ISO 8859-1
☒ ISO 10646 (UCS-2)	☒ ISO 10646 (UCS-4)	☒ JIS X 0208

Default strings implemented in the objects use UTF-8.
Default strings can be restored by writing an empty string.

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

_____

Configuration Switches

Hexadecimal Switches X, Y	Network-Address

DIP Switch 2	OFF	ON	OFF	ON
DIP Switch 3	OFF	OFF	ON	ON
Baudrate	9600	19200	38400	76800

Device Object

Property	Remark / Value	RW
Object_Identifier	device, default instance: 32900 + Address Switch	RW-E
Object_Name	max. 63 Bytes, default “MB-BAC-WA1/4”	RW-E
Object_Type	DEVICE (8)	R
System_Status	OPERATIONAL (0)	R
Vendor_Name	“TROX GmbH”	R
Vendor_Identifier	329	R
Model_Name	“MB-BAC-WA1/4”	R
Location	max. 63 Bytes, default “”	RW-E
Description	max. 127 Bytes, default “”	RW-E
Firmware_Revision	“1.0”	R
Application_Software_Version	“1.0”	R
Protocol_Version	1	R
Protocol_Revision	12	R
Protocol_Services_Supported	read-property, write-property, subscribe-cov, who-has, who-is, device-communication-control, reinitialize-device	R
Protocol_Object_Types_Supported	DEVICE, ANALOG_VALUE, BINARY_VALUE, MULTISTATE_VALUE	R
Object_List	device, analog-value 1…12, binary-value 1…2, multistate-value 1…24 (Analog-value 1…12 and multistate-value 5…24 by default are disabled and not accessible. They are selectively enabled depending on operating mode with multistate-value 1…4.)	R
Max_APDU_Length_Accepted	480	R
Segmentation_Supported	NO_SEGMENTATION (3)	R
APDU_Timeout	10000	R
Number_Of_APDU_Retries	3	R
Device_Address_Binding	-	R
Database_Revision	0	R
Max_Master	default 127	RW-E
Max_Info_Frames	default 1	RW-E
Active_COV_Subscriptions	max. 10 Subscriptions, for multistate-value 13…24, Confirmed / Unconfirmed, Lifetime = 0…65535 sec.	R
R: Read Property, W: Write Property, -E: Storage in EEPROM / Flash		

Binary Value Objects

Property	Remark / Value	RW
Object_Identifier	binary-value, instance 1 … 2	R
Object_Type	BINARY_VALUE (5)	R
Object_Name	max. 42 Bytes	RW-E
Description	max. 84 Bytes, default “”	RW-E
Present_Value	INACTIVE (0) / ACTIVE (1)	
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0)	R
Inactive_Text	max. 31 Bytes	RW-E
Active_Text	max. 31 Bytes	RW-E
R: Read Property, W: Write Property, -E: Storage in EEPROM / Flash		

Instance	Object_Name default	Inactive_Text default	Active_Text default	Present_Value default	Present_Value RW
1	“Test”	“No_Test_Active”	“Test_Active”	0	RW
2	“FireChain”	“Relay_Off”	“Relay_On”	0	R

Analog Value Objects

Property	Remark / Value	RW
Object_Identifier	analog-value, instance 1 … 12	R
Object_Type	ANALOG_VALUE (2)	R
Object_Name	max. 42 Bytes	RW-E
Description	max. 84 Bytes, default “”	RW-E
Present_Value	0…6553,4	RW-E
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0)	R
Units	seconds (73)	R
R: Read Property, W: Write Property, -E: Storage in EEPROM / Flash		

Instance	Object_Name default	Present_Value default
1	“DriveTime1”	240.0
2	“DriveTime2”	240.0
3	“DriveTime3”	240.0
4	“DriveTime4”	240.0
5	“TurnOffTime1”	35.0
6	“TurnOffTime2”	35.0
7	“TurnOffTime3”	35.0
8	“TurnOffTime4”	35.0
9	“RcvHrtBt1”	0.0
10	“RcvHrtBt2”	0.0
11	“RcvHrtBt3”	0.0
12	“RcvHrtBt4”	0.0

Analog-value 1…12 by default are disabled and not accessible.
They are enabled in operating mode Motorized_Damper with multistate-value 1…4.

