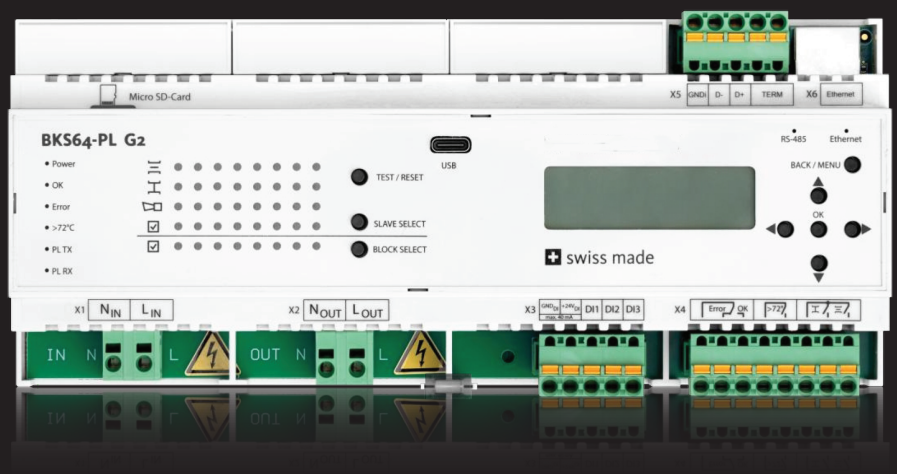
BKS16/64-PL G2

Master unit
Powerline communication



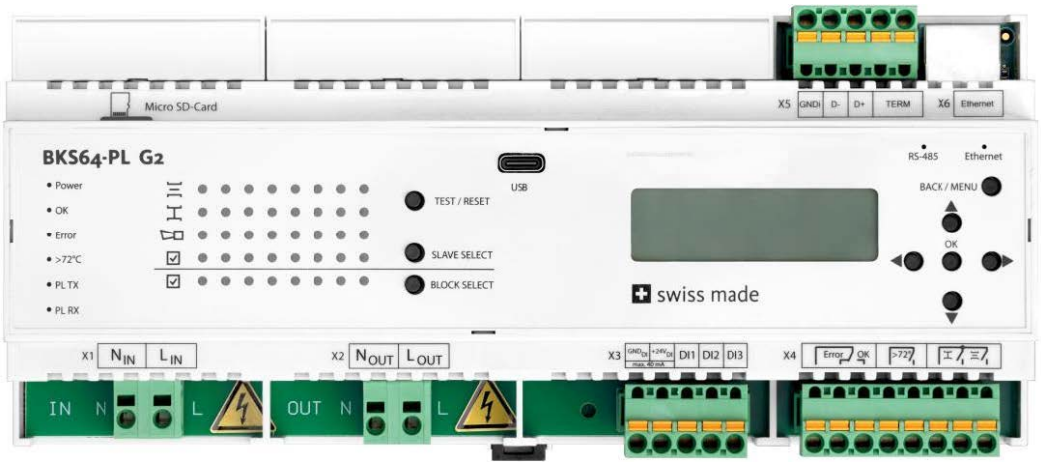
Datasheet

Powerline → BKSXX-PL (G2) (master for 16/64 slaves)

BKS16-PL G2 / BKS64-PL G2

Technical datasheet

Digital communication and control unit for control and secure monitoring of up to 16 or 64 motorized fire dampers, VAVs and other dampers/valves including sensors in technical systems.



Primary features

+ **Master for up to 16 / 64 BKN230-24-PL and VKN230-24-PL* units**
+ 230VAC **Powerline** communication on field side
+ Filters included. More than 100 dB attenuation @ 100kHz against power mains
+ Topology: Free
+ Max. distance between master and slave: 1200 m
+ Automatic detection of slaves due to unique MAC address
+ Automatic or manual assignment of slave addresses (Bus ID, 1..64)
+ Addressing via QR codes and Addressing Sheet
+ Display of damper / valve positions (incl. angle**)
+ Button on device for slave function check
+ Conventional actuation via optically isolated control inputs
+ Relay outputs for enabling ventilation
+ Optional control and monitoring via
  Modbus RTU (RS-485) or **Modbus TCP/IP (Ethernet)**
  BACnet MS/TP or **BACnet IP**
+ Optional monitoring on external computer or on control cabinet touch screen (TCP/IP communication)
+ USB interface and **CDU software** for simple configuration and diagnostics at on-site computer
+ Event logging

* The datasheets for the BKN230-24-PL and VKN230-24-PL are provided separately. Since two actuators are connected to each VKN230-24-PL, a maximum of 8 or 32 VKN230-24-PLs can be connected to one master.
**only for Belimo Top-Line actuators or actuators connected to a VKN230-24-PL

1 CONTENTS

2 SUMMARY

The **BKS64-PL G2** is a 64-way master for BKN230-24-PL / VKN230-24-PL units. It is a control and display device for motorized fire dampers, VAV dampers and other dampers/valves[1]. Powerline communication with the devices takes place directly via the devices' 230 VAC power lines.

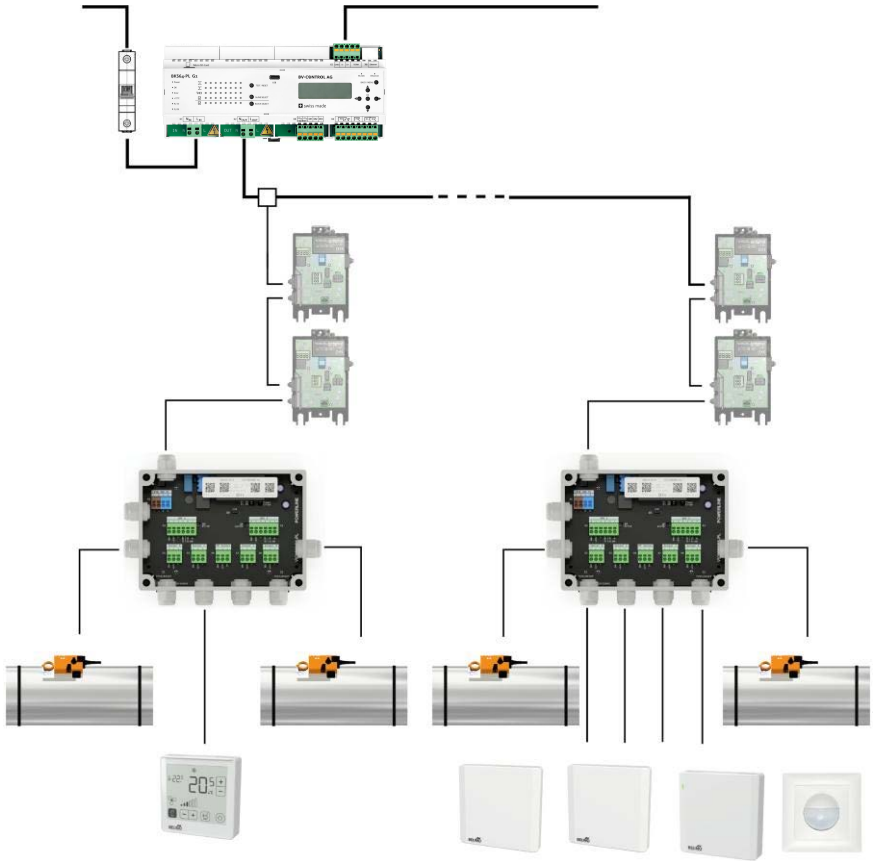
The **BKS16-PL G2** is designed for smaller systems with up to 16 slaves; its functionality and connections are identical to the BKS64-PL G2.

The G2 versions support the VKN230-24-PL modules, and thus also VAV dampers and other dampers/valves with sensors.

The powerline slaves have a unique physical MAC address and are therefore automatically recognized, regardless of pre-addressing[2]. Addressing, which primarily serves for spatial assignment, can be performed directly on the device before installation or later during commissioning, automatically or selectively.

The damper/valve positions and any faults are displayed directly on the device. Slaves can be selected and tested at the touch of a button. The dampers/valves can be opened or closed using a potential-free contact or +24 VAC/DC external voltage.

The master can also be controlled via MODBUS (TCP/IP and RTU) or BACnet (IP or MS/TP), thus also serving as a Modbus/Powerline or BACnet/Powerline **gateway**.



[1] The supported actuators are described in the datasheet of the VKN230-24-PL

[2] Pre-addressing described in the datasheet of the BKN230-24-PL

3 SAFETY INSTRUCTIONS

The device is designed for use in stationary heating, ventilation and air conditioning systems and may not be used for applications outside the specified area of use.

Installation and connection of the 230VAC power supply must be carried out by a qualified electrical fitter. All statutory and official directives must be observed.

DANGER

Electric shock in the event of contact with 230 VAC lines

Wiring may only be carried out when the system is disconnected from the power supply!

The device may not be disposed of as domestic waste.

4 TECHNICAL DATA

Electrical data	Rated voltage	**230 VAC 50/60Hz**
	Power consumption Dimensioning	8 W 120 VA+ N x $S_{slave+actuator}$
	Connections	230VAC power supply: Spring terminals 230VAC Powerline: Spring terminals Otherwise: plug-in spring terminals
	Relay load	0.5A @ 48VAC ; 1A @ 24VDC
	Inputs Auxiliary voltage	Type: Optical coupler 6mA @ 24 VDC (common reference point) +24VDC @ max. 40 mA, galvanically isolated
	USB interface	USB-C, galvanically isolated
Powerline communication	Frequencies	Frequency 1: 80 kHz … 167 kHz Frequency 2: 110 kHz … 197 kHz See table in section 7.1
	Modulation type	PSK
	Baud rate	Max. 28.8 kbps
	Receiving sensitivity	Max. 36 dBµV
	Number of slaves	Max. 16 (BKS16-PL) / 64 (BKS64-PL)
	Max. range of master to BKN with TT Installation cables	Line: 1200 m Otherwise: max. 1200 m END to END
	Typical cycle time with 64 slaves	2.6 s … 6.4 s
Powerline Filter	Attenuation	>100 dB @ 100 kHz
Modbus RTU BACnet MS/TP	Medium	RS-485, galvanically **isolated**
(Default)	Transmission formats	1-8-N-2**,** 1-8-N-1, **1-8-E-1** and 1-8-O-1 (start bit, data bits, parity, stop bits)
	Baud rates	9600, 19200, **38400,** 57600, 76800 Bd
	Addresses	Modbus 1…247 (0 reserved for broadcast) BACnet 0…127
	Termination	150 Ω connectible by wire bridge
	Typical response time	< **10 ms** (delay can be added)
	Parameterization	Via CDU (configuration and diagnostics tool) or device menu
Modbus TCP/IP BACnet IP	IP address assignment	**Static** or DHCP **Default: 10.0.0.2**
	Configuration	Via CDU software or device menu
Safety	Protection class	**II**
	EMC Low Voltage Directive	CE according to 2014/30/EU CE according to 2014/35/EU
	Mode of operation	Type 1 (EN 60730-1)
	Ambient temperature	-30° … +50°C
	Storage temperature	-30° … +80°C
	Humidity test	95% rel. H., non condensing (EN 60730-1)
	Maintenance	Maintenance-free
Mechanical data	Dimensions	Installation width 212.1 mm Height 94 mm Depth 58 mm
	Weight	approx. 465 g
	Installation	on 35 mm DIN rail

5 LIMITATIONS AND INSTRUCTIONS

The device has an internal filter which blocks mains interference signals and Powerline signals to the mains. Parallel operation with several masters is thereby possible without additional filters. However, since Powerline signals can also be transmitted to adjacent systems via inductive or capacitive lines, different communication channels must be used on the different masters.

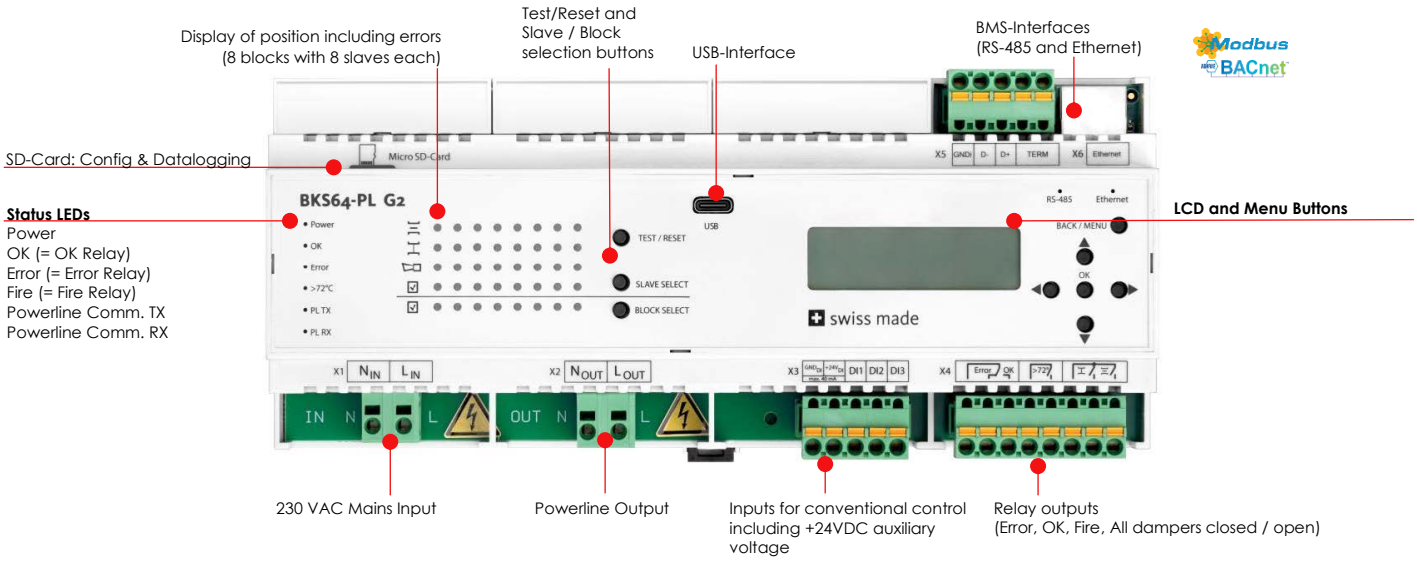
If possible do not route the 230VAC Powerline cables immediately parallel to lines to devices which could cause major interference e.g. inverters. If this cannot be avoided, switching channels can remedy any interference.

The master has an internal 10A fine-wire fuse, which also interrupts the powerline output in the event of a short circuit. However, a **circuit breaker** must be installed upstream from the master as line protection.

With an inrush current limiter installed downstream of the circuit breaker (e.g., type ICL-16R), the line protection can be optimally designed and problems with the startup behavior can be avoided.

The master's 230VAC line with Powerline Signal (L_{Out}, N_{Out}) may not be used for third party slaves.

6 OVERVIEW OF DEVICE



7 CHARACTERISTICS AND FUNCTIONS

7.1 POWERLINE COMMUNICATION

Communication with slaves is via digital phase modulation (phase-shift keying) simultaneously on two frequencies. Depending on the connection quality, for each individual BKN the master can automatically select between different PSK types (B-PSK, Q-PSK, 8-PSK). In addition, if connections are subject to strong interference, communication can only take place in the zero crossing phase.

The two communication frequencies are defined by the communication channel according to the following table:

Channel	Frequency 1 [kHz]	Frequency 2 [kHz]
1	80	110
2	83	113
3	86	116
4	89	119
5	92	122
6	95	125
7	98	128
8	101	131
9	104	134
10	107	137
11	140	170
12	143	173
13	146	176
14	149	179
15	152	182
16	155	185
17	158	188
18	161	191
19	164	194
20	167	197

A Power Cycle must be carried out after changing channels.
The channel is automatically transmitted to the connected slaves at system restart.

7.2 RESPONSE TIMES & BUS MONITORING

A query to the BKN230-24-PL lasts, depending on the type of PSK modulation, between 40 ms and 100 ms, so **with 64 slaves** a typical cycle time is between 2.6s and 6.4s[3]. This cycle time is displayed on the LCD of the master.

If a slave receives no control signal from the master during the pre-set BUS timeout, the following action is performed:

BKN (Fire Protection): The actuator travels to the safety position.

BKN (Smoke Extraction): The bus timeout is disabled because both damper positions can be safety positions.

VKN: If a bus fail position is set, the actuator travels to that position.

