

WSC 104

CompactSmoke™

Installation instruction

For firmware version from 1.09

(Version 2608)



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1 Safety information

1.1 Safety

Only allow appropriately trained, qualified and skilled personnel to carry out installation work.

Reliable operation and the avoidance of damage and hazards are only guaranteed if installation and settings are carried out carefully in accordance with these instructions.

There may be personal danger by electrically operated windows:

- the forces occurring in the automatic mode can be such that parts of the body could get crushed
- when opened, actuators (spindles) could protrude into the room

For this reason, measures have to be taken prior to starting up the actuators, which exclude the danger of injury.

For safety reasons we recommend installing opening restrictors on bottom-hung windows.

If windows are subjected to rain and/or high wind loads, we recommend connecting a wind/rain sensor to the smoke ventilation panel for the automatically closing of the windows.

The smoke ventilation panel is to be located in a safe place, protected from the effects of fire and smoke.

The smoke ventilation panel is to be surface mounted.

The smoke ventilation panel has two energy suppliers: 230V AC and back-up batteries.

The manufacturer does not assume any liability for possible damage resulting from inappropriate use.

1.2 Mains

Mains voltage can cause death, severe injury or considerable damage to assets.

The connection of the smoke ventilation panel is reserved for qualified personnel.

Disconnect all poles of the panel from the supply voltage prior to opening, installation or assembling.

Installation and use according to the national regulations.

1.3 Back-up batteries

Back-up batteries 2 batteries per panel can cause severe injury or considerable damage to assets.

The connection of the smoke ventilation panel is reserved for qualified personnel.

Disconnect all poles of the panel from the back-up batteries prior to installation or assembling.

Ensure that the mains cable can be switched via an external or customer-supplied two-pole switch element or a switch element controlling all poles – see section 7.1 “Cable routing”

Installation and use according to the National regulations.

Dispose of used batteries according to the National regulation.

CAUTION

RISK OF EXPLOSION IF BATTERIES ARE REPLACED BY AN INCORRECT TYPE.

1.4 Application

The smoke ventilation panel is exclusively designed for the automatic opening and closing of smoke extraction systems, windows, flaps or doors.

Always check that your system meets the valid national regulations.

Pay particular attention to the opening cross section, the opening time and opening speed.

The cable cross sections depend on the cable length and current consumption (amperage).

1.5 Cable routing and electrical connection

Fuse the mains power supply cable separately on site, if required by national regulation.

Cable routing and connection - adhere to national regulations.

Establish the cable types, if necessary, with the local approval bodies or the fire protection authority.

Do not conceal flexible cables.

Junction box must be accessible for maintenance purposes.

Remove the mains power fuse and disconnect the back-up batteries prior to starting maintenance work or making changes to the system.

Secure the system to prevent unintentional switching on again.

Route all low voltage cables (24 VDC) separate from the power current cables.

Design cable types, lengths, and cross sections in accordance with the technical information.

Cable specifications is a guide only, the overall responsibility resides with the electrical contractor on site.

Installation must be in accordance with the national electrical regulations.

1.6 Commissioning

Once the panel is completely terminated and batteries and mains connected, you need to commission the panel!

See chapter 16 “Commissioning and test run” on page 22.

2 Structure of the smoke panel

The WSC 104 contains a power supply unit (SMPS) type WCA 1P1, and a main card type WSA 1SS with input, output and auxiliary supply (AUX).

The main card type WSA 1SS allows connections of 1 motor line and 1 keypad.

The motor line can be used for either a 24 VDC standard actuators or MotorLink® actuators. The motor line only can have 24 VDC standard or MotorLink® actuators connected. The smoke panel automatically detects whether 24 VDC standard or MotorLink® actuators are connected to the panel.

Alternatively, a pyrotechnic gas generator can be connected to the smoke control panel. If a pyrotechnic gas generator is connected, DIP-switch 8 must be set to ON.

