Communication and power supply unit for motorised fire dampers

- **Communication via BACnet MS/TP and Modbus RTU (RS-485)**
- **AC 230 V supply via Euro plug**
- **Power is supplied to the actuators via a plug contact (galvanically isolated, DC 24 V)**
- **Simple integration of a smoke detector with no additional power supply is possible**
- **Suitable actuators: BF24..-ST, BFN24..-ST, BFL24..-ST**

BACnet
Modbus

Technical data

|		
Electrical data	Nominal voltage	AC 230 V, 50/60 Hz
	Nominal voltage range	AC 198...264 V
	Power consumption In operation	3 W (operating position, incl. actuator)
	For wire sizing	14 VA (incl. actuator)
	Connections	See „Connections" on page 3
Control	Communication	BACnet MS/TP or Modbus RTU (ex factory)
	BACnet MS/TP	see description from page 4
	Modbus RTU	see description from page 7
	Typical response time	<100 ms
Safety	Protection class	**II** Protective insulated ▢
	Degree of protection	IP40
	EMC	CE according to 2014/30/EU
	Low-voltage-directive	CE according to 2014/35/EU
	Mode of operation	Type 1 (EN 60730-1)
	Rated impulse voltage	2.5 kV (EN 60730-1)
	Control pollution degree	2 (EN 60730-1)
	Ambient temperature	−20...+50°C
	Non-operating temperature	−40...+80°C
	Humidity test	95% r.h., non-condensing (EN 60730-1)
	Maintenance	Maintenance-free
Dimensions / Weight	Dimensions	see „Dimensions" on page 12
	Weight	ca. 350 g

Safety notes

⚠️

- **The device has been designed for use in stationary heating, ventilation and air-conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.**
- **Only authorised specialists may carry out installation.**
  All applicable legal or institutional installation regulations must be complied with during installation.
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

Product features

|	
Application	The BKN230-24-MOD is installed with the motorised fire damper. This unit sets up the communication connection with higher-level systems while the built-in safety isolating transformer supplies DC 24 V voltage to the damper actuator.

Parameterisation (DIL switch)
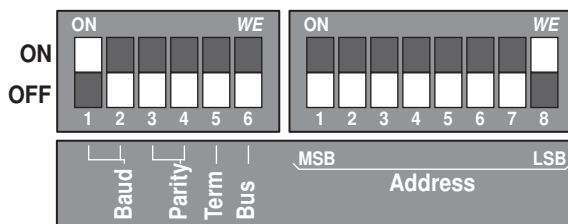
Parameterisation of the communication for BACnet MS/TP refer to Page 4.
Parameterisation of the communication for Modbus RTU refer to Page 7.

|	
Expansion options	An optoelectronic smoke detector can be connected directly without add-on devices. If a smoke or temperature alarm is tripped, the local damper immediately moves into the safety position and sends a corresponding message to the higher-level system.
Local override control	If no control commands are received by the BKN230-24-MOD or if no communication line is connected, the damper remains in the safety position. However, the damper can still move into the operating position by means of the wire bridge (Terminal 1 to 4) as soon as power supply voltage is applied. The BKN230-24-MOD can thus be used without a control system, for example if the damper needs to be continuously open without remote monitoring. The local safety function of the smoke detector is not affected. The actual position of the damper is displayed by the LEDs in the device. On-site damper test using the test key is possible. In the case of override control (terminal 1+4), the stored smoke detector fault must first be reset before the damper can be started up. The reset is executed via test button (test run / fault acknowledgement).
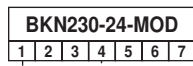
Electrical installation

① **Power supply cable and plug, AC 230 V**

② **Tab connection for**
– BELIMO damper actuator (motor DC 24 V)

③ **Tab connection for**
– BELIMO damper actuator (limit switch)