[3] Communication with VKN slaves is slower, with 64 VKN slaves the typical cycle time is between 3.2s and 14.4s

8 OPERATION

The device can be configured and operated directly via the integrated display and the buttons.

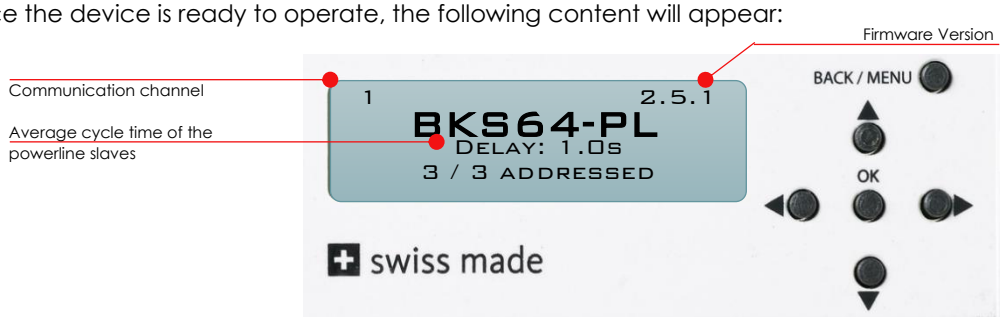
8.1 SLAVE MENU

The most important operating parameters can be set via the menu:

Main menu	Function / sub-menu	Characteristic	Range of values / options	Operation
Addressing				
	Rescan		No, Yes	◄► , Power Cycle
	Auto			
	Manual		- , 1…64	Digits: ◄► Numerical value▼▲
	Clear All		No, Yes	
	Clear Selected			
	Back			
Settings				
	Slaves			
		Application	**Fire Protection** Smoke Control	▼▲
		Max Time to Open [s]	30...600	Digits: ◄► Numerical value▼▲
		Max Time to Open 15 Degrees [s]	5…600	Digits: ◄► Numerical value▼▲
		Max Time to Close [s]	10…600	Digits: ◄► Numerical value▼▲
		Auto Test Wait [s]	1…255	Digits: ◄► Numerical value▼▲
		Communication Timeout	5…255	Digits: ◄► Numerical value▼▲
		Max Power [W]	10…30	Digits: ◄► Numerical value▼▲
		Resolved Error Behavior	Normal Operation Stay Closed	▼▲
		Max Identify Time [min]	1…255	Digits: ◄► Numerical value▼▲
		Back		
	Control			
		Interface	BACnet IP BACnet MSTP **Modbus TCP/IP** Modbus RTU None	▼▲
		Bus Watchdog	On Off	▼▲
		Back		
	Network			
		IP Mode	DHCP STATIC	▼▲
		IP	0.0.0.0 - 255.255.255.255	Digits: ◄► Numerical value▼▲
		MASK	0.0.0.0 - 255.255.255.255	Digits: ◄► Numerical value▼▲
		Gateway	0.0.0.0 - 255.255.255.255	Digits: ◄► Numerical value▼▲
		MAC **(read only)**	AA:AA:AA:AA:AA:AA	
		Telnet	On Off	▼▲
		Back		
	RS-485			
		ID	Mode: 1…247 BACnet: 0…127	Digits: ◄► Numerical value▼▲
		Baud Rate	9600 19200 38400 57600 76800	▼▲
		Parity	Even Odd None	▼▲
		Stop Bits	1 2	▼▲
		Delay	0…255	Digits: ◄► Numerical value▼▲
		Back		
	BACnet			
		Device ID	1...4 194302	Digits: ◄► Numerical value▼▲
		APDU Timeout	1000…60000	Digits: ◄► Numerical value▼▲
		APDU Retries	0…10	Digits: ◄► Numerical value▼▲
		Max Master	1...127	Digits: ◄► Numerical value▼▲
		Max Info Frames	1…255	Digits: ◄► Numerical value▼▲
		Port	0…65535	Digits: ◄► Numerical value▼▲
		Hide Unaddressed Slaves	On / Off	▼▲
		Back		
	Powerline			
		TX Gain	0...31	▼▲, Power Cycle
		Channel	0…20	▼▲, Power Cycle
	Date Time			
		Time Zone	+0, +1, +2, +3	▼▲
		Daylight Saving	Auto, Off	▼▲
		Set Date Time	1.1.2000 00:00:00 – 31.12.2100 23:59:59	Digits: ◄► Numerical value▼▲
		Back		
	Save & Restart			
	Revert Changes			
	Back			
Reset to Factory Defaults			No, Yes	◄►
Restart Device			No, Yes	◄►
Force Slave Update			No, Yes	◄► , Power Cycle
Reset Password				
Back				

To activate changed settings, you need to save (Save & Restart) and carry out a Power Cycle depending on the setting.

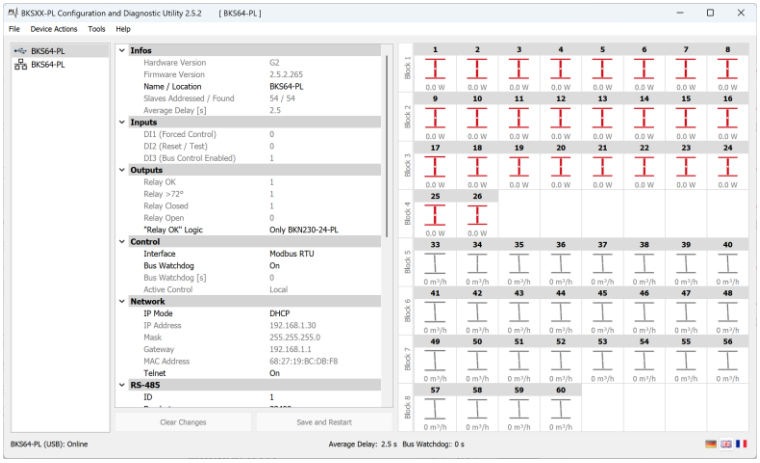
Once the device is ready to operate, the following content will appear:



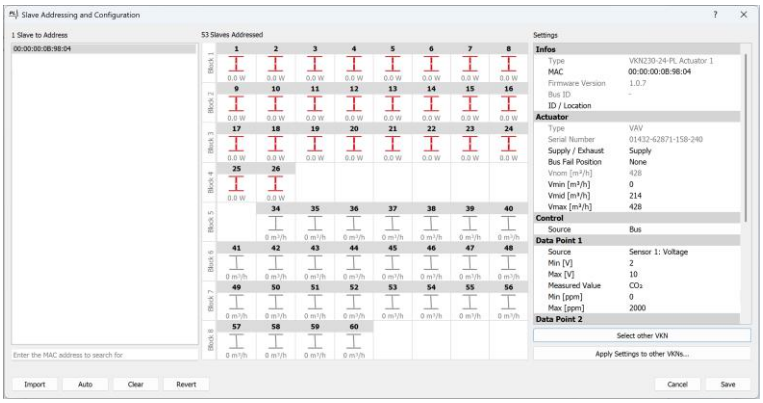
The menu locks automatically after a certain time. Press (> 3 s) the **BACK / MENU** button to unlock.

8.2 CONFIGURATION AND DIAGNOSTIC SOFTWARE (CDU)

The device is easily configured with the CDU. It offers an overview of the hardware inputs and outputs and displays the Powerline slaves and their status.



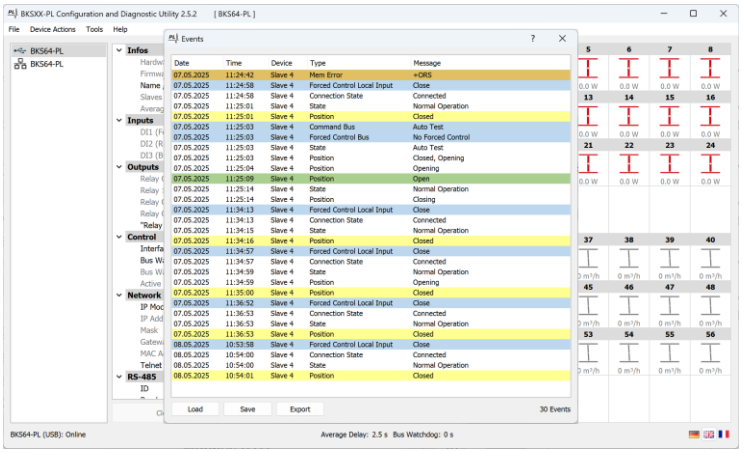
The most important function is the selective slave addressing and configuration. It can be retrieved via **Tools -> Slave Addressing and Configuration...**



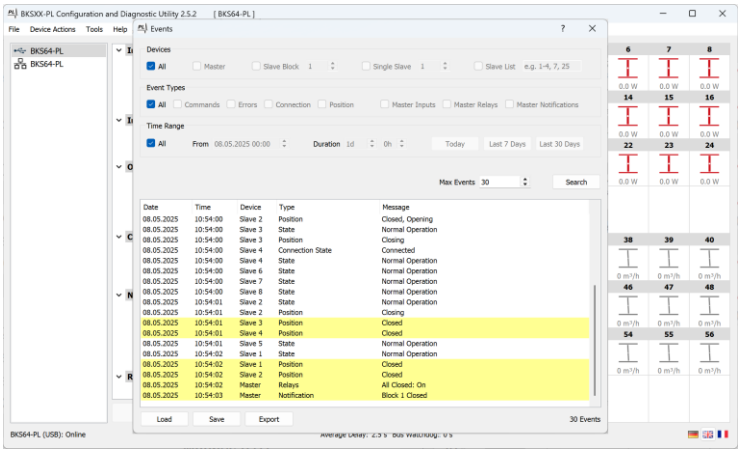
Slaves which have been found but not yet addressed are displayed in the list on the left. Pressing the Test button on a slave selects the corresponding MAC address. The slaves can be set to the corresponding address via **Drag and Drop**. In the alternative automatic process, the BUS IDs are assigned ascending corresponding to the MAC address.

Addressing can also take place directly at the device. (See section 8.4 and 8.5)

All events are logged to the SD-card. The data can be visualized directly on the device or in the CDU. With a double click on the master in the list or a slave in the matrix, corresponding history will directly show up.



The Events dialog (**Tools -> Events...**) allows to filter the events by device, event type and time range.



The Data can be exported to a CSV or PDF File and can be used to show that the commission was successful.

BKS64-PL Event Report

Date: 24.09.2018
Time: 11:58:03
Master (IP / MAC): BKS64-PL (192.168.1.30 / 00:04:A3:44:32:F1)
Application: Fire Protection

Devices: All
Event Types: All
Time Range: Last 30 Events
Number of Events: 30

Date	Time	Device	Type	Message
24.09.2018	11:41:34	Slave 1	Command Local Input	Open
24.09.2018	11:41:34	Slave 58	Command Local Input	Open
24.09.2018	11:41:34	Slave 6	Position	Closed, Opening
24.09.2018	11:41:34	Slave 1	Position	Closed, Opening
24.09.2018	11:41:35	Slave 64	Position	Closed, Opening
24.09.2018	11:41:35	Master	Digital Inputs	Forced Control: Off
24.09.2018	11:41:35	Slave 64	Command Local Input	Close
24.09.2018	11:41:35	Slave 6	Command Local Input	Close
24.09.2018	11:41:35	Slave 1	Command Local Input	Close
24.09.2018	11:41:35	Slave 58	Command Local Input	Close
24.09.2018	11:41:35	Master	Digital Inputs	Forced Control: On
24.09.2018	11:41:35	Slave 64	Command Local Input	Open
24.09.2018	11:41:35	Slave 6	Command Local Input	Open
24.09.2018	11:41:35	Slave 1	Command Local Input	Open
24.09.2018	11:41:35	Slave 58	Command Local Input	Open
24.09.2018	11:41:36	Slave 58	Position	Closed, Opening
24.09.2018	11:41:38	Slave 6	Position	Opening
24.09.2018	11:41:39	Slave 1	Position	Opening
24.09.2018	11:41:39	Master	Relays	All Closed: Off
24.09.2018	11:41:39	Slave 64	Position	Opening
24.09.2018	11:41:39	Master	Notification	Block 1 not Closed
24.09.2018	11:41:39	Master	Notification	Block 8 not Closed
24.09.2018	11:41:40	Slave 58	Position	Opening
24.09.2018	11:42:03	Slave 6	Position	Open
24.09.2018	11:42:03	Slave 1	Position	Open
24.09.2018	11:42:03	Slave 64	Position	Open
24.09.2018	11:42:03	Master	Notification	Block 1 Open
24.09.2018	11:42:04	Master	Notification	Block 8 Open
24.09.2018	11:42:04	Slave 58	Position	Open
24.09.2018	11:42:04	Master	Relays	All Open: On

8.3 INITIAL COMMISSIONING

Each powerline slave has its own unique MAC address. Addressing assigns a **Bus ID** between 1 and 64 to the MAC address. Using the Bus ID, the device can be addressed via Modbus/BACnet. Typically, each device is also assigned an ID/location. This ID serves as identification and usually contains the device's location.

Example project with 3 fire dampers

08.03.2018

BUS-ID	ID	MAC Address
1	HB_VW03_U04_TL001_F01	00:04:A3:44:3A:36
2	HB_VW03_U04_TL001_F02	00:04:a3:42:DA:28
3	HB_VW03_U04_TL001_F03	00:04:a3:42:DA:7D

For easy commissioning, we recommend following the following procedure:

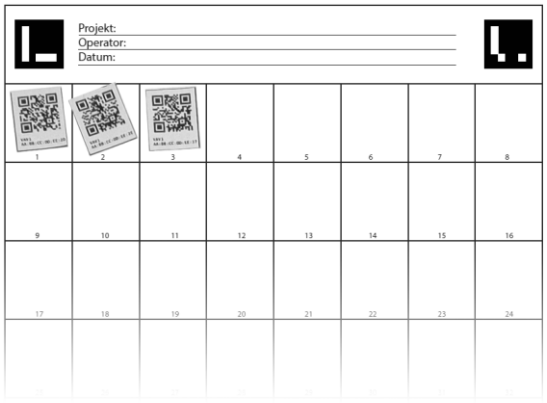
1) During planning, create a list that specifies which Bus ID should be located at which location (ID). Create this list in a text file (*.txt); you will need this file again during commissioning. The list must be written in the following format:

Bus ID [Tab] ID/Location

Example:

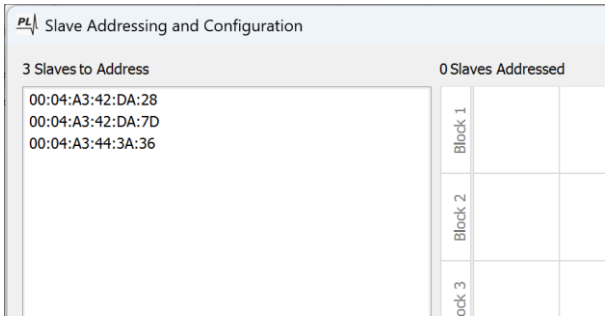
1 HB_VW03_U04_TL001_F01
2 HB_VW03_U04_TL001_F02
3 HB_VW03_U04_TL001_F03

2) When installing the slaves, stick the QR codes in the correct position on the Addressing Sheet (the numbers on the Addressing Sheet correspond to the bus IDs)



Afterwards, take a photo of the address sheet and save it on your laptop.

3) Once the electrical installation of the slaves and the master is complete, you can start a Rescan on the master via the CDU. Once the correct number of slaves has been found, click on **Slave Addressing and Configuration…** You will now see the MAC addresses of the unaddressed slaves in the left column.



4) Click **Import** and select the photo from step 2). The Addressing Sheet will be converted into an addressing list, which you can save if needed. The slaves are now addressed.

5) Click on **Import** again and select the list from point 1) to add the ID/Location to the addressed slaves

6) Save the changes and then confirm that all slaves have been correctly found and addressed.

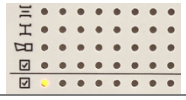
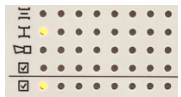
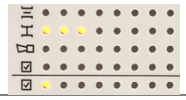
For small systems or for correction purposes, you can also perform the addressing manually. You can simply drag the found slaves into the visualization matrix to assign the Bus IDs:

There are two ways to manually identify slaves:

- ➔ Select a non-addressed slave in the list or a slave in the matrix and the blue LED of the slave flashes
- ➔ Press the test button on the slave itself and the slave will be selected in the CDU

8.3.1 Commissioning with direct addressing on the master

The following commissioning process need only be carried out once.