Multistate Value Objects

Property	Remark / Value	RW
Object_Identifier	multistate-value, instance 1 … 24	R
Object_Type	MULTISTATE_VALUE (19)	R
Object_Name	max. 42 Bytes	RW-E
Description	max. 84 Bytes, default “”	RW-E
Present_Value	State	
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0)	R
Number_Of_States		R
State_Text	max. 31 Bytes	RW-E
R: Read Property, W: Write Property, -E: Storage in EEPROM / Flash		

Instance	Object_Name default	Present_Value	Damper State Enabled	Number_Of_States	State	State_Text default
1 2 3 4	“Damper1” “Damper2” “Damper3” “Damper4”	RW-E operating mode	1…5	5	1 (default) 2 3 4 5	“Inactive” “Motorized_Damper” “Limit_Switches_Open_and_Closed” “Only_Limit_Switch_Open” “Only_Limit_Switch_Closed”
5 6 7 8	“SafetyPos1” “SafetyPos2” “SafetyPos3” “SafetyPos4”	RW-E	2	2	1 2 (default)	“open” “close”
9 10 11 12	“ActuDrive1” “ActuDrive2” “ActuDrive3” “ActuDrive4”	RW	2	2	1 2 (at reset: opposite of SafetyPos)	“open” “close”
13 14 15 16	“ActuPos1” “ActuPos2” “ActuPos3” “ActuPos4”	R	2, 3, 4, 5	3, 2	1 2 3	“open” “close” “running”
17 18 19 20	“ActuPos1a” “ActuPos2a” “ActuPos3a” “ActuPos4a”	R	4, 5	2	1 2	“open” “close”
21 22 23 24	“Alarm1” “Alarm2” “Alarm3” “Alarm4”	RW	2, 3, 4, 5	7	1 (default) 2 3 4 5 6 7	“OK” “System_Error” “Runtime_Error” “Manipulation” “Update_Error” “Alarm” “Alarm_a”

Multistate-value 5…24 by default are disabled and not accessible.
They are selectively enabled depending on operating mode with multistate-value 1…4.

B Modbus interface

Frame timing with ModbusRTU

The division into frames is determined at Modbus with pause times . The following intervals apply to rates of up to 19200 Bd; values for higher Baud rates are given in brackets:

- At the Sending is at most 1,5 Characters (750µs) as a Pause between 2 characters of a frame.
- At least 3,5 Characters (1750µs) must when Transmission the Pause between 2 frames.
- The Area in between serves as Tolerance range for the Receiver. If this pause is exceeded during reception, the frame ends.

This device makes no pauses between and characters when sending . There is a silent interval of >= 3.6 character times (1800µs) before the send process starts.
The reception ends at approximately 2.5 characters (1250µs) pause.

Modbus functions

The coding of the Modbus RTU frames is shown below (representation without CRC). For data with 2 bytes the High-Byte comes first.

Meaning of the Exception codes:

1	Illegal Function Code	Unknown Code in Function or Subfunction.
2	Illegal Data Address	A Register address is invalid.
3	Illegal Data Value	Inconsistent Coding with RegisterQuantity, Number of bytes, Data value.

Modbus function 3 (0x03) Read Holding Registers

Modbus function 4 (0x04) Read Input Registers

These functions are used , to read several consecutive registers . Both functions are identical.

Request:

Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x03 / 0x04
Byte 2-3	Register Address	First Register
Byte 4-5	Register Quantity	Number of Registers

Response:

Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x03 / 0x04
Byte 2	Byte Count	2 Bytes per Register
Byte 3-4	Register Value	0x0000-0xFFFF
Byte ...	Register Value	0x0000-0xFFFF

Error:

Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Error Code	0x83 / 0x84
Byte 2	Exception Code	0x02.0x03

Modbus function 06 (0x06) Write Single

This function is used , towrite in a single register to .