④ **USB mini socket for**
– BKN-MOD-BAC Update Tool

⑤ **Connecting terminals for**
1 External smoke detector, +24 V, max. 50 mA
2 External smoke detector, control input
3 GND
4 BKN Direct Control, override control input
5 Modbus GND
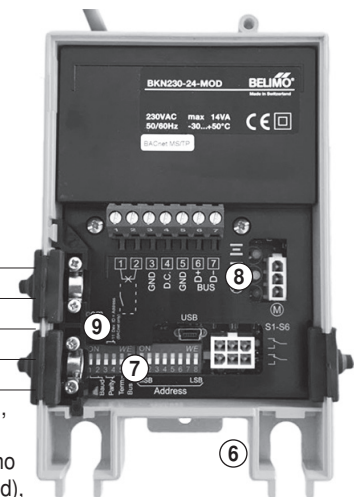6 Modbus D+
7 Modbus D–

BACnet / Modbus wiring
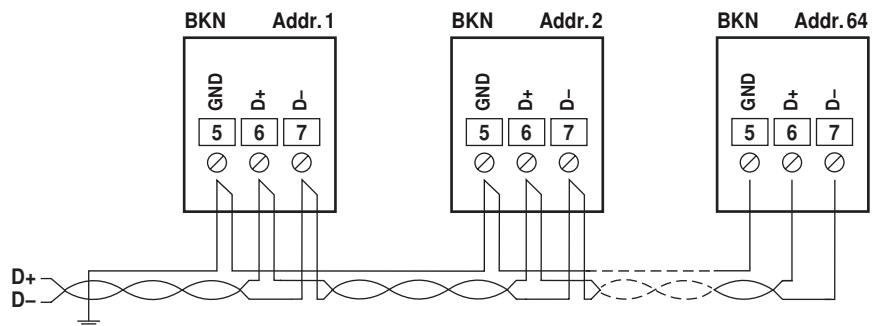
BACnet / Modbus-GND

Implementation of the bus wiring in 3-wire format
is mandatory. The GND must be connected to the
protective earth of the control cabinet.

The wiring of the line for BACnet (MS/TP) / Modbus (RTU) is to be carried out in accordance with
applicable RS485 regulations.

Indicators and operating elements

⑥ **Button Test run / fault acknowledgement**
Press the button for longer than one second to trigger the
following functions:
a) starts test run
b) resets a current error message

⑦ **DIL switch** (see „Parameterisation")

⑧ **LEDs status signalisation BELIMO damper actuator:**

Green	on	Upper limit switch (damper open)
	blinking	Damper opens (motor is actuated)
Yellow	on	Lower limit switch (damper closed)
	blinking	Damper closes (motor is not actuated)
Red	on	Internal device fault (BKN)
	blinking	External fault = smoke detector triggered, nominal position not reached
	flashing	External fault = If an error is stored (i.e. no longer pending, but not yet acknowledged), then this is displayed on the device by a periodic flash of the red LED.

⑨ **LED display communication BACnet / Modbus:**
Yellow flickering BACnet / Modbus communication is illuminated during RX and TX

Signalisation

Command OPEN / upper position not reached:		Command CLOSE / lower position not reached:	
LED green blinking		LED green on	Damper is in OPEN position
LED yellow on	Damper is in CLOSED position	LED green off	Damper blade is between OPEN and CLOSE
LED yellow off	Damper blade is between CLOSE and OPEN	LED yellow blinking	
LED red blinking		LED red blinking	
error message after 180 seconds		error message after 60 seconds	

Communication and power supply unit for motorised fire damper DC 24 V, communication via BACnet / Modbus

BELIMO

General informations BACnet

General informations

Date	3. February 2018
Vendor Name	BELIMO Automation AG
Vendor ID	423
Product Name	Field Module for Fire Damper
Product Model Number	BKN230-24-MOD
Applikations Software Version	2.1
Firmware Revision	1.0.1
BACnet Protocol Revision	12
Product Description	Communication and power supply unit for motorised fire damper
BACnet Standard Device Profile	BACnet Application Specific Controller (B-ASC)

BACnet Interoperability Building Blocks supported (BIBBs):
– Data sharing – ReadProperty-B (DS-RP-B)
– Data sharing – ReadPropertyMultiple-B (DS-RPM-B)
– Data sharing – WriteProperty-B (DS-WP-B)
– Data sharing – COV-B (DS-COV-B)
– Device management – DynamicDeviceBinding-B (DM-DDB-B)
– Device management – DynamicObjectBinding-B (DM-DOB-B)
– Device management – DeviceCommunicationControl-B (DM-DCC-B)