Break glass unit

Break glass unit type WSK 50x are to be used together with WSC 104.

Smoke zone

Only 1 independent smoke zone can be implemented by the panel.

Inputs

The main card has 1 terminal for connecting actuators, 1 input for smoke detectors, 1 input for break glass units (where up to 10 break glass units can be connected) and 1 input for ventilation keypads (no max. number of keypads).

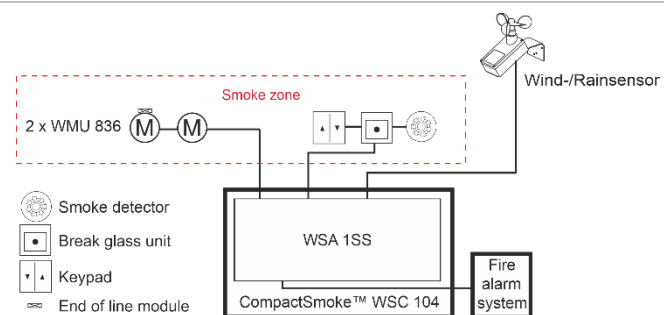
Smoke detectors can also be connected to a break glass unit (type WSK 501 / 502). A maximum of 10 smoke detectors can be connected to the system in total.

System example

A keypad and a smoke detector are cabled directly to the break glass unit in the smoke zone, which means that the need for cabling in the building is significantly reduced.

A wind/rain sensor is connected to close the windows during comfort ventilation in case of high wind and/or rain.

The smoke ventilation panel is connected to the Fire Alarm System.



2.1 ISO 21927-9 related data

The following optional indications, as defined in ISO 21927-9 clause 5 are included

- Audible indication
- Output to fire alarm
- Output of the fault conditions

The panel is an ISO 21927-9 Type D panel.

Minimum 1 break glass unit type WSK 5xx must be installed together with the panel, for the panel to conform with the ISO 21927-9 standard.

2.1.1 Access levels

Level	Access to	Who has access
1	<i>Public</i> You can see the smoke ventilation panel and break glass unit from the outside with the doors closed and locked	Everyone / General public
2	<i>Operation</i> You can open the break glass unit and reset the system	Chosen person e.g., building facility manger with a special key to break glass unit.
3	<i>Configuration</i> You can open the panel house; manual operate the windows as well as change the DIP switch settings.	Chosen persons with a special key and authorized to re-configure and service the panel e.g., a trained technician.
4	<i>Maintenance</i> Administrative overall level: for operating as well as updating with new software.	A trained technician, with access to the key to the panel, authorized by WindowMaster to upgrade the firmware of the panel and with a computer running the upgrading application, supplied by WindowMaster.

3 Max. numbers of actuators per motor line and panel

The table shows the max. number of actuators, which can be connected to the motor line / panel depending on the type of the actuators.

	Per WSC 104	
	24 VDC Actuator	MotorLink® Actuator ¹⁾
WMD 820-1	4	4
WMD 820-2	4	2
WMD 820-3	3	3
WMD 820-4	4	4
WMS 306-1	4	4
WMS 306-2	4	2
WMS 306-3	3	3
WMS 306-4	4	4
WMS 309-1	4	4
WMS 309-2	4	2
WMS 309-3	3	3
WMS 309-4	4	4
WMS 409 xxxx	2	0
WMS 409-1	2	4
WMS 409-2	2	2
WMU 831 / 836 / 851-1	4	4
WMU 831 / 836 / 851-2	4	2
WMU 831 / 836 / 851-3	3	3
WMU 831 / 836 / 851-4	4	4
WMU 861-1	4	4
WMU 861-2	4	2
WMU 861-3	3	3
WMU 861-4	4	4
WMU 842 / 852 / 862 / 882-1	2	2
WMU 842 / 852 / 862 / 882-2	2	2
WMU 863 / 883-1	1	1
WMU 864 / 884-1	1	1
WMX 503 / 504 / 523 / 526-1	8	4
WMX 503 / 504 / 523 / 526-2	8	2
WMX 503 / 504 / 523 / 526-3	6	3
WMX 503 / 504 / 523 / 526-4	8	4
WMX 803 / 804 / 813 / 814 / 823 / 826-1	4	4
WMX 803 / 804 / 813 / 814 / 823 / 826-2	4	2
WMX 803 / 804 / 813 / 814 / 823 / 826-3	3	3
WMX 803 / 804 / 813 / 814 / 823 / 826-4	4	4
WML 820/825	4	0
WML 860-1	4	4
WML 860-2	4	2
WML 860-3	3	3
WML 860-4	4	4