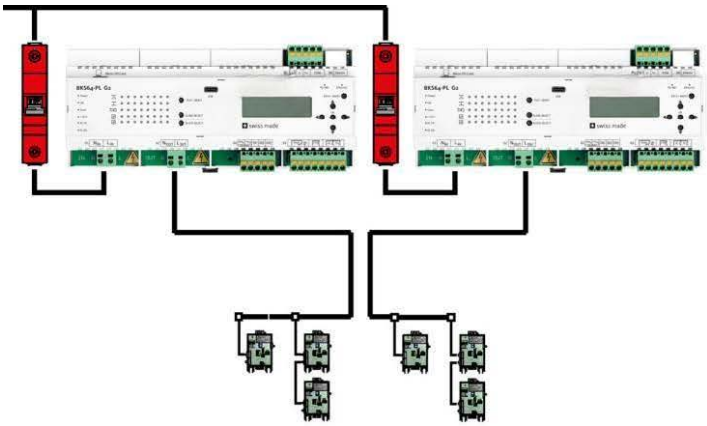
Step	Display	Operation	LED matrix
1	0 BKS64-PL 2.5.1 Press ▶ to scan for Slaves	Start scan ▶	Only addressed slaves are displayed on the matrix
2	Channel 6 (default)	Select channel ▼▲, **OK**	
3	Power Cycle 1) Power Off 2) Wait 10 s 3) Power On	Switch off device via circuit breaker	
4		Wait 10 seconds Switch on device again	
	6 BKS64-PL 2.5.1 Init Powerline Setup		
	6 BKS64-PL 2.5.1 Init Check for Slave Update	Slaves with outdated firmware are updated	
	6 BKS64-PL 2.5.1 Init Scanning...	Scans for slaves	
5	Found 3 Slaves All Slaves Found ◀ No (Rescan) Yes ▶	▶ When all slaves are found ◀ Repeat search (back to **step 2**)	
6	Select Addressing Method ◀ Manual Auto▶	◀ Manual addressing or ▶ automatic addressing (continue to **step 11**)	
7	Manual 1/4 00:04:a3:44:3A:36 - 00:04:a3:44:DA:28 - 00:04:a3:44:DA:7D -	Select MAC address ▼▲, **OK**	
8	00:04:a3:44:DA:28 1	Set Address (Bus ID) Digits: ◀▶ Numerical value: ▼▲ **OK**	
9	Manual 1/4 00:04:a3:44:3A:36 3 00:04:a3:44:DA:28 1 00:04:a3:44:DA:7D 2	Repeat steps 7 and 8 until all slaves have been addressed and click **BACK** to end	
10	ALL Slaves Correctly Addressed? ◀ No Yes ▶	▶ confirm that all slaves have been addressed or ◀ back to **step 9**	
11	6 BKS64-PL 2.5.1 Delay: 1.0 s 3 / 3 addressed	Commissioning complete	

8.4 COMMISSIONING WITH MULTIPLE MASTERS

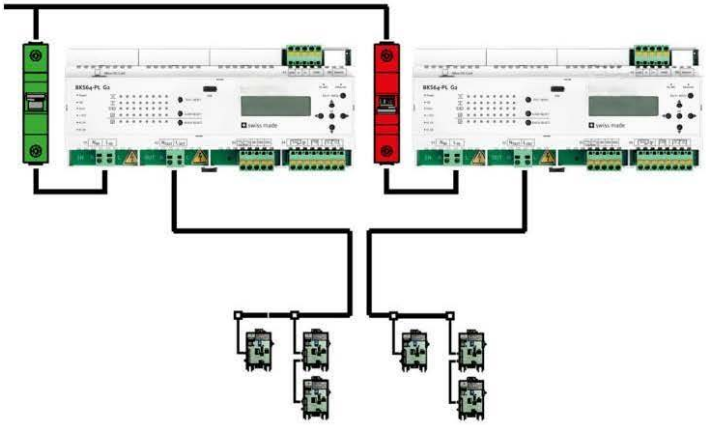
In a system in which the Powerline cables from different masters are routed immediately in parallel, **different channels must be set** because the signals can couple by capacitive or inductive means to those of other systems. **The Powerline commissioning must only take place simultaneously on one master. All masters must be fused separately in order to be able to commission them in turn.** Once commissioning is complete, simultaneous start-ups, e.g. after a power failure, are not a problem.

Method:

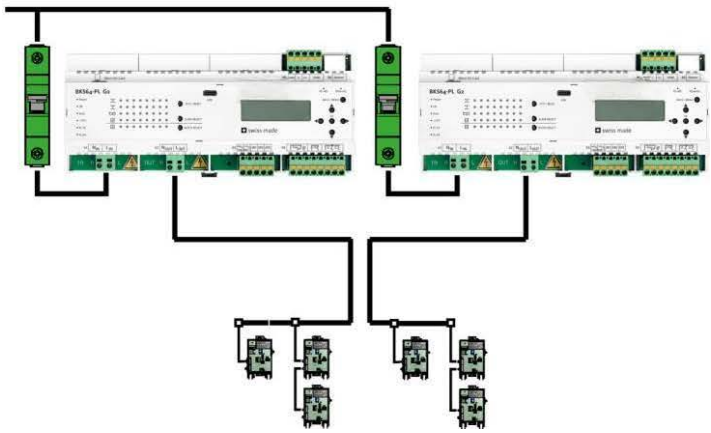
1. Switch off both masters



2. Switch on power to first master and commission Powerline with **standard channel 6**



3. Switch on power to second master and commission Powerline with **another channel**.



8.5 MAINTENANCE

8.5.1 Replacing actuators

BKN:
Smoke extraction and fire protection actuators can be replaced during operation. Errors that occur during this process can be acknowledged afterwards. If a Top-Line actuator is replaced with a conventional actuator, the BKN must be restarted (briefly disconnect the power; after restarting, the BKN needs approximately 30 seconds to resume operation).

VKN:
VKN actuators can be replaced during operation. If the new actuator is of the same type (e.g., a VAV is replaced with a new VAV), the saved configuration of the old actuator is applied to the new one. Errors that occur during this process can be acknowledged afterwards.

Note: If the settings of an actuator are changed (e.g., via NFC) without replacing the actuator, these settings are adopted and the VKN forwards them to the master.

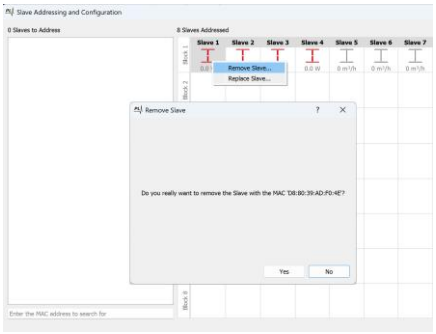
8.5.2 Replace slaves

Slaves are usually removed, replaced, or added while the system is de-energized. After modifying the system, a new Rescan must be initiated, and the addresses reset if necessary. The addresses of the untouched slaves are retained.

Slaves can also be removed, replaced, or added while the system is running, if necessary. The following chapters explain the process for the various modifications.

8.5.2.1 Removing a slave

1. Connect the laptop to the BKSXX-PL master via USB.
2. In the CDU, open the **Tools -> Slave Addressing and Configuration…** dialog. In the matrix, right-click on a slave you want to remove and select **Remove Slave…**
3. Now physically remove the slave, if you haven't already done so.

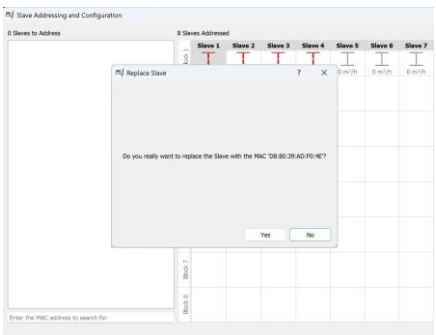


8.5.2.2 Replacing a slave

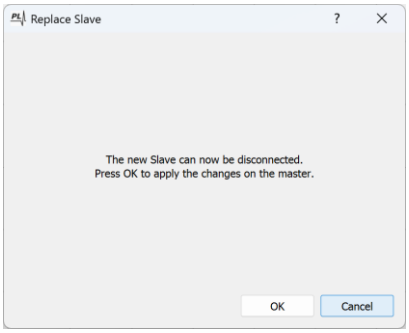
1. Connect the laptop via USB to the BKSXX-PL master and **simultaneously** to the slave that will replace an existing slave. The new slave does not need to be connected to the powerline power cable yet; it can also be powered separately.
   (The connection between the laptop and the BKSXX-PL master can also be established via ethernet)

2. In the CDU, open the **Tools -> Slave Addressing and Configuration…** dialog and, in the matrix, right-click on the slave that is to be replaced and select **Replace Slave…**

   If necessary, the new slave will now be automatically updated and the configuration will be applied to the slave.



3. The slave can now be installed at the correct location.



4. When you click OK in the next dialog, the configuration will also be saved on the master and the slave will be replaced.

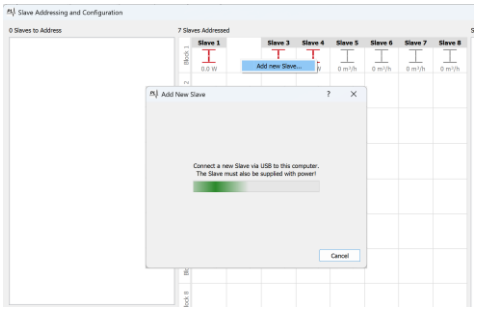
5. Before adding or replacing further slaves, the replaced slave must be removed from the powerline bus.

8.5.2.3 Adding a slave

1. Connect the laptop via USB to the BKSXX-PL Master and **simultaneously** to the slave to be added. The slave does not need to be connected to the powerline power cable yet; it can also be powered separately.
   (The connection between the laptop and the BKSXX-PL master can also be established via ethernet)

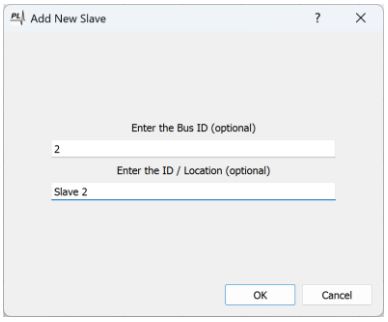
2. In the CDU, open the **Tools -> Slave Addressing and Configuration…** dialog and right-click on an empty field in the matrix and select **Add New Slave…**

   The slave will now be automatically updated if necessary.



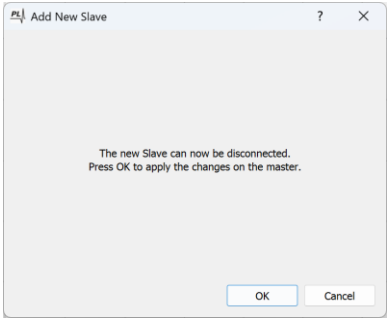
3. You can now enter the Bus ID and the description for the installation location (ID/Location).

   After you click OK, the configuration is saved on the slave.



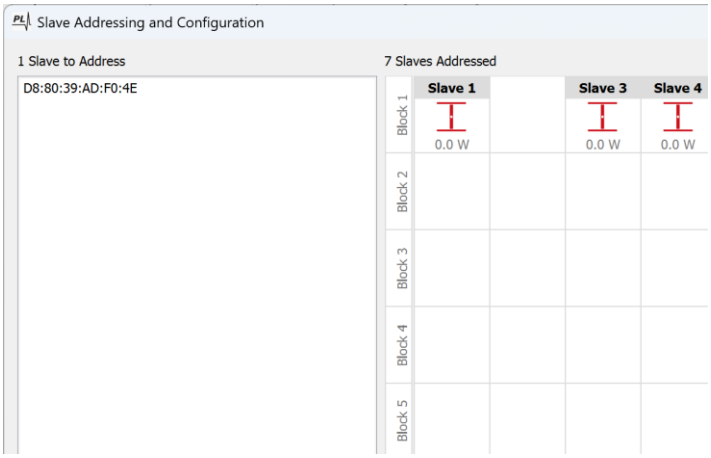
4. The slave should now be installed at the correct location and connected to the powerline cable.

5. When you click OK in the next dialog, the configuration is also saved on the master, and the new slave is integrated.



If you do not assign a Bus ID in step 3, the slave will remain on the left side of the list, will not affect the relay logic, and will not yet be mapped to the Modbus registers or BACnet objects.

Once the slave is finally installed and connected to the powerline supply line, you can drag the slave from the list to the corresponding Bus ID, and it will be integrated.



8.5.3 Replacing a master

If the master needs to be replaced, the SD card from the old master can be inserted into the new one to transfer all settings. The new master must be designed for the same number of slaves as the old one. The new master does not require a Rescan after electrical installation and is immediately ready for operation. If the new master is of the same generation (e.g., both devices are BKS64-PL **G2**), the firmware from the old device will also be installed on the new master.

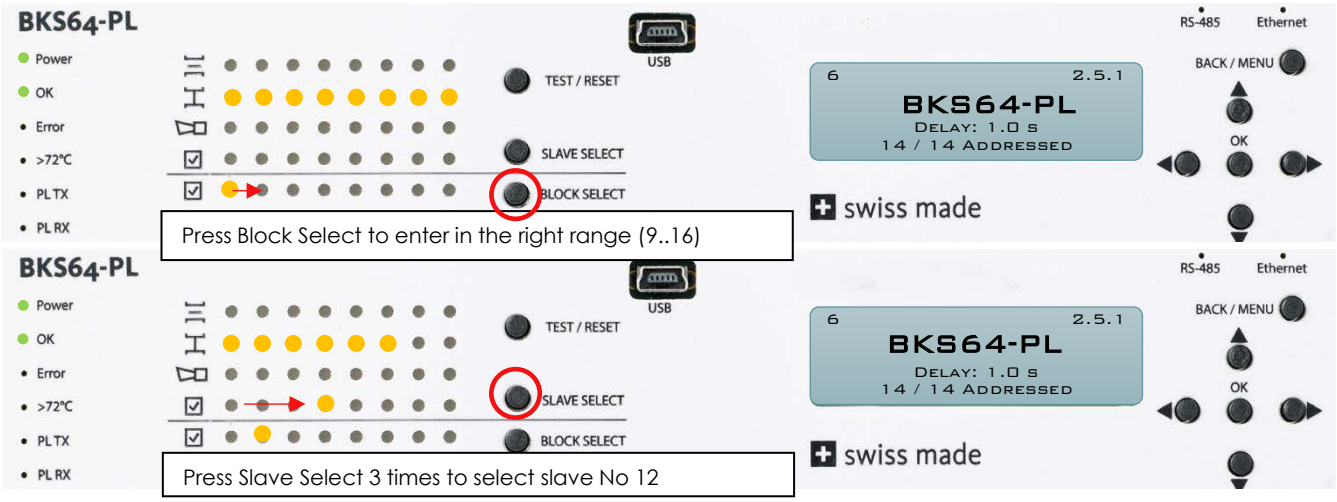
If the SD card of the old master is missing or defective, the settings can also be restored to the new master by importing them via the CDU. It is therefore recommended to export the settings with the CDU after commissioning and store them securely.

The settings for the individual slaves (Bus ID, ID/Location, etc.) are stored on the slaves themselves. If neither an SD card nor an export is available, these settings are still saved and will be available again after a Rescan.

8.6 SLAVE TESTS AND STATUS DISPLAY

To test a specific slave, it must first be selected via **Block Select** and **Slave Select**.