Segmentation capability	No
Data Link Layer Options	MS/TP master, Baud rats: 9'600, 19'200, 38'400, 76'800
Device Address Binding	No static device binding supported
Networking Options	None
Character Sets supported	ISO 10646 (UTF-8)
Gateway Options	None
Network Security Options	Non-secure device
Conformance	Listed by BTL

Parameterisation BACnet

Parameterisation (DIL switch)
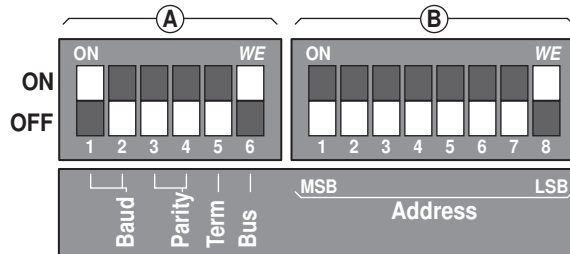
Ⓐ

Baud rate	1	2
9'600	OFF	OFF
19'200	OFF	ON
38'400	ON	OFF
76'800	ON	ON

Parity	3	4
1-8-N-1	OFF	OFF
1-8-N-1	OFF	ON
1-8-N-1	ON	OFF
1-8-N-1	ON	ON

Termination	5
with 150 Ω	ON
OFF	OFF

Bus	6
BACnet	ON
Modbus	OFF

Ⓑ

BACnet address	1	2	3	4	5	6	7	8
0		OFF	OFF	OFF	OFF	OFF	OFF	OFF
1		OFF	OFF	OFF	OFF	OFF	OFF	ON
2		OFF	OFF	OFF	OFF	OFF	ON	OFF
...								
127		ON	ON	ON	ON	ON	ON	ON

Protocol Implementation Conformance Statement - PICS

Object processing

Objekt type	Optional properties	Writeable properties
Analog Input [AI]	Description COV increment	COV increment
Analog Value [AV]	Description COV increment	Present value COV increment
Binary Input [BI]	Description Active text Inactive text	
Device	Description Location Active COV Subscriptions Max Master Max Info Frames	Object Name Location APDU timeout (1000…60'000) Number of APDU Retries (0...10) Max Master (1...127) Max Info Frames (1...255)
Multi-state Input [MI]	Description State text	
Multi-state Output [MO]	Description State text	Present Value
Multi-state Value [MV]	Description State text	Present Value

– The device does not support the services CreateObject and DeleteObject.
– The specified maximum length of writable strings is based on single-byte characters.
  • Object name: 32 char
  • Location: 64 char
  • Description: 64 char

Service processing

– The device supports the DeviceCommunicationControl and ReinitializeDevice services. No password is required.
– A maximum of 64 active COV subscriptions with a lifetime of 1…28800 sec. (8 hours) are supported.

BACnet object description

Object Name	Object Type [Instance]	Description / Comment	Values	Value Default	COV Increment	COV Increment Default	Access
Device	Device [Inst.Nr]	Object device *Device Name: If set to an empty string, default Device name is set to factory settings.* *Device Instance Number = Device Offset Object + BACnet MAC address (Dip Switches), not writable with Instance Property*	0…4194302	–	–	–	W
RelPos	AI[1]	Relative Position in %	0-50-100	–	0.01…100	1	R
AbsPos	AI[2]	Absolute Position in °	0-45-90	–	0.01…65535	1	R
BusWatchdog Countdown	AI[130]	Current Timer Value of the Bus Watchdog Countdown (Communication Supervision)	0…3600	0	0.01...1000	1	R
ActPower Consumption	AI[131]	Power consumption in W	0…2.147e+9	0	0.01...100	1	R
OffsetDeviceID	AV[121]	This value plus the parameterized MAC address (0…127) define the Device Instance Number.	0…4'194'056 (2^22 - 247)	1000	1.0...1000	1	W
BusWatchdog	AV[130]	Timeout for Bus Watchdog in s *0 = watchdog deactivated* *If the Present_Value is not ZERO, the implementation tracks write procedures to the Present_Values for Override MO[1].* *If the Present_Values of MO[1] is written, the timer is reset.* *Upon timeout the Priority_Array of the MO[1] object is cleared and the Relinquish_Default becomes valid.*	0...3600	300	1.0...1000	1	W