	24 VDC Actuator	MotorLink® Actuator ¹⁾
WMB 801/802 ²⁾	max. 4A connected to the WMB	
WMB 811 / 812 / 815 / 816 / 817 / 818 ²⁺³⁾	4	2

¹⁾ MotorLink™ actuators must be of the same type and with same configuration

²⁾ Do not exceed the total power consumption of the motor line

³⁾ When having two locking actuators on the motor line, it must be one of each type: 1 x WMB 811 and 1 x WMB 812, WMB 815 and WMB 816, or WMB 817 and WMB 818

4 Accessories and spare parts

Accessories	
Back-up battery for WSC 104 – 3.4Ah (2 x WSA 003 per panel)	WSA 003
Break glass unit, primary, with data communication, PVC housing. With input for smoke detector and comfort keypads. Only one unit per panel. x = colour of the housing: 1=red, 2=yellow, 3=grey, 5=orange	WSK 501 000x
Break glass unit, primary, with data communication, metal housing. With input for smoke detector and comfort keypads. Only one unit per panel. x = colour of the housing: 2=yellow, 3=grey, 5=orange	WSK 502 000x
Break glass unit, primary, with data communication, PVC housing. No input for smoke detector or keypad. Max. 10 units per panel. x = colour of the housing: 1=red, 2=yellow, 3=grey, 5=orange	WSK 503 000x
Break glass unit, primary, with data communication, metal housing. No input for smoke detector or keypad. Max. 10 units per panel. x = colour of the housing: 2=yellow, 3=grey, 5=orange	WSK 504 000x
Fireman's override switch	WSK 510
Smoke detector	WSA 311
Rain sensor	WLA 331
Rain/wind speed sensor	WLA 330
End of line motor module	WSA 514
End of line smoke detector module (10kΩ resistor), 10 pcs.	WSA 501
Cable glands	WSA 133
Cables for smoke ventilation – see separate data sheet for further information	WLL 8xx
Comfort keypad for 1 window or 1 window group	WSK 110 0A0B
Spare parts	
4A power supply unit for WSC 104	WCA 1P1
Main card incl. cover	WSA 1SS
Replacement glass for break glass units' type WSK 501 / 502 / 503 / 504, 5 pcs.	WSK 397
Keys for break glass units' type WSK 501 / 503, 5 pcs.	WSK 398
Keys for break glass units' type WSK 502 / 504, 1 pcs.	WSK 453
Lockable replacement PVC housing for break glass unit x=colour of the housing: 1 = red, 2 = yellow, 3 = grey, 5 = orange	WSK 399 000x

5 Technical data

Technical data	
Output current (nominal)	4A
Secondary voltage	Voltage 24 VDC (±15%) Open circuit voltage (no load) 24 VDC @ 20°C Ripple at max. load 150mVp-p
AUX	24 VDC, 500mA
Motor lines Smoke zones	1 motor line – the line can be either 24 VDC standard motor line or MotorLink® motor line. 1 smoke zone.
Primary voltage	230V AC, 50Hz (85-264V AC, 47-63Hz)