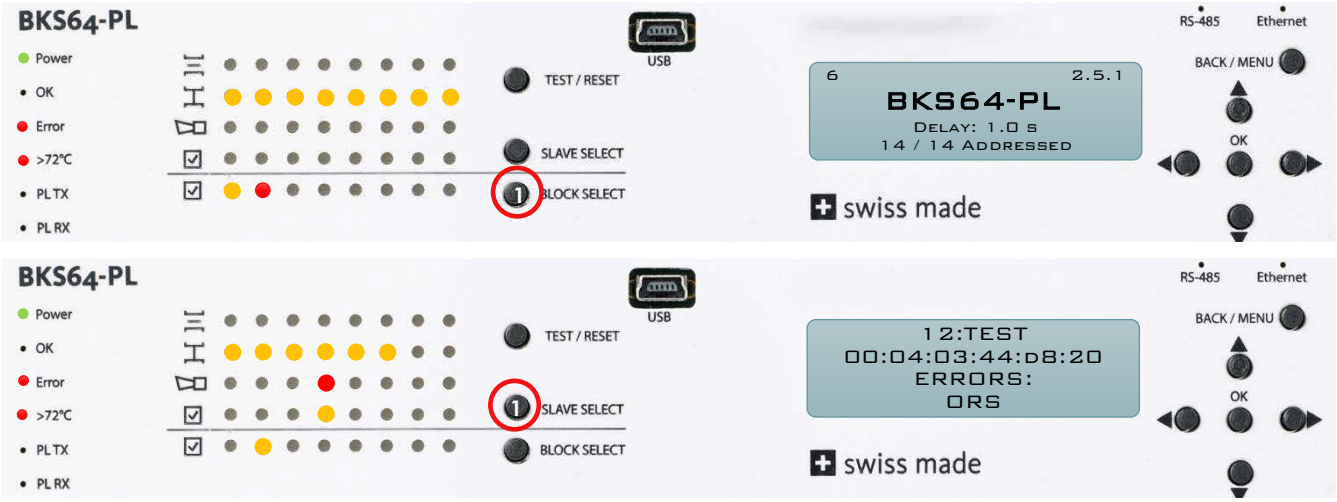
Example: Test slave with Bus ID 12



When a slave is selected, its status incl. power consumption is described on the LCD display. Press **TEST/RESET** to reset errors or start an automatic test run.

If a slave has an error, this is signalled with the corresponding LED. If a slave with an error is not in the currently selected block, the corresponding block flashes red. To determine the error, navigate to the corresponding block and select the corresponding slave.

Example: Smoke alarm triggered on slave 12



9 TERMINAL CONFIGURATION, INPUTS AND OUTPUTS

X1 Power supply

Spring terminal for 230 VAC 2 x 2.5 mm² installation cable

X1.1 Neutral conductor (N)
X1.2 Phase conductor (L)

(internal fuse:10A, slow-blow)

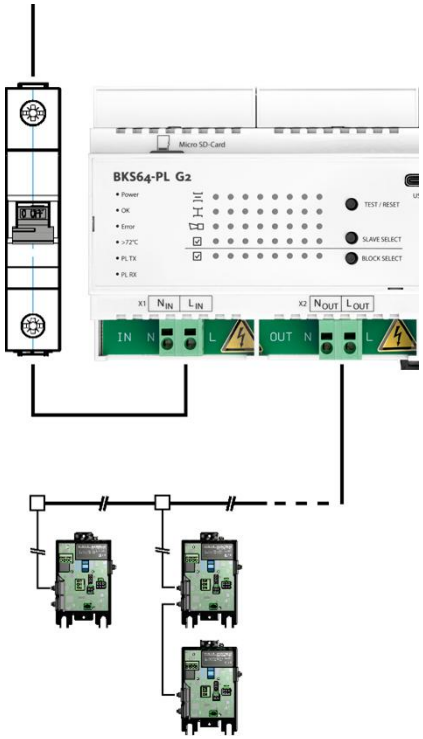
X2 Powerline output

Spring terminal for 230 VAC installation cable

X1.1 Neutral conductor (N)
X1.2 Phase conductor (L)

Cross section
1.5 mm² if less than 32 slaves
2.5 mm² if 32 or more slaves

Connect optional shield to earth only at the master end.



Note:
Poorly connected 230 VAC cables can greatly affect the communication and destroy master or slaves.

X3 Auxiliary voltage (electrically isolated) and optocoupler inputs

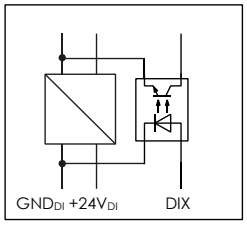
X3.1 GND_{DI} (common GND)

X3.2 $+24V_{DI}$ (max. load: 40 mA)
(use only for own inputs DI1 to DI3)

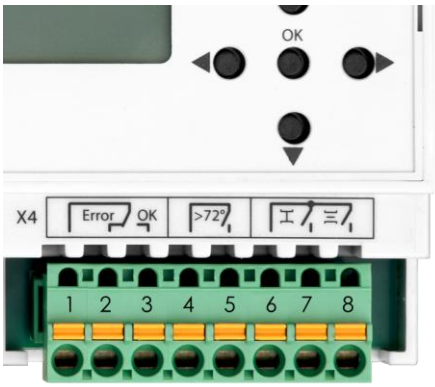
X3.3 DI1, damper / valve control
+24 VAC/VDC: Open *dampers/valves*
0V or open: Close *dampers/valves*

X3.4 DI2, Test/Reset
+24 VAC/VDC:
- Reset errors
*- **BKN:** Reverse damper position*
*- **VKN:** Dampers/valves travel to the Max/V_{Max} position. If DI1 is also active, the dampers/valves travel to the Min/V_{Min} position.*

X3.5 DI3, bus enable
+24 VAC/VDC:
Control via bus enabled and prioritised
DI1/DI2 ignored
0V or open:
Actuation only possible via DI1/DI2,
BUS control commands are ignored,
BUS monitoring possible



X4 Relay outputs



Operating relay (changeover)
X4.1 COM
X4.2 NC Collective fault
X4.3 NO Everything OK (system on)

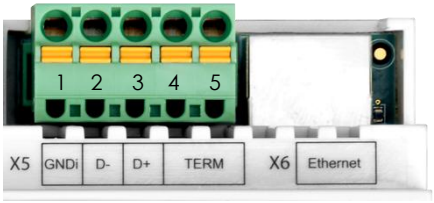
Fire alarm relay (thermoelectric tripping device or smoke detector)
X4.4 COM
X4.5 NC

Damper position (2 x NO)
X4.6 COM
X4.7 NO damper closed
X4.8 NO damper open

1	2	3	4	5	6	7	8
Collective fault			Smoke detector / thermoelectric tripping device		Damper position		
COM	Fault	No fault	>72°		COM	CLOSED	OPEN
Changeover			NC		2 x NO		
1 and 2 connected: Error or device disconnected from power **1 and 3** connected: No fault			**4 and 5** connected: Smoke detector on BKN and thermoelectric tripping device at actuator OK **4 and 5** open: Smoke detector on BKN or thermoelectric tripping device at actuator triggered		**6 and 7** connected: All dampers (BKN only) closed **6 and 8** connected: All dampers (BKN only) open Device disconnected from power: Contacts open		

X5 RS-485 (3-wire, isolated)

X5.1 GNDi (isolated GND) (**earthed at master end**)
X5.2 D-
X5.3 D+
X5.4 Terminating resistor 1
X5.5 Terminating resistor 2 (bridge to X5.4 for terminating resistor)



Supported protocols: Modbus RTU and BACnet MS/TP

The interface parameters (baud rate, number of start and stop bits and parity) and the address are defined with the configuration tool or via the menu.

X6 Ethernet

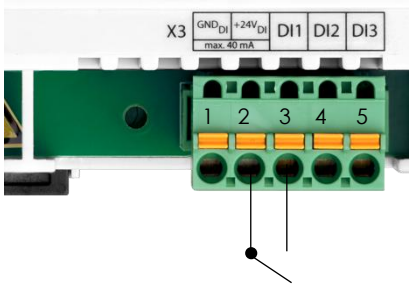
The IP address can be obtained automatically via DHCP or assigned statically. This setting takes place via the configuration tool or the menu.

Supported protocols: Modbus TCP/IP and BACnet IP

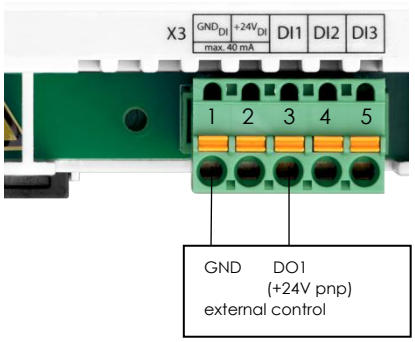
10 CONTROL

10.1 CONVENTIONAL CONTROL

The command to open or close all dampers/valves can be given with the digital input DI1 (terminal X3.3). For this purpose, the auxiliary voltage at X3.2 is available. Alternatively, an external power supply (24VAC / +24VDC) can be used.



Control with auxiliary voltage



Control via the logic voltage of an ext. controller

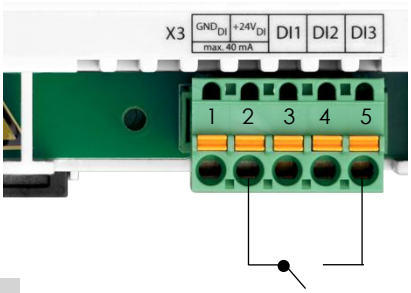
Note (Fire Protection): If you route the control signal (DI1) via the fire alarm relay (X4.4/X4.5), all dampers close when the smoke detector / thermoelectric tripping device of any slave triggers.

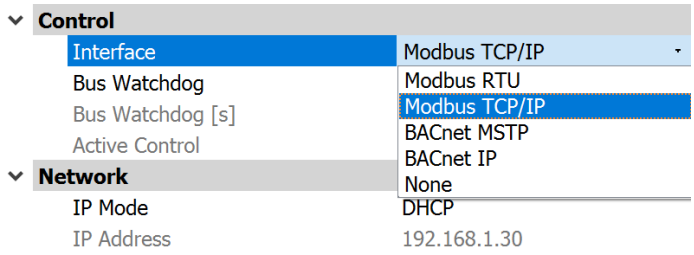
Using the "Resolved Error Behavior" setting, you can also set whether a fire alarm, when no longer active, must be acknowledged (input DI2, RESET button or bus) or **not (default)** for the dampers to open again.

10.2 Bus Control

Bus control can be activated via input DI3. Interruption of the input allows the user to switch to conventional control (for example manual operation). Monitoring via bus is also possible if DI3 is not active.

The different protocols can be selected via the configuration tool or the menu





10.2.1 MODBUS (TCP/IP or RTU)

Once the control interface is set to Modbus TCP/IP or RTU, the registers can be read. To control the slaves, hardware input DI3 must be active. A bus watchdog ensures that the dampers close (BKN, fire protection only) or the dampers/valves travel to the bus fail position (VKN) if no control commands are received within two minutes.

10.2.1.1 Implemented commands

Standard commands	Read Holding Registers [3] Read Input Register [4] (same as Read Holding Register [3]) Write Single Register [6] Write Multiple Registers [16]

Organization of the registers	**Status register and I/O register** Register **no. 1 to 20** (description follows) **Control and status register (compressed mapping)** Register **no. 10,001 to 10,048** (description follows) **Control and status register (mapping for individual slaves)** Register no. **(100 * Bus ID) + 1 to (100 * Bus ID) + 33 (Bus ID: 1..64)**

10.2.1.2 Status and I/O register

No.	Addr.	Name	Description	Read	Write
1	0	Reserved	Reserved	X	
2	1	Bus watchdog	0: Bus watchdog disabled 1: Bus watchdog enabled	X	
3	2	Bus watchdog countdown	120…0 [s] If the bus watchdog is active and the countdown has reached 0, the following action is performed: **BKN:** The forced control for all dampers is set to "No Command" (*Close* for fire protection). **VKN:** If a bus fail position is set, this is sent to the slave as forced control. The forced control (register 102, etc.) and the setpoint (register 120, etc.) are ignored as long as the countdown is at 0.	X	
4	3	Reset bus watchdog countdown	A write command (0 or 1) resets the countdown to 120 seconds	X	X
5	4	Local forced control DI1	0: No voltage at DI1 1: +24V at DI1	X	
6	5	TEST/RESET DI2	0: No voltage at DI2 1: +24V at DI2	X	
7	6	Bus control DI3	0: BUS control not active 1: BUS control active	X	
8	7	-		X	
9	8	-		X	
10	9	-		X	
11	10	-		X	
12	11	Operating relay	0: Error 1: Everything OK	X	
13	12	Fire alarm relay	0: Relay not activated 1: Relay activated	X	
14	13	Relay all dampers closed	1: All addressed dampers are closed (**BKN only**)	X	
15	14	Relay all dampers open	1: All addressed dampers are open (**BKN only**)	X	
16	15	Reset	1: Acknowledge all slave related errors without starting test run[2] (resets the bus countdown)	X	X
17	16	VAV Flow supply air	The total flow of all VAV actuators configured as 'Supply' (**VAV and VRU**)	X	
18	17	VAV Flow exhaust air	The total flow of all VAV actuators configured as 'Exhaust' (**VAV and VRU**)	X	
19	18	VAV position supply air	The maximum position of all VAV actuators configured as 'Supply' (in percent, **VAV and VRU**)	X	
20	19	VAV position exhaust air	The maximum position of all VAV actuators configured as 'Exhaust' (in percent, **VAV and VRU**)	X	

[2] In case of saved mechanical errors, a test run will be executed as well

10.2.1.3 Control and status register (compressed mapping)

No.	Addr.	Name	Affected Powerline Bus IDs	Description	Read	Write
10,001 **10,002** **10,003** **10,004** **10,005** **10,006** **10,007** **10,008**	10,000 10,001 10,002 10,003 10,004 10,005 10,006 10,007	**Forced control**	01 - 08 (Block 1) 09 – 16 (Block 2) 17 – 24 (Block 3) 25 – 32 (Block 4) 33 – 40 (Block 5) 41 – 48 (Block 6) 49 – 56 (Block 7) 57 – 64 (Block 8)	Bit XX: two bits per slave 00 = no command (fire dampers close) 01 = open damper / valve 10 = close damper / valve (11) => 01 (open damper / valve) Value: 01010101b (21845) or value: 11111111b (-1) opens all dampers / valves in the corresponding block	X	X
10,009 **10,010** **10,011** **10,012**	10,008 10,009 10,010 10,011	**TEST/Reset**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 1 = resets saved errors and starts automatic test run (resets the bus watchdog countdown)	X	X
10,013 **10,014** **10,015** **10,016**	10,012 10,013 10,014 10,015	**Active, addressed slave**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Slave not active (Bus ID not used) 1 = Slave active (Bus ID is used)	X	
10,017 **10,018** **10,019** **10,020**	10,016 10,017 10,018 10,019	**Powerline connection status**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = No connection 1 = Connection via Powerline OK	X	
10,021 **10,022** **10,023** **10,024**	10,020 10,021 10,022 10,023	**Initialization**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Slave in operation 1 = Slave in initialization	X	
10,025 **10,026** **10,027** **10,028**	10,024 10,025 10,026 10,027	**TEST mode**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Normal mode 1 = Slave being tested	X	
10,029 **10,030** **10,031** **10,032**	10,028 10,029 10,030 10,031	**Error**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = No error[1] 1 = Error[1]	X	
10,033 **10,034** **10,035** **10,036**	10,032 10,033 10,034 10,035	**Damper / valve position Open**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Damper / valve is not open 1 = Damper / valve is open	X	
10,037 **10,038** **10,039** **10,040**	10,036 10,037 10,038 10,039	**Damper / valve position Closed**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Damper / valve is not closed 1 = Damper / valve is closed	X	
10,041 **10,042** **10,043** **10,044**	10,040 10,041 10,042 10,043	**Damper position Opening (BKN only)**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Damper not opening 1 = Damper opening	X	
10,045 **10,046** **10,047** **10,048**	10,044 10,045 10,046 10,047	**Damper position Closing (BKN only)**	1 - 16 17 - 32 33 – 48 49 -64	Bit X: 0 = Damper not closing 1 = Damper closing	X	

[1] With the device setting „**Normal**“ (Menu→Settings→Slaves→Resolved Error Behavior) only actual errors are signaled, with „**Stay Closed**“ actual and saved errors are signaled

[1] With the device setting „**Normal**“ (Menu→Settings→Slaves→Resolved Error Behavior) only actual errors are signaled, with „**Stay Closed**“ actual and saved errors are signaled

10.2.1.4 Status register (block mapping)

No.	Addr.	Name	Description	Read	Write
10,201	10,200	**Block 1 Error**	0 = No addressed slave in the corresponding block has an error[1] 1 = At least one addressed slave in the corresponding block has an error[1]	X	
10,202	10,201	**Block 2 Error**			
10,203	10,202	**Block 3 Error**			
10,204	10,203	**Block 4 Error**			
10,205	10,204	**Block 5 Error**			
10,206	10,205	**Block 6 Error**			
10,207	10,206	**Block 7 Error**			
10,208	10,207	**Block 8 Error**			
10,209	10,208	**Block 1 Open**	0 = Not all addressed slaves in the corresponding block are open 1 = all addressed slaves in the corresponding block are open	X	
10,210	10,209	**Block 2 Open**			
10,211	10,210	**Block 3 Open**			
10,212	10,211	**Block 4 Open**			
10,213	10,212	**Block 5 Open**			
10,214	10,213	**Block 6 Open**			
10,215	10,214	**Block 7 Open**			
10,216	10,215	**Block 8 Open (BKN only)**			
10,217	10,216	**Block 1 Closed**	0 = Not all addressed slaves in the corresponding block are closed 1 = all addressed slaves in the corresponding block are closed	X	
10,218	10,217	**Block 2 Closed**			
10,219	10,218	**Block 3 Closed**			
10,220	10,219	**Block 4 Closed**			
10,221	10,220	**Block 5 Closed**			
10,222	10,221	**Block 6 Closed**			
10,223	10,222	**Block 7 Closed**			
10,224	10,223	**Block 8 Closed (BKN only)**			

[1] With the device setting „**Normal**“ (Menu→Settings→Slaves→Resolved Error Behavior) only actual errors are signaled, with „**Stay Closed**“ actual and saved errors are signaled

10.2.1.5 Control and status register (mapping for individual slaves)

The information can also be queried individually for each slave. The information about the slave with Powerline Bus ID 1 is in registers 101 to 133 and about the slave with Bus ID 2 in 201 to 233 etc.