BKN230-24-MOD   Communication and power supply unit for motorised
fire damper DC 24 V, communication via BACnet / Modbus

BELIMO®

BACnet object description

Object Name	Object Type [Instance]	Description / Comment	Values	Default	Access
SummaryStatus	BI[101]	Summary status *Note: Summary Status summarizes the state from MI[106], MI[110], MI[111].*	0: OK 1: Not OK	–	R
Override	MO[1]	Override Control Status Flags: {FALSE, FALSE, OVERRIDDEN, OUT_OF_SERVICE} Overridden: Flag set if Local Test Button activated. Out of service: Flag set if Local control / bridge connected between terminal 1 and 4. If local override control should not be used, remove the control / bridge between terminal 1 and 4. *Remark: Object can be monitored by BusWatchdog (see AV[130])*	1: None 2: Open 3: Close	1	C
Command	MV[120]	Initiate Function *Initiation of actuator functions for service and test, the value goes after the command back to None (1) automatically.*	1: None 2: – 3: Test 4: Reset	1	W
InternalActivity	MI[100]	Detailed Status Information Test: Internal Test running, activated by bus *Remark: An activated Local Test Button is shown on MO[1]-Overridden Status Flag.*	1: None 2: Test	–	R
StatusActuator *	MI[106]	Status Actuator: Mechanical overload due to blocked actuator etc.	1: OK 2: Actuator cannot move 3: – 4: – 5: Actuator disconnected, 6: Actuator too much current	–	R
StatusDevice *	MI[110]	Status Device: Internal Error, Hardware Defect, BusWatchdog, etc.	1: OK, 2: BusWatchdog triggered, 3: InternalError	–	R
StatusTripping *	MI[111]	Status Sensor: Indicates information about the status of the smoke detector and temperature sensor.	1: OK 2: Smoke Detector triggered 3: Temperature Sensor triggered 4: Smoke Detector & Temp Sensor triggered	–	R

Access: R = Read, W = Write, C = Commandable with priority array
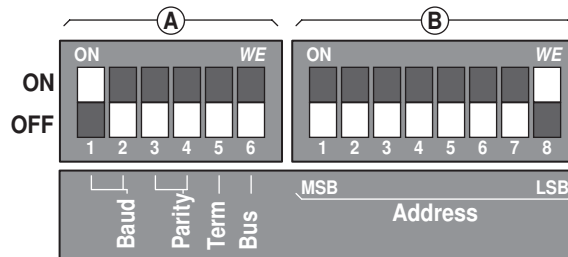* All Status Information except the „BusWatchdog triggered" need a reset command to go back to normal operation

Specific Malfunction description*	Possible Causes	Recommended Actions
Status Actuator: Actuator cannot move	– End position not reached within time – Actuator leaves end position (e.g. open) with no reason – End switches not connected As consequence actuator runs into safety position Close.	– Check working range /damper blade and limitation switches – Check actuator /end switches connection on BKN230-..-MOD
Status Actuator: Actuator disconnected	– Actuator not connected – Temperature Sensor (BAE/BAT) triggered As consequence actuator runs into safety position Close.	– Replace Temperature Sensor (BAE / BAT) in case it is broken due to high temperature / fire – Check actuator connection on BKN230-..-MOD
Status Actuator: Actuator too much current	– Actuator broken – Short circuit	– Replace actuator
StatusDevice: InternalError	Internal Device Error	– Contact Belimo

BKN230-24-MOD   Communication and power supply unit for motorised
fire damper DC 24 V, communication via BACnet / Modbus

BELIMO

General information Modbus

General information

Parameterisation	via DIP-swichtes
Protocol	Modbus RTU / RS-486
Number of nodes	Max. 64 (without repeater)
Transmission formats	1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1 Default: 1-8-N-2 (Start bits, Data bits, Parity, Stop bits)
Baud rate	9'600, 19'200, 38'400, 76'800 Bd Default: 38'400 Bd
Address range	1...247, values over 247 are interpreted as 247, 0 = Broadcast
Terminating resistor	150 Ω, can be activated by DIP-Switch