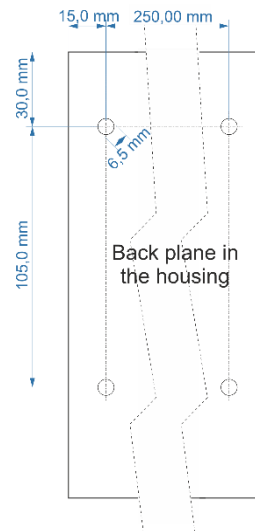
Power consumption	Min. config. 1.62W ¹ . Max. config. 3.38W ² . At max. load 120W 1) min. config. idle: 1 x break glass unit WSK 501 and 1 x smoke detector WSA 311, system operational but no actuators are running 2) max. config. idle: 1 x break glass unit WSK 501, 9 x break glass units WSK 503, 4 x smoke detectors WSA 311 and 1 x rain sensor WLA 330 system operational but no actuators are running 3) max. load: 1 x break glass unit WSK 501, 9 x break glass unit WSK 503 and 10 x smoke detectors WSA 311 in alarm. actuator output and AUX fully loaded.	
Leakage current	Max. 1.4mA @ 240VAC	
Inrush current on primary site	50A / 230VAC Max. 5 x WSC 104 per 10A supply group. Circuit breaker "C" characteristic.	
±24V change over time	Min. 500ms	
Back-up batteries	2 x WSA 003 (12 VDC / 3.4A), Expected lifetime max. 4 years, only use genuine WindowMaster supplied batteries	
Emergency power	>72 hours in accordance with EN 12101-10	
Charging unit (integrated in WSA 1SS card)	Charging voltage: 27.7 – 27.8 VDC at 20°C Charging current: 700mA current limited	
Priority	Smoke signal has always highest priority	
Cable monitoring	24 VDC standard actuators with end of line module and smoke detectors are monitored. Actuators with MotorLink® and break glass units are monitored by data communication. Back-up batteries are monitored by cyclic measuring	
LED message OK, fault and alarm	Green Yellow Red	all OK fault fire
Reopening the actuators	Every 2 nd min. in 30min. after a SHE open (selectable) Pre-set: <u>no</u> reopening	
Connection cable	Actuators Other components	flexible max. 6 mm ² / solide max. 10 mm ² min. 0.2mm ² / max. 1.5mm ²
Operating conditions	-5°C - +40°C, max. 95% relative humidity (not condensing) EN 12101-10: Operation class A, Environmental class 1, IP30	
Max. actuator activation duration (duty cycle)	ED 40% (4min. per 10min.)	
Max. allowed current drawn from the battery when the primary power source is disconnected	4A incl. AUX The total current consumption may not exceed 4A incl. load on AUX (max. 500mA)	
Max. interruption time during switching between power sources	<2.0sec	
Break glass unit	Up to 10 break glass units type WSK 50x can be connected to the panel, but only 1 WSK 501 / 502 per panel. Smoke detectors and ventilation keypads can only be connected to the break glass units type WSK 501 / 502. Smoke detectors and ventilation keypads <u>cannot</u> be connected to WSK 503 / 504. Up to 10 smoke detectors can be connected to the system. Smoke detectors can either be connected to the WSK 501 / 502 and/or the smoke detector input on the main card. There is no limit on the number of ventilation keypads connected to the WSK 501 / 502.	
Number of motor lines	1 x 4A motor line for 24 VDC standard or MotorLink® actuators	
Material	Plastic housing for surface mounting	

Colour	White (RAL 9016)
Size	224 x 283 x 85mm (H x W x D)
Weight	1.2kg no batteries, 4kg with batteries (2 x WSA 003)
Protection class	IP30
Approval / certification	Approved and certified according to EN 12101-10 and ISO 21927-9
Delivery	CompactSmoke™ smoke ventilation panel, 7 x 10kΩ resistors, 1 x WSA 514 end of line module. Back-up batteries included.
Note	We reserve the right to make technical changes

6 Mounting

The smoke ventilation panel is fixed to the wall through the Ø6.5mm holes in the back plane of the housing.

The smoke ventilation panel is to be mounted in a safe place, protected from the effects of fire and smoke.