E.g. slave with Bus ID 1

No.	Addr.	Name	Description	Read	Write
101	100	Active	0: not active (Bus ID not assigned, register no. 102 – no. 133 are not valid and set to -1) 1: active (corresponding Bus ID is used, register no. 102 – no. 133 are valid)	X	
102	101	Forced control	**BKN230-24-PL**: 0 = None -> Fire protection: Close 1 = Open damper 2 = Close damper **VKN230-24-PL**: 0 = None 1 = Open damper/valve 2 = Close damper/valve 3 = Min 4 = Mid 5 = Max 6 = Stop 7 = 100% / V_{Nom} 8 = Fast Open 9 = Fast Close 10 = Bus Override via relative setpoint (For further details, see register 119, address 118) **VKN**: Depending on the currently connected actuator, not all forced control values are available	X	X
103	102	Command	0 = No command 1 = Reset saved errors and start automatic test run 2 = Range adaption (**VKN only**) 3 = Synchronization (**VKN only**) **VKN**: Depending on the currently connected actuator, not all commands are available	X	X
104	103	Type	1 = common valve or damper actuator 2 = VAV / EPIV 3 = fire protection or smoke extraction		
105	104	Powerline communication	0: not connected (Powerline signal interrupted or error) 1: connected	X	
106	105	Initialization / Status	**BKN**: 1: Device is initializing **VKN**: 1: Device is initializing 2: Range adjustment active 3: Synchronization active 4: Gears disengaged	X	
107	106	Test	1: Device in auto test mode	X	
108	107	Damper/valve position	**Normal BKN actuator:** 0: Damper closed 10,000: Damper open 5,000: Otherwise **Belimo Top-Line actuator / VKN:** 0: 0% open (damper/valve closed) 1,000: 10% open … 10,000: 100% open (damper/valve open)	X	
109	108	Opening	1: The damper opens (when the damper is open 0) **BKN only**	X	

110	109	Closing	1: The damper is closing (when the damper is closed 0) **BKN only**	X
111	110	Power consumption of actuator in mW	Examples: 0: The actuator is using no power 2,000: The actuator is using 2 W 4,800: The actuator is using 4.8 W	X
112	111	Errors	**BKN230-24-PL:** BIT 0: Actuator's BAE (thermoelectric tripping device) triggered BIT 1: Smoke detector triggered BIT 2: - BIT 3: Internal error BIT 4: Mechanical error BIT 5: Overload BIT 6: Initialization error (requires reset) BIT 7: Connection to actuator lost **VKN230-24-PL:** BIT 0: Lost connection to actuator sensor BIT 1: Lost connection to MP sensor BIT 2: Device specific (see register 115, address 114) BIT 3: Internal error BIT 4: - BIT 5: - BIT 6: - BIT 7: Lost connection to actuator	X
113	112	Saved errors	Analogous to **register 112**	X
114	113	Error summary	1: At least one error	

		VKN extension: The following registers (115-133) are only valid for VKN; for BKN, the registers are invalid with the value -1			
115	114	Device specific errors	**VAV / EPIV (without V4) / common damper or valve actuators**: BIT 0: Excessive Utilisation BIT 1: Control Range Increased BIT 2: Overload BIT 3: Supercap Malfunction **VRU**: BIT 0: - BIT 1: - BIT 2: - BIT 3: - BIT 4: Error dP Sensor BIT 5: - BIT 6: Airflow not Reached BIT 7: - BIT 8: - BIT 9: - BIT 10: Bus Watchdog Triggered BIT 11: Actuator Doesn't Fit to Application BIT 12: Pressure Sensor Wrong Connected BIT 13: Pressure Sensor not Reached BIT 14: dP Sensor Out of Range BIT 15: - **EPIV V4**: BIT 0: No Communication to Actuator BIT 1: - BIT 2: Actuator Cannot Move BIT 3: Reverse Flow BIT 4: Flow Setpoint not Reached BIT 5: Flow with Closed Valve BIT 6: Flow Actual Exceeds Flow Nominal BIT 7: Flow Measurement Error BIT 8: - BIT 9: Flowbody Temperature Error BIT 10: Communication to Sensor Interrupted BIT 11: Freeze Warning BIT 12: Glycol Detected BIT 13: - BIT 14: - BIT 15: Bus Watchdog Triggered	x	
116	115	V_{Nom}	V_{Nom} of the actuator in m^3/h (VAV/VRU) or l/min (EPIV)	X	
117	116	Min	**VAV / VRU:** V_{Min} of the actuator in m^3/h **EPIV:** V_{Min} of the actuator in l/min **Other:** Min of the actuator in % (0: 0%, 10,000: 100%) configurable via the CDU	X	
118	117	Mid	**VAV / VRU:** V_{Mid} of the actuator in m^3/h **EPIV:** V_{Mid} of the actuator in l/min **Other:** Mid of the actuator in % (0: 0%, 10,000: 100%) configurable via the CDU	X	
119	118	Max	**VAV / VRU:** V_{Max} of the actuator in m^3/h **EPIV:** V_{Max} of the actuator in l/min **Other:** Max of the actuator in % (0: 0%, 10,000: 100%) configurable via the CDU	X	
120	119	Relative setpoint	Relative setpoint in hundredths of a percent if control via CDU is configured as bus or if the forced control (register 102, address 101) is set to 10 (bus) 0 = 0% → Min 10,000 = 100% → Max	X	X
121	120	Absolute setpoint	**VAV / VRU:** Setpoint of the actuator in m^3/h **EPIV:** Setpoint of the actuator in l/min **Other:** Setpoint of the actuator in % (0: 0%, 10,000: 100%)	X	

122	121	Absolute flow	**VAV / VRU:** Actual value (flow) of the actuator in m³/h **EPIV:** Actual value of the actuator in l/min **Other:** -				X
123	122	Raw value data point 1	Voltage: Current: Resistor: PT1000: PT100: NI1000LS: NI1000: Digital: MP temperature MP temperature setpoint MP humidity MP CO_2 MP Ventilation EPIV temperature EPIV glycol	Values in mV: Values in µA: Values in 0.1 Ohm: Values in 0.01 °C Values in 0.01 °C Values in 0.01 °C Values in 0.01 °C Digital 0/1: Values in 0.01 °C Values in 0.01 °C Values in 0.01 % Values in PPM Values in 0.01% Values in 0.01 °C Values in 0.01 %	10,000 10,000 10,000 2,165 2,165 2,165 2,165 0: input open 1: connected to GND 2,165 2,050 5,825 400 2,500 2,165 625	→ 10V → 10mA → 1kOhm →21.65 °C →21.65 °C →21.65 °C →21.65 °C →21.65 °C →20.5 °C → 58.2 % → 400 ppm → 25.0 % →21.65 °C → 6.2 %	X
124	123	Raw value data point 2	See raw value data point 1				X
125	124	Raw value data point 3	See raw value data point 1				X
126	125	Raw value data point 4	See raw value data point 1				X
127	126+ 127*	Converted value data point 1	CO_2: Temperature: Humidity: VOC: Diff. pressure: Flow:	Values in PPM: Values in 0.01 °C Values in 0.01 % Values in 0.01 % Values in Pa Values in m³/h	400 2,165 5,825 2,000 200 1,000	→ 400 ppm → 21.65 °C → 58.2 % → 20.00 % → 200 Pa → 1,000 m³/h	X
129	128 + 129*	Converted value data point 2	See converted value data point 1				x
131	130+ 131*	Converted value data point 3	See converted value data point 1				x
133	132+ 133*	Converted value data point 4	See converted value data point 1				x

*32 bit signed format: little endian, byte swap

10.2.2 BACnet

10.2.2.1 General Information & BIBBs

General Information	Vendor Name Vendor Identifier BACnet Protocol Revision BACnet Standard Device Profile	BACnet Application Specific Controller (B-ASC)
	Segmentation Capability	No
	Data Link Layer Options	MS/TP master Baud Rates: 9600, 19200, 38400, 57600, 76800 BACnet IP master
	Device Address Binding	No static device binding supported
	Character Sets Supported	ISO 10646 (UTF-8)
	Network Security Options	Non-secure device
BIBBs **BACnet Interoperability** **Building Blocks supported**	DS-COV-B DS-RP-B DS-RPM-B DS-WP-B DM-DDB-B DM-DOB-B DM-DCC-B DM-RD-B DM-UTC-B	Data Change of Value-B Data Sharing-Read Property-B Data Sharing-Read Property Multiple-B Data Sharing-Write Property-B Device Management-Dynamic Device Binding-B Device Management-Dynamic Object Binding-B Device Management-Device Communication Control-B Device Management-Reinitialize Device-B Device Management-UTCTimeSynchronization-B

10.2.2.2 PICS Protocol Implementation Conformance Statement

Object Type	Optional Properties	Writable Properties
Analog Input [AI]	Description COV Increment	Object Name [max 63 bytes] Description [max 63 bytes] COV Increment
Analog Output [AO]	Description COV Increment	Present Value Object Name [max 63 bytes] Description [max 63 bytes] COV Increment
Binary Input [BI]	Description Active Text Inactive Text	Object Name [max 63 bytes] Description [max 63 bytes]
Binary Value [BV]	Description Active Text Inactive Text	Present Value Object Name [max 63 bytes] Description [max 63 bytes]
Bitstring Value [BSV]	Description Bit Text	Object Name [max 63 bytes] Description [max 63 bytes]
CharacterString Value [CSV]	Description	Object Name [max 63 bytes] Description [max 63 bytes]
Device	Description Location Active COV Subscriptions Local Date Local Time UTC Offset Daylight Savings Status **BACnet MS/TP:** Max Master Max Info Frames	Object Identifier Object Name [max 64 bytes] Description [max 64 bytes] Location [max 64 bytes] APDU Timeout (1000…60‘000) Number of APDU Retries (0...10) **BACnet MS/TP:** Max Master (1...127) Max Info Frames (1...255)
Multi-state Input [MI]	Description State Text	Object Name [max 63 bytes] Description [max 63 bytes]
Multi-state Output [MO]	Description State Text	Present Value Object Name [max 63 bytes] Description [max 63 bytes]
Multistate Value [MV]	Description State Text	Present Value Object Name [max 63 bytes] Description [max 63 bytes]

- The device does not support the services CreateObject and DeleteObject
- The device supports the DeviceCommunicationControl and ReinitializeDevice services. No password is required
- The device supports a maximum of 1024 simultaneous COV subscriptions with a runtime of 1…28,800s (8 hours)

10.2.2.3 BACnet object list

Project Type / Instance(s)	Project name	Values	Active/ inactive or status text	Unit	COV Support	Description	Access[1]
AI 0	Bus Watchdog			Seconds	yes	Bus watchdog countdown (is reset with a forced control / test reset command or control heartbeat) When the watchdog counts to 0, the following action is performed: **BKN**: The *priority arrays* of all **MO** objects are cleared (fire dampers **close**). **VKN**: If a bus fail position is set, this is sent to the device as forced control. The forced control (MO 101-164) and the setpoint (AO 101-164) are ignored as long as the bus watchdog countdown is set to 0.	r
AI 1	Total Supply VAV			m^3/h	yes	The total flow of all VAV actuators configured as 'Supply' (**VAV and VRU**)	r
AI 2	Total Exhaust VAV			m^3/h	yes	The total flow of all VAV actuators configured as 'Exhaust' (**VAV and VRU**)	r
AI 3	Max Position Supply VAV			%	yes	The maximum position of all VAV actuators configured as 'Supply' (in percent, **VAV and VRU**)	r
AI 4	Max Position Exhaust VAV			%	yes	The maximum position of all VAV actuators configured as 'Exhaust' (in percent, **VAV and VRU**)	r
AI 101-164	Actuator Power Slave x			Watt	yes	Power consumption of the actuator (**BKN only**)	r
AI 201-264	Actuator Position Slave x			%	yes	Relative Position of the actuator in %	r
AI 301-364	Actuator Absolute Setpoint Slave x			m^3/h, l/min, %	yes	Absolute setpoint of the actuator (**VKN only**)	r
AI 401-464	Actuator Absolute Flow Slave X			m^3/h, l/min	yes	Absolute flow of the actuator (**VKN only**)	r
AI 501-564	Actuator VNom Slave x			m^3/h, l/min	yes	V_{Nom} of the actuator (**VKN only**)	r
AI 601-664	Actuator Min Slave x			m^3/h, l/min, %	yes	Min / V_{Min} of the actuator (**VKN only**)	r
AI 701-764	Actuator Mid Slave x			m^3/h, l/min, %	yes	Mid / V_{Mid} of the actuator (**VKN only**)	r
AI 801-864	Actuator Max Slave x			m^3/h, l/min, %	yes	Max / V_{Max} of the actuator (**VKN only**)	r
AI 901-964	Actuator Data Point 1 Slave x			sensor-specific	yes	Data point 1 of the VKN	r
AI 1001-1064	Actuator Data Point 2 Slave x			sensor-specific	yes	Data point 2 of the VKN	r
AI 1101-1164	Actuator Data Point 3 Slave x			sensor-specific	yes	Data point 3 of the VKN	r
AI 1201-1264	Actuator Data Point 4 Slave x			sensor-specific	yes	Data point 4 of the VKN	r

[1] Access: R = Read, W = Write, C = Commandable with priority array

AO 101-164	Actuator Relative Setpoint Slave x			%	yes	Relative setpoint of the actuator in % between Min und Max (**VKN only**)	c
BI 0	Relay OK	1.0	on , off	-	yes	Status of the Error/OK Relay	r
BI 1	Relay > 72 Degrees	1.0	on , off	-	yes	Status of the local fire alarm relay	r
BI 2	Relay All Closed	1.0	on , off	-	yes	Status of damper-Closed Relay	r
BI 3	Relay All Open	1.0	on , off	-	yes	Status of damper-Open Relay	r
BI 4	DI1 Local forced control	1.0	on , off	-	yes	Status of DI1 (local forced control)	r
BI 5	DI2 Local Reset	1.0	on , off	-	yes	Status of the DI2 (Local Test/Reset)	r
BI 6	DI3 Bus Control enabled	1.0	on , off	-	yes	Status of DI3 (bus control)	r
BI 7	DI4	1.0	on , off	-	yes	Not used	r
BI 8	DI5	1.0	on , off	-	yes	Not used	r
BI 9	DI6	1.0	on , off	-	yes	Not used	r
BI 10	DI7	1.0	on , off	-	yes	Not used	r
BI 11	Heartbeat	1,0	on , off	-	yes	Toggles every second to indicate that the device is running	r
BI12	Heartbeat Slow	1,0	on , off	-	yes	Toggles every 15 seconds	r
BV 0	Reset all Slaves	1.0	on , off	-	yes	Resets all saved errors, resets the bus watchdog countdown	w
BV 1	Control Heartbeat	1.0	on , off	-	yes	Heartbeat in order to obtain bus control The bus watchdog countdown is reset by a write command If the bus forced control (**MO** objects) is not periodically written, the bus watchdog can be reset by periodic writing of 0 or 1 of the Control Heartbeat	w
BV 101-164	Reset/Test Slave x	1.0	on , off	-	yes	Resets saved errors and starts test run on slave x resets the bus watchdog countdown	w
BSV 101-164	Device Specific Errors Slave x			-	yes	Actuator errors that are specific to the attached actuator (**VKN only**)	r
CSV 101-164	ID / Location Slave x			-	yes	Contains the "ID / Location" of slave x	r
MI 0	Summary Status all Slaves	[1,2,3,4]	[Inactive, Unknown, Not Ok, Ok]	-	yes	Status summary of all active slaves **Inactive**: No slave addressed **Unknown**: No connection to the slaves **Not Ok**: At least one active slave with status Not Ok[1] **Ok**: All active slaves Ok	r