Parameterisation Modbus

Parameterisation (DIL switch)

A

Baud rate	1	2
9'600	OFF	OFF
19'200	OFF	ON
38'400	ON	OFF
76'800	ON	ON

Parity	3	4
1-8-N-2	OFF	OFF
1-8-N-1	OFF	ON
1-8-E-1	ON	OFF
1-8-O-1	ON	ON

Termination	5
with 150 Ω	ON
OFF	OFF

Bus	6
BACnet	ON
Modbus	OFF

B

Modbus address	1	2	3	4	5	6	7	8
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
...								
247	ON	ON	ON	ON	OFF	ON	ON	ON

Modbus overview

Register

	No.	Adr	Register	R / W
In operation	1	0	–	
	2	1	**Override control**	R / W
	3	2	**Command**	R / W
	4	3	Actuator type	R
	5	4	Relative position [%]	R
	6	5	Power consumption of actuator [mW]	R
	7	6	–	
	8	7	–	
	9	8	Collective fault	R
Service	101	100	Series number 1st part	R
	102	101	Series number 2nd part	R
	103	102	Series number 4th part	R
	104	103	Firmware version (Modbus module)	R
	105	104	Malfunction and service information	R
	106	105	–	
	107	106	–	
	108	107	Bus Watchdog countdown	R
	109	108	**Bus fail position**	R / W
	110	109	**Bus Watchdog**	R / W

- Registers in Bold can be written
- Registers <100 (In operation) which can be written are non-permanent and should therefore be updated periodically
- Registers >100 which can be written are permanent

Commands

All data is arranged in a table and addressed by 1..n (register) or 0..n-1 (address). No distinction is made between data types (Discrete Inputs, Coils, Input Registers, Holding Registers). As a consequence, all data can be accessed with the two commands for Holding Register. The commands for Discrete Inputs and Input Registers can be used as an alternative.

Standard commands:
Read Holding Registers [3]
Write Single Register [6]

Optional commands:
Read Discrete Inputs [2]
Read Input Registers [4]
Write Multiple Registers [16]

Note regarding Read Discrete Inputs

The command reads one or more bits and can alternatively be applied for reading the malfunction and service information in Register 105 (Adr 104). The Start address for "BAT (duct temperature sensor) triggered" is calculated with $104 * 16 + 6 = 1670$

Modbus register description

Register 1 (reserved) Not used in this device. Constant value 65'535.

Register 2: Override control Overriding the setpoint with defined compulsions

Note
If no override is set (value 0), then the fire damper remains in safety position (Closed).

Override control	
0	None
1	Open
2	Close

Register 3: Command Initiation of actuator functions for service and test; the register is reset automatically.

Command	
0	None
2	Test run
4	Reset faults

Register 4: Actuator type

Actuator type	
3	Fire damper actuator

Register 5: Relative position Position in accordance with position indicator switches
– Damper closed: 0 (0%)
– Intermediate switching: 5,000 (50%)
– Damper open: 10,000 (100%)

Register 6: Power consumption of actuator Actual power consumption in mW.
Can be used for troubleshooting or monitoring purpose

Register 9: Collective fault Fault is set when one of the bits 0...7 of Register 105 is set
(used as sensor value for air/water/VAV)

Collective fault	
0	no fault
1	fault

Register 101, 103: Series number Each node has an unambiguous series number. The series number consists of 4 segments, although only parts 1, 2 and 4 are displayed on Modbus.
Example: 00839-31324-064-008

Register 101	Register 102	Register 103
1st part	2nd part	4th part
00839	31324	008

Register 104: Firmware Version Firmware Version (VX.XX)
e.g. 201 V2.01

Modbus register description

Register 105:
Malfunction and service information

The status information is split into messages about the actuator (malfunctions) and other service information.