7 Installation

7.1 Cable routing

For cable routing we recommend the use of fire protected cables retaining their function E90 or E30.

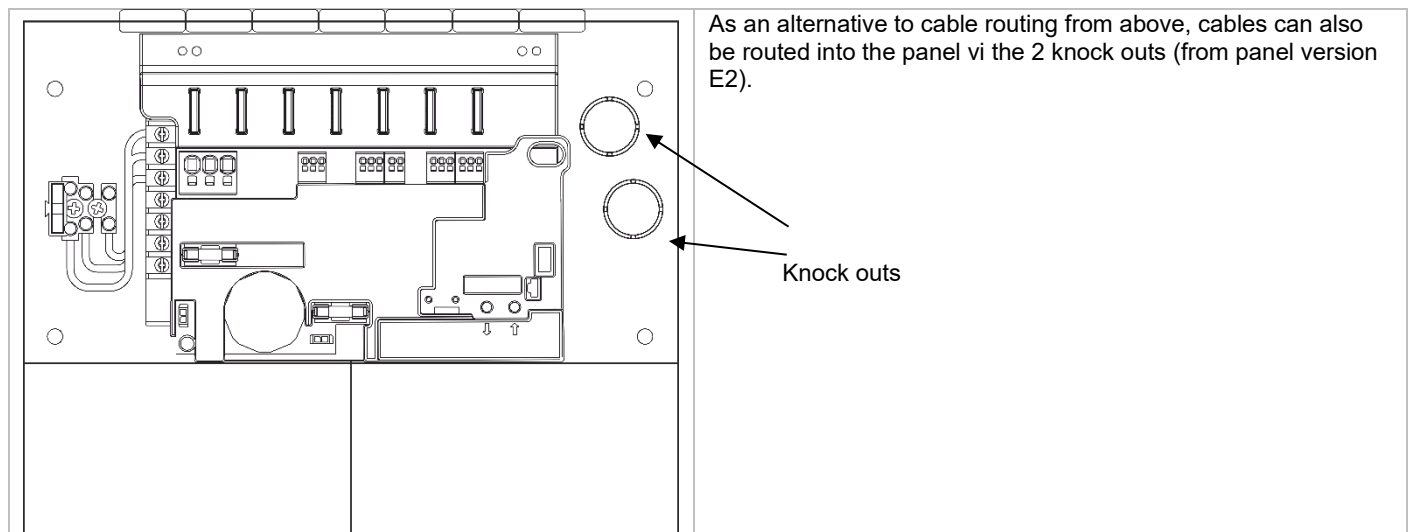
See also chapter 8 "Cable dimensioning" in this instruction.

However, this must be agreed with the Engineer or, if necessary, with the local fire protection department.

Do not reduce the cable cross sections specified in the cable lengths table.

All cables of the control (except the mains supply cable) carry 24 VDC and must be routed separate from the mains supply cable. Adhere to the pertinent national and local regulations when routing the cables.

Lead the connection cables into the housing of the control panel from above. Cable glands must comply with fire class V-1 (IEC/EN 60695-11-20 / UL 94) or higher and be in accordance with national and local regulations.



7.2 Cables into housing

All connection terminals (except the mains terminals) are of the plug-in type.

Connect the connection cables in accordance with the terminal plan. Ensure that the connections are made correctly.

Incorrect cable clamping, mixing up numbers or colours could lead to malfunctions of the control panel or of the external components.

Ensure that the electrical cables are always routed according to the valid national and local regulations.

7.3 Connection of safety earth wire and mains

See chapter 9 "Description of card and mains connection" for further description.

7.4 Installation of the break glass unit, ventilation keypad and smoke detector

Ensure that the break glass unit and the ventilation buttons are visible and well accessible. Do not install behind protruding walls, door panels or hidden by the building structure.

Note: Installation height of the break glass unit 1.5 – 1.7m above floor.

Install the smoke detectors in accordance with their enclosed instructions.