[1] **Not Ok:** Status is "Warning", "Error", "Error during initialization", "Overload", "Lost Connection to Slave", "Internal Error", or "Gear disengaged"

MI 1-8	Summary Status Block x	[1,2,3,4]	[Inactive, Unknown, Not Ok, Ok]	-	yes	Status summary of active slaves in block x **Inactive**: No slaves in block x **Unknown**: No connection to the slaves in block x **Not Ok**: At least one active slave in block x with status Not Ok[1] **Ok**: All active slaves in block x Ok	r
MI 10	Summary Position of all Slaves	[1,2,3,4,5]	[Inactive, Unknown, Closed, Open, Other]	-	yes	Position summary of all active slaves (**BKN only**) **Inactive**: No slave addressed **Unknown**: No connection to the slaves **Closed**: Damper of all active slaves closed **Open**: Damper of all active slaves open **Other**: Damper position of the active slaves different or in middle position	r
MI 11-18	Summary Position Block x	[1,2,3,4,5]	[Inactive, Unknown, Closed, Open, Other]	-	yes	Position summary of all active slaves in block x (**BKN only**) **Inactive**: No slaves in block x **Unknown**: No connection to the slaves in block x **Closed**: Damper of all active slaves in block x closed **Open**: Damper of all active slaves in block x open **Other**: Damper position of the active slaves in block x different or in middle position	r

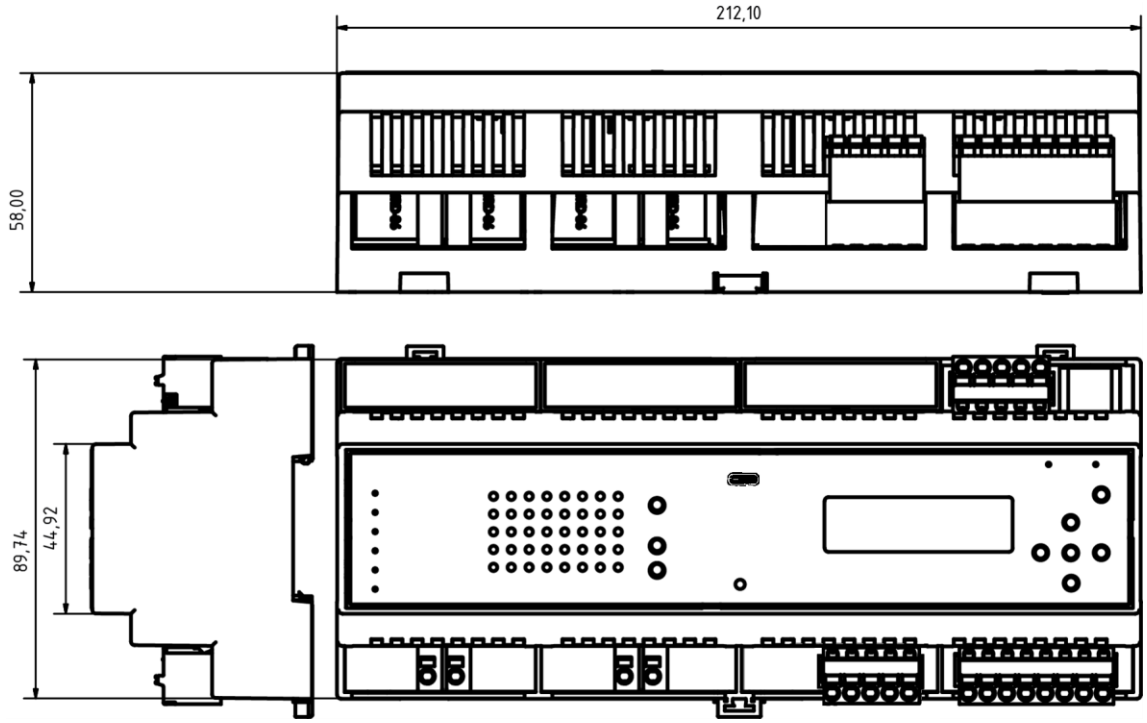
MI 101-164	Status Slave x	[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]	[Inactive, Unknown, Init, Normal operation, Test, Test (local), Warning, Error, Error during initialization, Overload, Lost Connection to Slave, Internal Error, Gear disengaged, Synchronization, Range Adaption]	-	yes	Detailed status of slave x **Inactive**: No slave with given Bus ID **Unknown**: No connection to slave **Init**: Slave initializing **Normal operation**: Slave functions correctly **Test**: Slave performs auto-test **Test (local)**: The slave test button is pressed so a test (reversing) is performed **Warning**: At least one saved error **Error**: There is at least one actual error **Error during Initialization**: An error has occurred during initialization which needs a reset (acknowledgement) of the slave (**BKN only**) **Overload**: The connected actuator caused an overload (to protect the slave the damper is not opened for one minute after which the status is automatically exited) (**BKN only**) **Lost Connection to Slave**: Interruption of connection to the slave **Internal Error**: Internal error (e.g: defective device) **Gear disengaged:** Gear of the actuator disengaged (**VKN only**) **Synchronization:** Actuator is synchronizing (**VKN only**) **Range Adaption:** Actuator performs a range adaption (**VKN only**)	r
MI 201-264	Position Slave x	[1,2,3,4,5,6]	[Unknown, Closed, Open, Closing, Opening, Middle]	-	yes	Position of slave x **Unknown**: Slave not present or no connection to the slave **Closed**: Damper/valve closed **Open**: Damper/valve open **Closing**: Damper in middle position and closing (**BKN only**) **Opening**: Damper in middle position and opening (**BKN only**) **Middle:** Damper/valve in middle position	r

MI 301-364	Sensor Status Slave x	[1,2,3,4,5,6,7,8,9,10,11,12,13,14]	[Unknown, OK, ORS, ORS & BAE, ORS & BAE Mem, BAE, BAE & ORS Mem, ORS Mem, BAE Mem, ORS Mem & BAE Mem, Lost connection to MP sensor, Lost connection to actuator sensor, Lost connection to MP sensor Mem, Lost connection to actuator sensor Mem]	-	yes	Sensor status of slave x **Unknown**: Slave not present or no connection to the slave **OK**: No error The following errors are only relevant for **BKN devices**: **ORS**: ORS triggered **ORS & BAE**: ORS and BAE triggered **ORS & BAE MEM**: ORS triggered, saved BAE error **BAE**: BAE triggered **BAE & ORS MEM**: BAE triggered, saved ORS error **ORS MEM**: Saved ORS error **BAE MEM**: Saved BAE error **ORS MEM & BAE MEM**: Saved ORS error and saved BAE error The following errors are only relevant for **VKN devices**: **Lost connection to MP sensor:** Connection to MP sensor lost **Lost connection to actuator sensor:** Connection to actuator sensor lost **Lost connection to MP sensor Mem:** saved 'Lost connection to MP sensor' Error **Lost connection to actuator sensor Mem:** saved 'Lost connection to actuator sensor' Error	r

MI 401-464	Actuator Status Slave x	[1,2,3,4,5,6,7,8,9,10,11,12]	[Unknown, OK, Mechanical, Mechanical & Overload, Mechanical & Overload Mem, Overload, Overload & Mechanical Mem, Mechanical Mem, Overload Mem, Mechanical Mem & Overload Mem, Device specific, Device specific Mem]	-	yes	Actuator status on slave x **Unknown**: Slave not present or no connection to the slave **OK**: no error The following errors are only relevant for **BKN devices**: **Mechanical**: Mechanical error **Mechanical & Overload**: Mechanical error and overload **Mechanical & Overload Mem**: Mechanical error and saved overload error **Overload**: Overload **Overload & Mechanical Mem**: Overload and saved mechanical error **Mechanical Mem**: Saved mechanical error **Overload Mem**: Saved overload error **Mechanical Mem & Overload Mem**: Saved mechanical error and saved overload error The following errors are only relevant for **VKN devices**: **Device specific:** Device specific errors, more detailed information can be found in the corresponding BSV object **Device specific Mem:** saved device specific error	r
MI 501-564	Status Actuator Connection of Slave x	[1,2,3,4]	[Unknown, OK, Disconnected, Disconnected Mem]	-	yes	Connection status to actuator of slave x **Unknown**: Slave not present or no connection to the slave **OK**: no error **Disconnected**: Actuator not connected **Disconnected Mem**: Saved "actuator not connected" error	r
MO 0	Forced Control all Slaves	[1,2,3,4,5,6,7,8,9,10,11]	[None, Open, Close, Min, Mid, Max, Stop, 100% / VNom, Fast Open, Fast Close, Bus]	-	yes	Bus forced control for all slaves A write command resets the watchdog countdown The given value/priority is applied to all slaves (MO 101-164). A description of the values can be found in MO 101-164.	c
MO 1-8	Forced Control of Block x	[1,2,3,4,5,6,7,8,9,10,11]	[None, Open, Close, Min, Mid, Max, Stop, 100% / VNom, Fast Open, Fast Close, Bus]	-	yes	Bus forced control for all slaves in block x A write command resets the watchdog countdown The given value/priority is applied to all slaves (MO 101-164) in block x. A description of the values can be found in MO 101-164.	c

MO 101-164	Forced Control Slave x	[1,2,3,4,5,6,7,8,9,10,11]	[None, Open, Close, Min, Mid, Max, Stop, 100% / VNom, Fast Open, Fast Close, Bus]	-	yes	Bus forced control for slave x A write command resets the watchdog countdown. **None**: No command (for fire damper equals to **Close**) **Open**: Open command **Close**: Close command The following forced control values are only relevant for **VKN devices**: **Min:** Min or V_{Min} **Mid:** Mid or V_{Mid} **Max:** Max or V_{Max} **Stop:** Motor Stop **100% / VNom:** 100% or V_{Nom} **Fast Open:** Fast open **Fast Close:** Fast close **Bus:** For actuators that are controlled directly via a data point, the control can be overwritten using the relative setpoint (AO 101-164)	C
MV 101-164	Command Slave x	[1,2,3,4]	[None, Reset / Auto Test, Range Adaption, Synchronization]	-	yes	Bus command for station x The bus watchdog is reset when a write command is issued. **None**: No command. **Reset / Auto Test**: Resets stored errors and starts a test run on slave x, like BV 101-164. **Range Adaption**: Starts a range adaptation (**VKN only**). **Synchronization**: Starts a synchronization (**VKN only**).	w

11 DIMENSIONS



Dimensions in mm


MP3
When Quality meets Passion

BKN230-24 PL

Powerline communication and power supply for one motorised fire dampers

Datasheet

Powerline → BKN230-24-PL

BKN(E)230-24-PL

Technical datasheet

Powerline communication and power supply for one motorized fire protection or smoke extraction damper with **conventional 24V** or **Belimo Top-Line "ST"** actuator

Primary features

+ 230VAC Powerline communication with dynamic signal adjustment and zero crossing detection
+ Connector for conventional or **Belimo Top-Line** actuator (auto-detection)
+ Connector for smoke detector
+ Push-button on device for damper function check
+ Topology: Free
+ Maximum distance from master 1200 m
+ Automatic detection by master (device has unique MAC address)
+ USB interface permits pre-addressing (BUS-ID) and issue of an identifier (ID/Location; e.g. location in the building, also possible via master)
+ Monitoring of the damper position (incl. angle*)
+ Run-time monitoring
+ Actuator power consumption monitoring
+ Powerline and USB Bootloader (firmware updates possible via master or directly via USB)

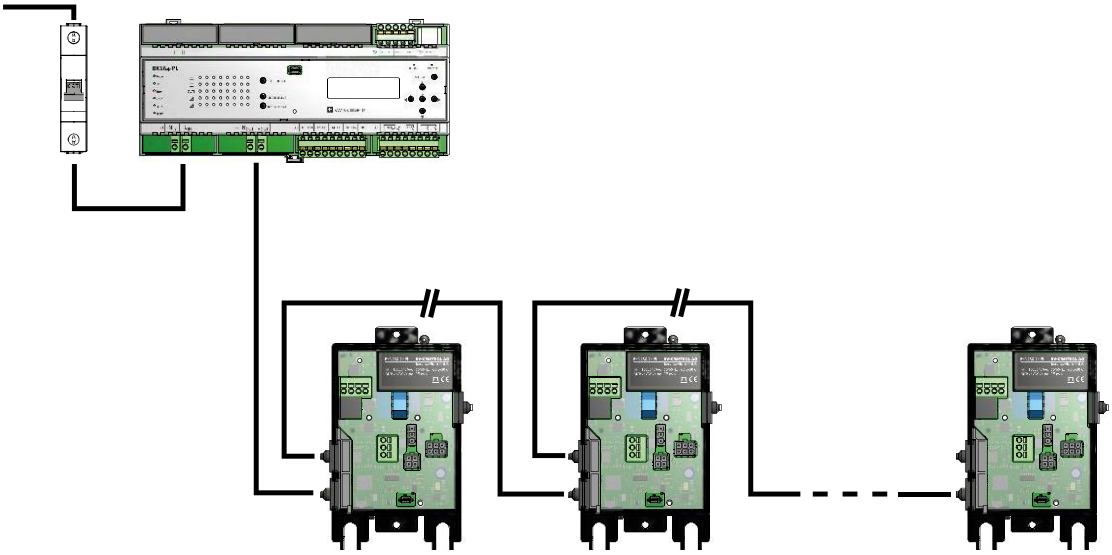
*Belimo Top-Line actuators only

1 CONTENTS

2 SUMMARY

The BKN230-24-PL is the linking element between a Powerline Master (e.g. BKS64-PL) and the motorized damper. It supplies electrical energy to a conventional spring return, smoke extraction or a Belimo Top-Line "ST" actuator and optional to a smoke detector. It communicates directly with the master device via the 230VAC power supply (POWERLINE technology).

The Powerline slaves (BKN230-24-PL) have a unique physical MAC address so are always detected by the master, irrespective of pre- or automatic addressing by the master.



3 SAFETY INSTRUCTIONS

The device is designed for use in stationary heating, ventilation and air conditioning systems and may not be used for applications outside the specified area of use.

Installation and connection of the 230VAC power supply must be carried out by a qualified electrical fitter. All statutory and official directives must be observed.

DANGER

Electric shock in the event of contact with 230 VAC lines

Wiring may only be carried out when the system is disconnected from the power supply!

Make sure the device cover is fitted before commissioning.

The device may not be disposed of as domestic waste.

4 TECHNICAL DATA

Electrical data	Rated voltage	100-240 VAC 50/60Hz
	Power consumption	2 W
	Power supply for actuator and smoke alarm	24VDC max. 700 mA
	Dimensioning	20 VA
Connections	230VAC Powerline	4 x spring terminals (2 x L + 2 x N) "Daisy-chain permitted"
	Smoke detector	Spring terminals (GND, +24V, IN)
	Actuator	AMP 3 and 6-way (conventional) AMP 4-way (communicative)
	USB interface	Mini-USB
Powerline communication	Frequencies	Frequency 1: 9-250 kHz Frequency 2: 9-250 kHz
	Modulation type	PSK
	Baud rate	Max. 28.8 kbps
	Reception sensitivity	Max. 36 dBµV
	Bus detection	Automatic via MAC address
	Addressing	Manual via USB or Automatic or manual via master
	Max. range of master to BKN with TT installation cables	Line: 1200 m Otherwise: max. 1200 m END to END

Safety	Protection class	**II**
	EMC Low Voltage Directive	CE according to 2014/30/EU CE according to 2014/35/EU
	Mode of operation	Type 1 (EN 60730-1)
	Ambient temperature	-30° … +50°C
	Storage temperature	-30° … +80°C
	Humidity test	95% rel. H., non condensing (EN 60730-1)
	Maintenance	maintenance-free
Mechanical data	Dimensions	Width 88 mm Height 153 mm Depth 54 mm
	Weight	290 g
	Assembly	Screw-fitted
Power consumption measurement	Accuracy	3% above/below measured value
	Resolution	0.1W

5 LIMITATIONS AND INSTRUCTIONS

The BKN230-24-PL may only be used with a designated master (e.g. BKS64-PL).