	Bit	Description
Malfunctions (low byte)	0	–
	1	Actuation path increased
	2	Mechanical overload
	3	–
	4	Safety-relevant malfunction
	5	Actuator too much current
	6	BAT triggered
	7	Smoke detector triggered
Service (high byte)	8	Internal activity
	9	–
	10	Bus monitoring triggered
	11	Local override control active
	12	–
	13	–
	14	–
	15	–

Malfunction Description

Bit 1 und 2: Mechanical travel increased / Mechanical overload

Firmware Version 1.x	Firmware Version 2.x
– End position not reached within time – Actuator leaves end position (e.g. open) with no reason – BAE / BAT on actuator triggered – Actuator / end switches not connected	– End position not reached within time – Actuator leaves end position (e.g. open) with no reason – Actuator / end switches not connected As consequence actuator runs into safety position Close

Recommended Action: – Check working range / damper blade and limitation switches
– Check actuator / end switches connection on BKN230-..-MOD

Bit 4: Safety-relevant malfunction

Internal device error

Recommended Action: – Contact Belimo

Bit 5: Actuator too much current

Firmware Version 1.x	Firmware Version 2.x
Not supported	– Actuator broken – Short circuit

Recommended Action: – Replace the actuator

Bit 6: BAT triggered

Firmware Version 1.x	Firmware Version 2.x
– Local connected BAE / BAT triggered	– **Temperature sensor** (BAT) on actuator triggered – Actuator / end switches not connected

Recommended Action: – Replace BAE / BAT in case it is broken due to high temperature / fire
– Check actuator / end switches connection on BKN230-..-MOD

Bit 7: Smoke detector triggered (Firmware Version 1.x und 2.x)
Local connected smoke detector triggered

Recommended Action: – Check the smoke detector

Bit 8: Internal activity (Firmware Version 1.x und 2.x)
Shows if there is a Test run via BACnet / Modbus active

Modbus register description

Bit 10: Bus monitoring triggered (Firmware Version 1.x und 2.x)

Bus time is up without receiving a command within the set Watchdog time.

Recommended Action: – Check the Modbus communication in general
– Check the cycle time of the periodic writing to Register 2 „override control"
– If necessary, adjust the watchdog time on Register 110 „Communication Watchdog"

Bit 11: Local override control active (Firmware Version 1.x und 2.x)

Local control / bridge connected between terminal 1 and 4.
The actual actuator position can be monitored via Register 5 „Relative position"

Recommended Action: – If local override control should not be used, remove the control / bridge between terminal 1 and 4.

The malfunction bits can be reset with Register 3 (Command value 4).
Bit 4 Safety relevant malfunction cannot be reset.

Register 108: Bus Watchdog countdown

The Bus Watchdog time, set on Register 110, is displayed as countdown
(Time until the control command has to get repeated).
This value allows troubleshooting in case of too short defined Watchdog and cycle times.

Register 109: Bus fail position

The bus monitoring controls the Modbus communication. If the override control (Register 2) is not renewed within 300 seconds, the actuator controls to the bus fail position (closed).
Activating only the bus fail position will set the Bus Watchdog time on register 110 as default to 300s.
Triggered bus monitoring is indicated in Register 105.

Bus fail position	
0	No bus monitoring
1	Rapid close if time is exceeded (factory setting)

Register 110: Bus Watchdog

If the Bus Fail Position is activated on Register 109, default setting is 300s.
The value 0 will disable the Watchdog (Register 109 and Register 110).

Bus Watchdog	
0	Disabled
1...3600 s	Enabled

Firmware history

Version overview

Firmware V2.2	Production date > 2019-03-01	– Override control command „Open" remains in the case of mechanical failure
Firmware V2.01	Production date > 2018-05-01	– Upgrade with BACnet MS/TP – Modbus: Extended with Register 108, 110, power consumption of actuator and additional malfunction and service information.
Firmware V1.10	Production date > 2016-01-01	– Time for bus monitoring increased from 120 to 300 seconds
Firmware V1.09	Production date > 2015-01-01	– More precise monitoring of the of desired position – Increased communication quality – Implemented display of stored malfunction – At stored malfunction (BAE/ORM) the actuator rest in safety position – Damper test works in local override control mode
Firmware V1.05	Production date > 2013-04-01	– Release without restrictions

Dimensions [mm]

Dimensional drawings

153

54

5

140

130

45

4.5

88

43