7.5 Assembly instructions

Always have assembly, installation, repair and maintenance of smoke and heat extraction systems carried out by qualified personnel trained for this purpose.

Rules to be adhered to for setting up and installation

The following safety relevant rules must be adhered to when planning the use of a smoke and heat extraction system and its set-up and installation:

- The Provincial Building Ordinance of the provinces,
- The regulations of the competent fire protection authority,

Accident prevention regulations

Adhere to the general accident prevention regulations (APR), the APR for power operated windows and doors, and the installation rules in your country.

CAUTION:

Live components are directly accessible after opening the system housing.

Prior to inserting / removing cards disconnect power to the panel from the mains supply and the back-up batteries.

- adhere to the installation instructions and your local energy providers
- select the place of installation such that free access is guaranteed for maintenance purposes
- select cables according to regulations in this instruction - take the calculation of the actuator supply cable lengths into account when laying the cables
- power cables entered via the cable glands
- connect the cables in accordance with the drawings provided by the manufacturer
- route the cables in the building according to the regulations in this instruction
- after the smoke panel is installed the back-up batteries will be fully charged after ca. 8 hours
- check all system functions

Electric cable routing for smoke and heat extraction systems

Electrical cables must be laid in accordance with the national and local rules in your country.

Do not use the PE wire / green/yellow wire!

Cables of type NYM, concealed, can be used.

For surface laying, halogen free safety cables are recommended (see cable plan).

If possible, the use of cable types should be agreed with the Technical Services and the competent fire protection authority.

For the maximum permissible cable lengths of the actuator supply cables for the WSC 104 system, taking the specified cable cross sections into account (cable information for surface laying), please refer to chapter 8 "Cable dimensioning".

8 Cable dimensioning

8.1 Maintaining the cable functions

According to valid national regulations.

The cable network for smoke ventilation systems ("Cable system") ends normally at the interface (junction box) for the actuator! The flexible, heat-resistant connection cable of actuator is part of the system component, electric actuator actuation, and is not a part of the electrical installation!

We recommend in all cases to discuss the type of cable routing with the competent firefighting authorities.

8.2 Max. cable length

Maximum permissible cable length from the smoke ventilation panel to the actuators and pyrotechnic gas generator taking into account the cable cross-section is shown in the following tables for "24 VDC standard actuators", "MotorLink® actuators" and "Pyrotechnic gas generator".

8.2.1 Formula for the calculation of the maximum actuator cable length

$$\text{Max. cable length (m)} = \frac{56 \times \text{cable cross section (mm}^2\text{)}}{\text{Max. total actuator current (Amp)}}$$

For both 24 VDC standard actuators and actuators with MotorLink® the cross section of the cable must not be less than 0.75mm² regardless of the result of above formula.

Maximum actuator cable length: Always measured from the smoke panel to the last junction box

Permissible max. voltage drop in the line: 2 V

Actuating current: Sum of all actuator power consumption per motor line

Note: do not use the PE wire / green/yellow wire!

Example Max. actuator cable length with cable cross section 0.75mm² and actuator current 2A: $(56 \times 0.75) : 2 = 21\text{m}$

8.2.2 Max. cable length – 24 VDC standard actuators

The actuator supply cable must have 3 wires: 2 wires current carrying / 1 wire for monitoring.

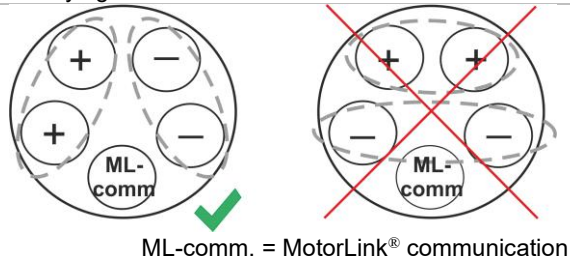
24 VDC standard Actuators						
Do not use the PE wire / green/yellow wire!						
cable cross section [a]	3-wire 0.75mm²	3-wire 1.50 mm²	5-wire 1.50 mm² 2-wire parallel	3-wire 2.50 mm²	5-wire 2.50 mm² 2-wire parallel	3-wire 4.00 mm²
Total actuator current [I]						
1A	42m	84m	168m	140m	280m	224m
2A	21m	42m	84m	70m	140m	112m
3A	14m	28m	56m	47m	93m	75m
4A	11m	21m	42m	35m	70m	56m