If possible, avoid routing the 230VAC Powerline cable immediately parallel to lines leading to devices which cause major interference e.g. inverters. If this cannot be avoided, switching to other channels at the master end can avoid possible interference.

6 COMMISSIONING, OPERATION AND DISPLAY

The device needs no configuration for operation. Detection by the master takes place automatically, based on a unique fixed MAC address. The slave address (BUS-ID) can be assigned automatically or manually. Together with the usual LEDs for damper positions and faults, the device has two white LEDs which indicate Powerline communication. The blue LED indicates the bootloader mode and is a means of identification.

LED for Damper Positions

Green:	blinking:	Damper is opening
	on:	Damper is open
	(Bootloader)	is updating
Yellow:	blinking:	Damper is closing
	on:	Damper closed

Error LED (Error list: see Chapter 8.9)

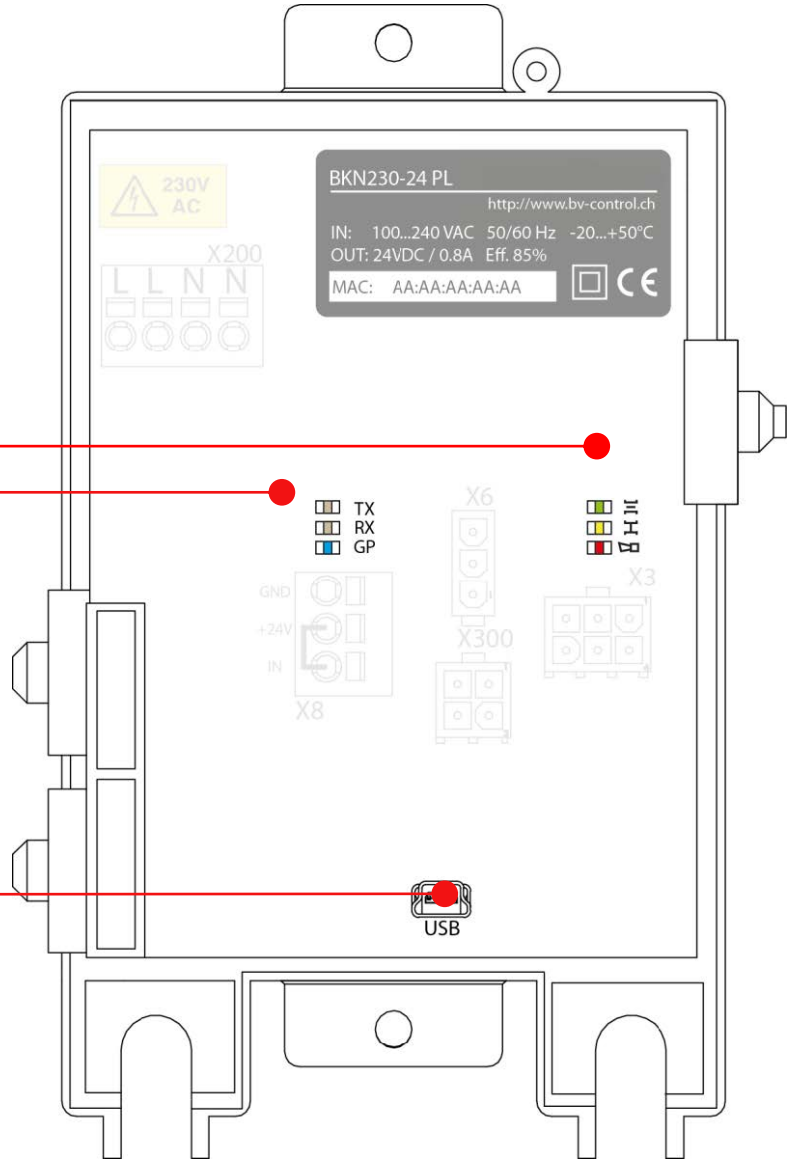
Red:	blinking:	error present
	on:	error saved

Communication-LED

White TX:	on:	PL Data sent
White RX:	on:	PL Data received

GP-LED

Blue:	on:	Device in Bootloader mode
	blinking:	Identified by the Master

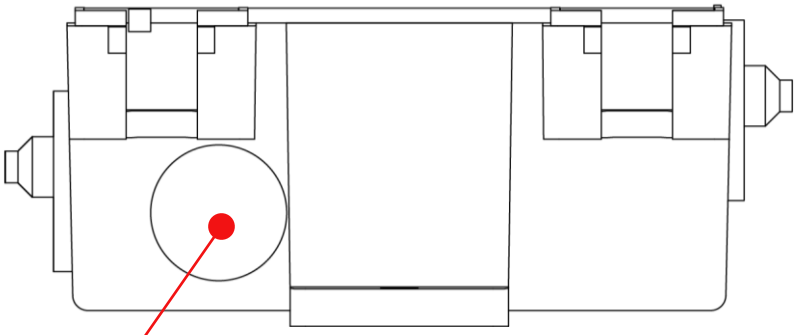


USB Interface

The USB interface allows reading of the MAC address and optionally setting the BUS-ID (1..64) and a device identifier in plain text (for example, location in the building)

Button

The button has several functions: A short keystroke erases stored errors. When the button is pressed, the actuator moves to the opposite position. The master recognizes a pressed button, what makes it easy to identify devices.



7 ELECTRIC CONNECTIONS AND TERMINAL CONFIGURATION

The connection of the 230 VAC Powerline cable to the spring terminals X200 may only be carried out by a qualified electrical fitter.

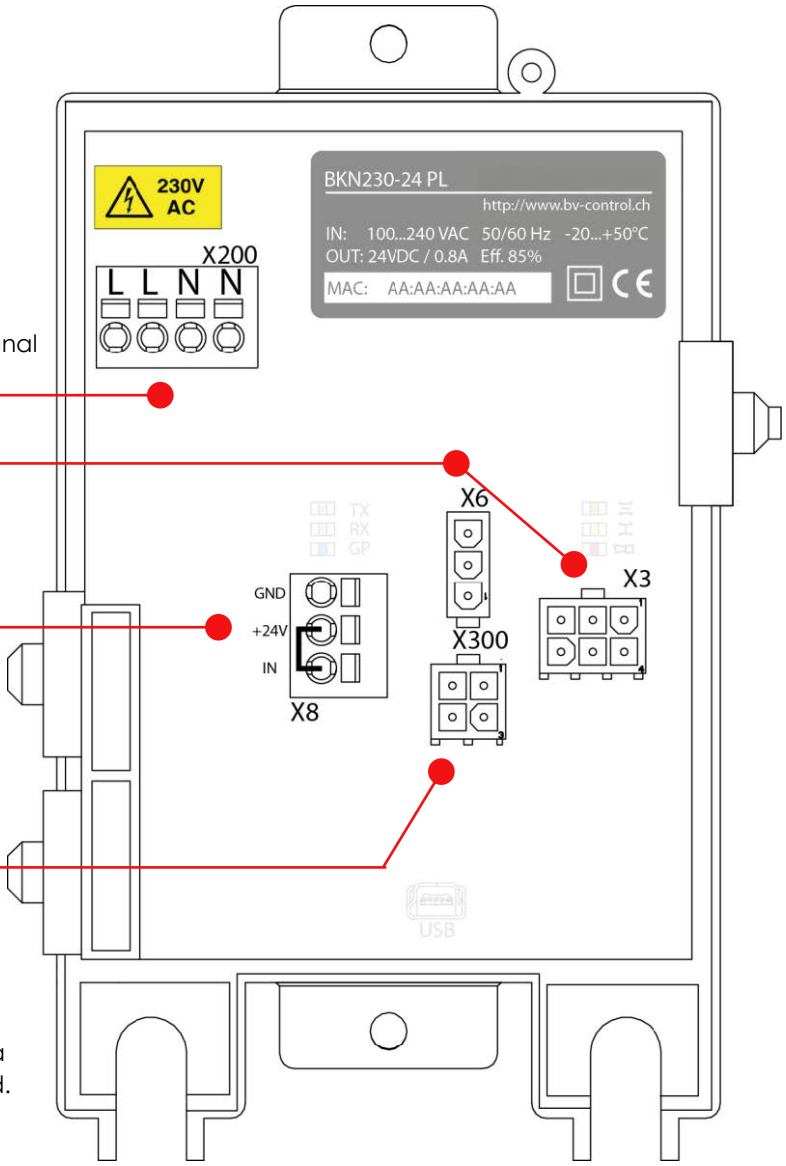
X200
Spring-terminals for 230VAC with Powerline Signal
Assignment: f.l.t.r.: L L N N

X6 und X3*
AMP plug-in connections for conventional actuators
X6: Supply (3-pole) X3: Limit switch (6-pole)

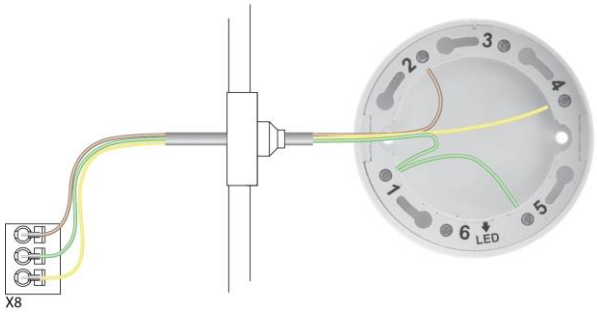
X8
Spring terminal for a smoke detector
Assignment: 1: GND
2: + 24VDC
3: IN
(without smoke detector: connect+ 24V and IN)

X300*
AMP connector, 4-pin, for Belimo top-line actuator

* The X6 and X300 terminals are arranged so that only either a conventional actuator or a Belimo Top-Line actuator can be connected.

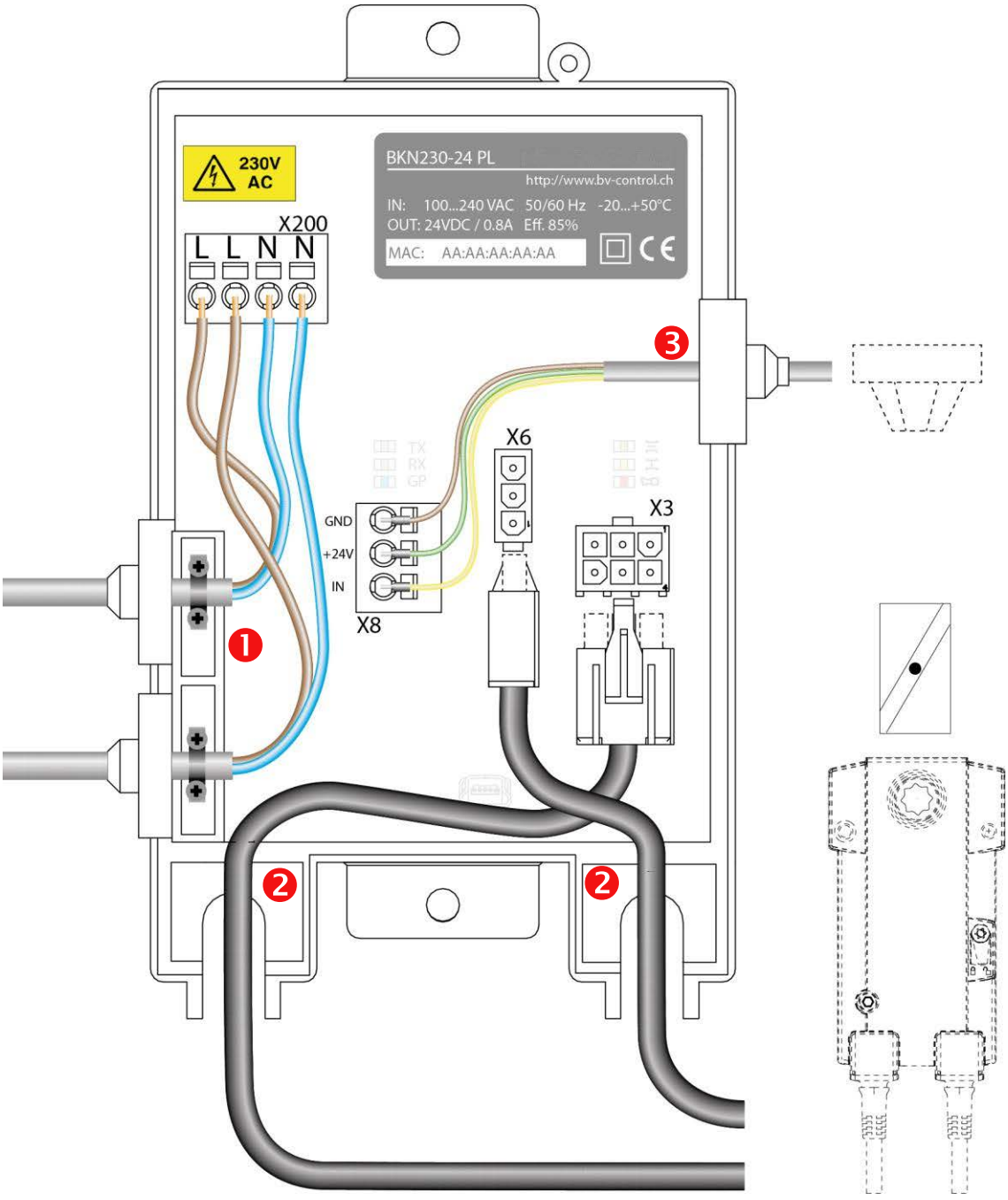


Smoke Detector example: ORS142 K (Hekatron)



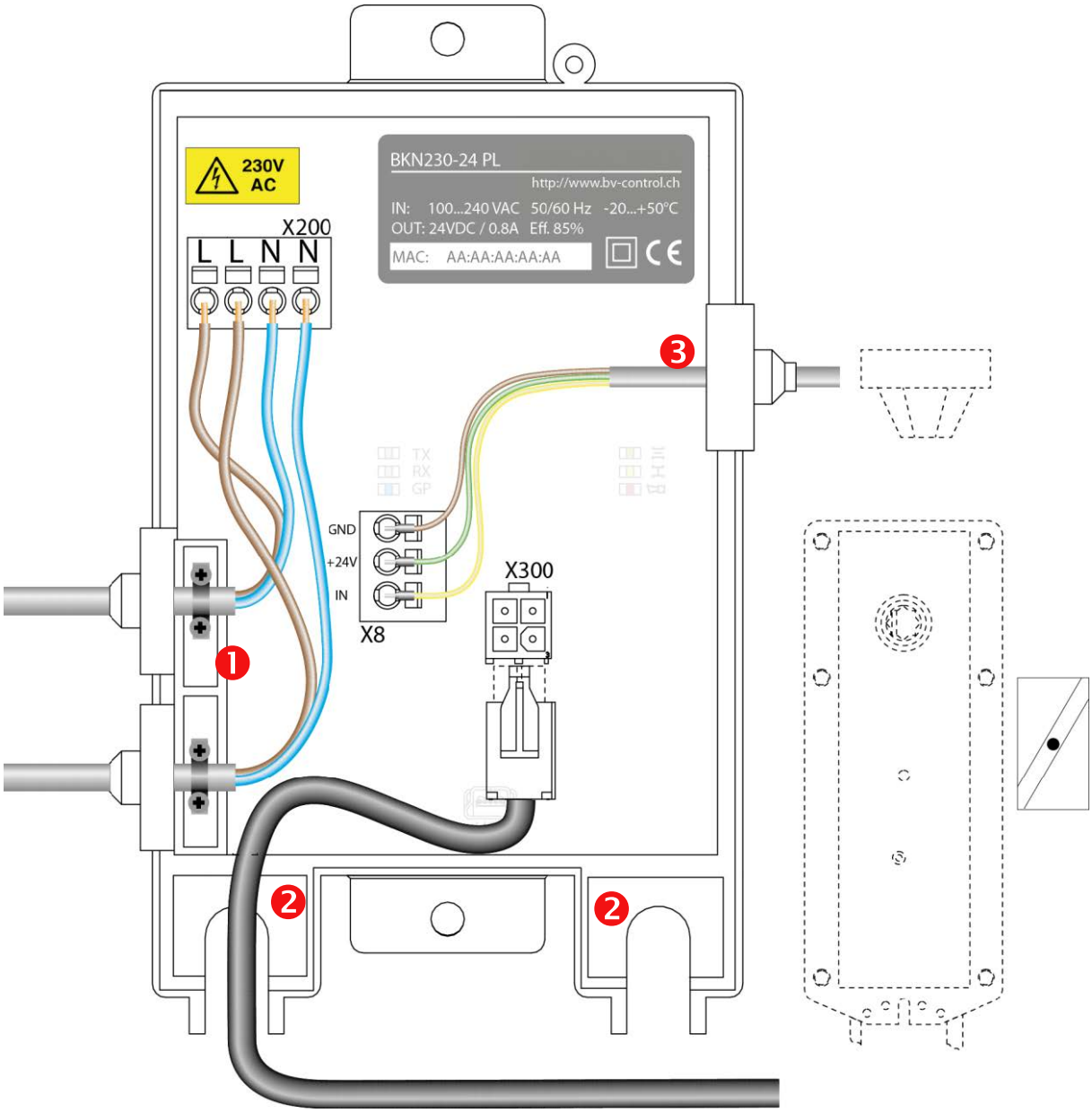
7.1 Cable routing inside the device with conventional actuator and smoke detector

The following image shows how the cables can be routed inside the device. The 230VAC Powerline cables should be inserted through the corresponding strain relief devices (1). The cables of the conventional actuator are fed through the bottom openings (2). The grommet, top right (3), is used for the smoke detector.