Request:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x06
Byte 2-3	Register Address	Address of the Register
Byte 4-5	Register Value	0x0000-0xFFFF

Response:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x06
Byte 2-3	Register Address	Address of the Register
Byte 4-5	Register Value	0x0000-0xFFFF

Error:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Error Code	0x86
Byte 2	Exception Code	0x02.0x03

Modbus function 16 (0x10) Write Multiple Registers

This function is used , to write in several consecutive registers.

Request:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x10
Byte 2-3	Register Address	First Register
Byte 4-5	Register Quantity	Number of Registers
Byte 6	Byte Count	2 Bytes per Register
Byte 7-8	Register Value	0x0000-0xFFFF
Byte ...	Register Value	0x0000-0xFFFF

Response:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x10
Byte 2-3	Register Address	First Register
Byte 4-5	Register Quantity	Number of Registers

Error:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Error Code	0x90
Byte 2	Exception Code	0x02.0x03

Modbus function 8 (0x08)

This function is used to check the Modbus communication.

Request:			
Byte 0	Slave Address	Rotary switch	1-99
Byte 1	Function Code	0x08	
Byte 2-3	Subfunction	see below.	
Byte 4-5	Data	see below.	
Response:			
Byte 0	Slave Address	Rotary switch	1-99
Byte 1	Function Code	0x08	
Byte 2-3	Subfunction	see below.	
Byte 4-5	Data	see below.	
Error:			
Byte 0	Slave Address	Rotary switch	1-99
Byte 1	Error Code	0x88	
Byte 2	Exception Code	0x01.0x03	

Sub-func.	Data Requ.	DataName Resp.	Meaning
0	*	*	Return Query Data The whole frame (max. 100 bytes) issent back .
1	x	x	Restart Communications Option Modbus communication is restarted after the response (warm start), the listen-only mode is ended.
4	0	-	Force Listen Only Mode No response is sent to . The listen-only mode starts immediately. The device then only responds to the function Diagnostics, sub-function Restart Communications Option.
10	0	0	Clear Counters All 5 diagnostic counters aredeleted .
11	0	Count	Return Bus Message Count Query the number of error-free received messages.
12	0	Count	Return Bus Bus communication Error Count Query the number of messages with CRC error, length < 3, parity error or framing error.
13	0	Count	Return Slave Exception Error Count The Number of the Error messages (Error) query.
14	0	Count	Return Slave Message Count The Number of the Messages for this Device query.
15	0	Count	Return Slave No Response Count The Number of the Broadcast messages query.

Modbus function 43/14 (0x02B/0x0E) Read Device

With this function data isread for identification of the device .

Request:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x2B
Byte 2	MEI-Type	0x0E
Byte 3	Read Device ID Code	0x01
Byte 4	Object ID	0x00
Response:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Function Code	0x2B
Byte 2	MEI-Type	0x0E
Byte 3	Read Device ID Code	0x01
Byte 4	Conformity Level	0x01
Byte 5	More Follows	0x00
Byte 6	Next Object ID	0x00
Byte 7	Number of Objects	0x03
Byte 8	ID: VendorName	0x00
Byte 9	Obj-Length	9
Byte 10-18	Obj-Value	"TROX GmbH"
Byte 19	ID: ProductCode	0x01
Byte 20	Obj-Length	12
Byte 21-32	Obj-Value	"MB-BAC-WA1/4"
Byte 33	ID: MajMinRevision	0x02
Byte 34	Obj-Length	4
Byte 35-38	Obj-Value	"V1.0"
Error:		
Byte 0	Slave Address	Rotary switch 1-99
Byte 1	Error Code	0xAB
Byte 2	Exception Code	0x01-0x03

In-circuit programming

On the Printed circuit board is one RJ12 socket, to which the Programming device is connected is connected. The MPLAB ICD 3 from Microchip is intended as the programming device.
The Connecting cable must be short be short, so that the Signals not influenced are not influenced.

The Processor board without Basic unit can be directly from the ICD 3 supplied can be supplied. When the Processor board on the Base unit is plugged in, must its Power supply switched on be switched on.

Bus interface

On the Base unit are the Terminals a and b each 2 times available.
BACnet: a = BUS+ b = BUS-
Modbus: a = D1 b = D0

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IOS **ANDROID**

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