7.2 WIRING WITH BELIMO TOPLINE ACTUATOR AND SMOKE DETECTOR

The cable of the communicative actuator (e.g. BF24TL-T-ST) is fed through the opening (2), on the bottom left or right.



8 CHARACTERISTICS AND FUNCTIONS

8.1 SWITCHING ON BEHAVIOR AND BOOTLOADER (SOFTWARE UPDATES)

After switching on the power, the device waits in bootloader mode for approx. 20 seconds. This is indicated by a steady blue LED. In this mode, the firmware of the slave can be updated via the Powerline signal via the master. The master may also end Bootloader mode before the 20 seconds has expired.

The device can be updated at any time directly via a USB cable. This update option is a precautionary measure in case of unforeseen system problems or new requirements.

The communication channels used are also set in bootloader mode. More about this in the next section.

Operating parameters such as e.g. the BUS timeout or the communication channels used can be set via the master at any time **without** firmware update.

8.2 COMMUNICATION

Communication with the master takes place via digital phase modulation (phase-shift keying) simultaneously on two frequencies. Depending on the connection quality, for each individual BKN the master can automatically select between different PSK types (B-PSK, Q-PSK, 8-PSK). In Addition, if connections are subject to strong interference, communication can only take place in the zero crossing phase.

8.3 BUS MONITORING

If the BKN receives no control signal from the master during the pre-set BUS timeout, it forces the actuator to travel to the safety position (fire damper only). This time can be set via the master.

8.4 ADDRESSING AND IDENTIFICATION

The device has a **unique physical MAC address** which permits automatic detection of the device by the Master. It is shown on the rating plate and is present in duplicate.

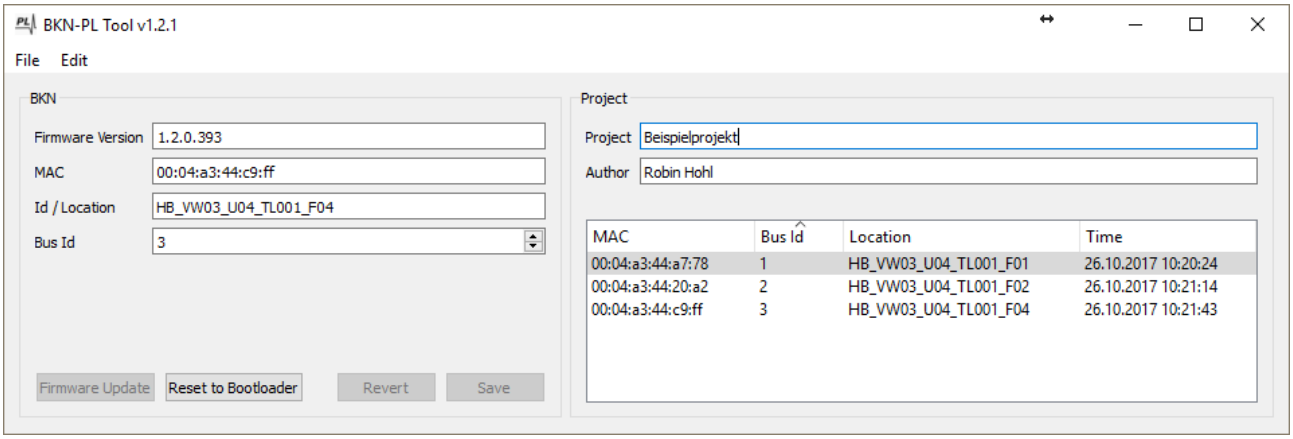
The **BUS-ID** (1..XX) is defined by the Powerline slave address. It is set to 0 as standard, i.e. the device is not addressed.

The BUS-ID can be assigned in different ways:

- Directly at the device via the USB interface and the Windows software "**BKN-PL Tool.exe**" (this option enables pre-addressing. The device must be connected to a 230 VAC power supply)
- Via the master (automatic, or via Drag and Drop)

As well as the BUS-ID, plain text identification is possible (**ID/Location**). It is optional and is used to locate the slaves within the building. Like the BUS-ID, it can be entered via the master or BKN software.

If pre-addressing is performed, a list (CSV file) can be produced automatically with the BKN-PL Tool.exe, in which MAC addresses, BUS-IDs and the identifiers are listed. To produce the list, you need to create a new project in the tool: **Edit -> New Project:**



Content of the CSV file:

Project: Beispielprojekt			
Author: Robin Hohl			
MAC	Bus Id	Location	Time
00:04:a3:44:a7:78	1	HB_VW03_U04_TL001_F01	26.10.2017 10:20
00:04:a3:44:20:a2	2	HB_VW03_U04_TL001_F02	26.10.2017 10:21
00:04:a3:44:c9:ff	3	HB_VW03_U04_TL001_F04	26.10.2017 10:21

If dampers are installed in the wrong places in the building, the descriptions and the BUS-IDs are easily corrected via the Master. The pre-addressing list can be corrected in this case with Excel but needs to be saved as a CSV file so that it can be opened again with the BKN tool.

8.5 ACTUATOR TEST RUN

Pressing the **TEST** button allows checking that the damper reaches both limit positions.

8.6 TRAVEL TIME MONITORING / LIMIT SWITCH MONITORING

The damper must reach the limit positions in a pre-specified time. The BKN monitors the two travel times and sets a **mechanical error** message if they are exceeded.

The maximum allowed travel time can be set via the master. At initialization the BSK must reach the lower limit position, otherwise an "Initialization error" is set.

8.7 POWER CONSUMPTION MEASUREMENT AND MONITORING

The BKN230-24-PL can measure the power consumption of the actuator and cut off the power supply if it is too high. The threshold can be set via the master. If exceeded, an error message is set.

8.8 SMOKE DETECTOR MONITORING

Additionally, the BKN powers a smoke detector and monitors its switch contact. Again, an error is triggered if the **+24 V** contact and **IN** is not connected on terminal **X8**. **If the smoke detector is triggered, the power supply to the actuator is cut off directly.**

8.9 SUMMARY OF FAULTS

All faults are indicated by a red LED. The precise cause of the fault can be obtained from the master or the respective Windows software. The following faults exist:

Fault	Description	Remedy
INIT	Error at start up	Check connections and perform reset
ORS	+24V and IN not connected	Check smoke detector
Mechanical fault	Limit switches not reached in set time	Check limit switch cable and damper
Overload	Actuator's current consumption is too high	Check damper mechanically
BAE*	No actuator connected or BAE* triggered on actuator	Check connection and BAE* of the actuator
actuator connection lost	Connection to Top-Line actuator lost	Check connection of the Top-Line actuator
BAE* Top-Line	BAE* of the Top-Line actuator has triggered	Check BAE* of the TL actuator

BAE = Thermoelectric tripping device.

9 TOPOLOGIES, CABLE CROSS SECTIONS AND MAX. DISTANCES

The Powerline communication technology permits different topologies including star-shaped, line, bus or tree. The following limitation applies for all topologies:

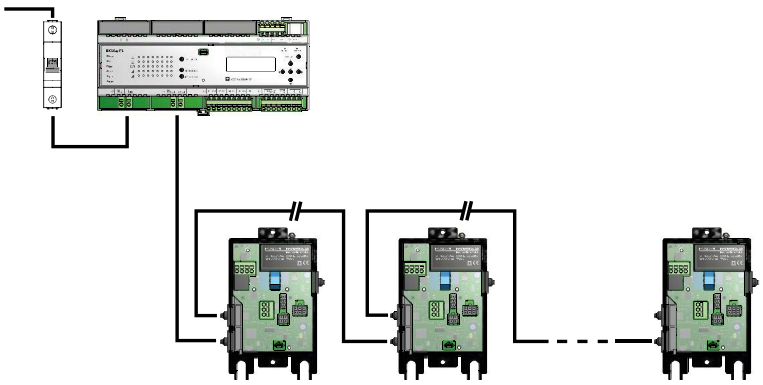
If there are fewer than 32 slaves and the maximum distance from master to BKN is less than 400m, an electrical installation cable with a cross section of 1.5mm² can be used.

From a distance (master to BKN) of 400m or a system with more than 32 slaves, a cross-section of 2.5mm² must be used. The maximum cable length from master to BKN must not exceed 1200m.

A number of topology examples are described below.

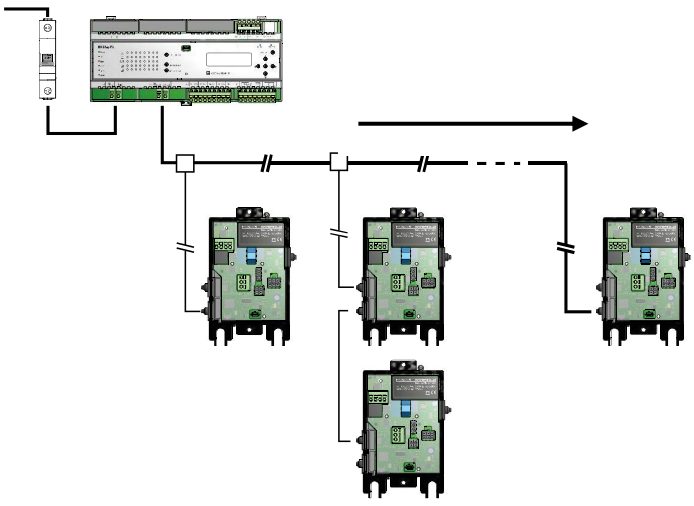
9.1.1 Line

Individual BKNs are daisy-chained directly in a linear topology



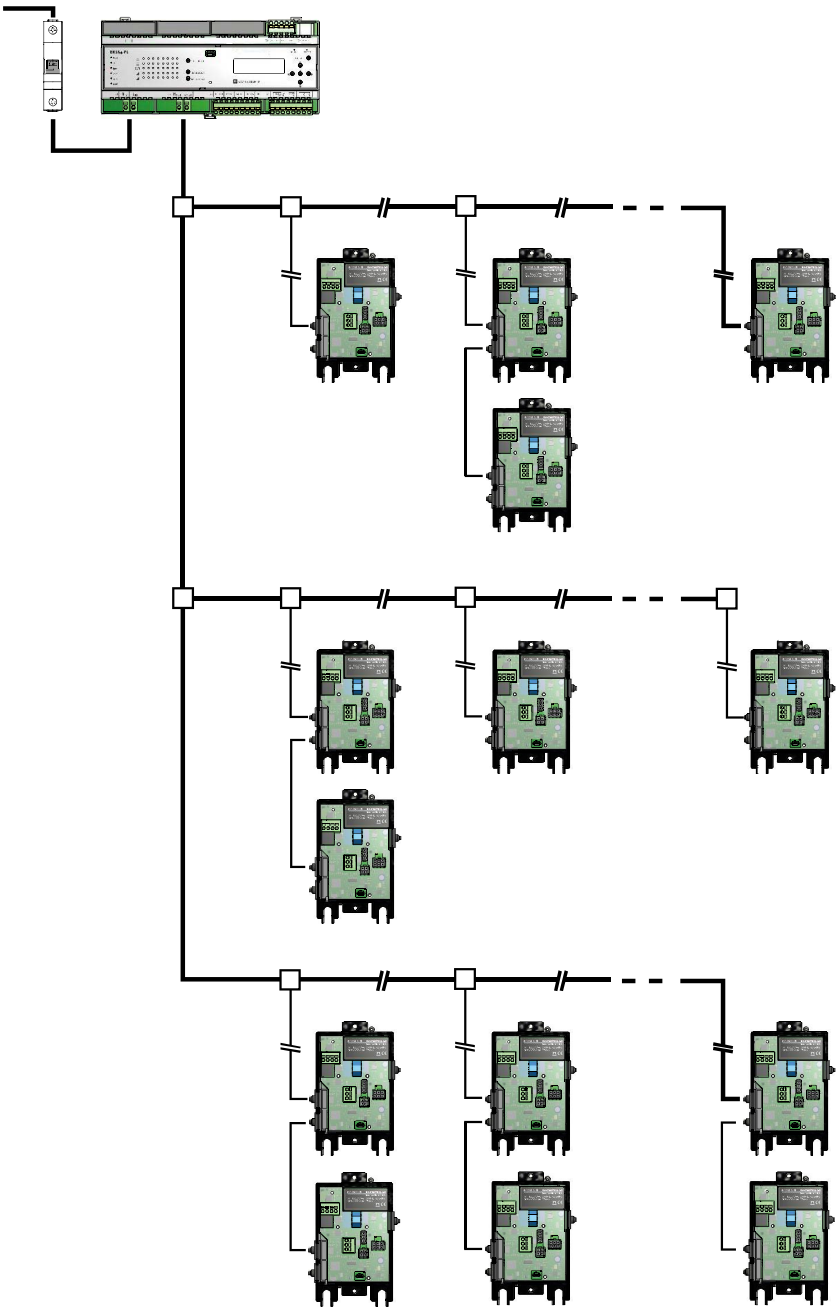
9.1.2 Basic BUS topology

In the basic bus topology, the individual BSKs are connected via branches to a main line. Several BSKs can be daisy-chained vertically one after the other.

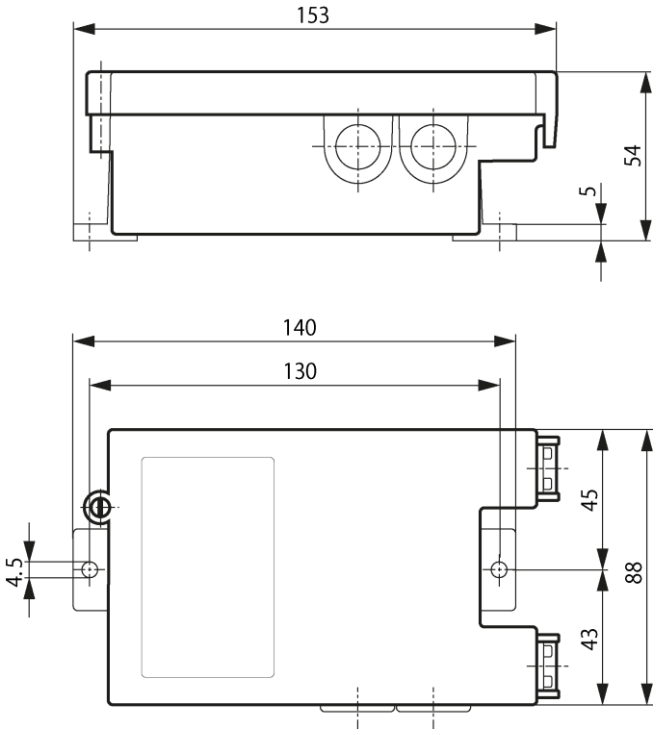


9.1.3 Extended BUS topology

Secondary lines can also be branched from a main line.
The maximum distance from the master to each BKN is again 1200 m. The overall length of all cables therefore may be several kilometres.



10 DIMENSIONS



Dimensions in mm


MP3
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