8.2.3 Max. cable length – actuators with MotorLink®

The actuator supply cable must have 3 wires: 2 wires current carrying / 1 wire for communication.

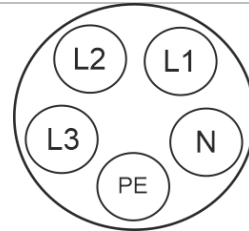
When a 5-wire cable is used for MotorLink®

It is not recommended to use parallel wire.



Furthermore, when using a 5-core cable, the distance between "–" and "Comm." must be the same as the distance between "+" and "Comm.".

Meaning if L2 e.g. is being used as "Comm." L1 and L3 must be used for "+" and "–".



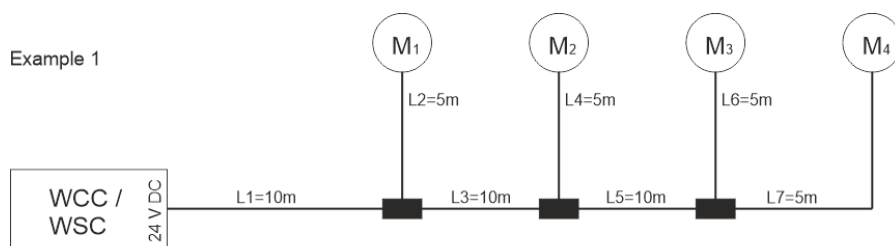
When using actuators with MotorLink® the max/total cable length is 50m regardless of the result of the above mentions formula.

Actuators with MotorLink®						
Do not use the PE wire / green/yellow wire!						
cable cross section [a]	3 wire 0.75mm²	3 wire 1.50 mm²	5 wire 1.50 mm² 2 wire parallel	3 wire 2.50 mm²	5 wire 2.50 mm² 2 wire parallel	3 wire 4.00 mm²
Total actuator current [I]						
1A	42m	50m				
2A	21m	40m	50m			
3A	14m	28m	50m	47m	50m	
4A	11m	21m	42m	35m		

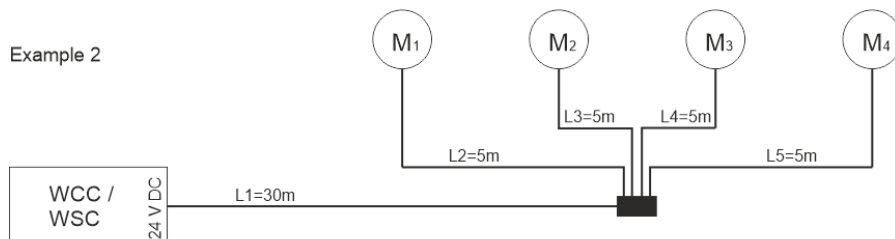
Definition of total cable length

The total cable length is defined as the sum of all cables from the panel output to the last actuator. Including the cable mounted on the actuator.

For example, in case of 4 actuators with 5m cable each, the remaining cable length is 30m.



$$\text{Total cable length} = L1 + L2 + L3 + L4 + L5 + L6 + L7 = 10\text{m} + 5\text{m} + 10\text{m} + 5\text{m} + 10\text{m} + 5\text{m} + 5\text{m} = 50\text{m}$$



$$\text{Total cable length} = L1 + L2 + L3 + L4 + L5 = 30\text{m} + 5\text{m} + 5\text{m} + 5\text{m} + 5\text{m} = 50\text{m}$$

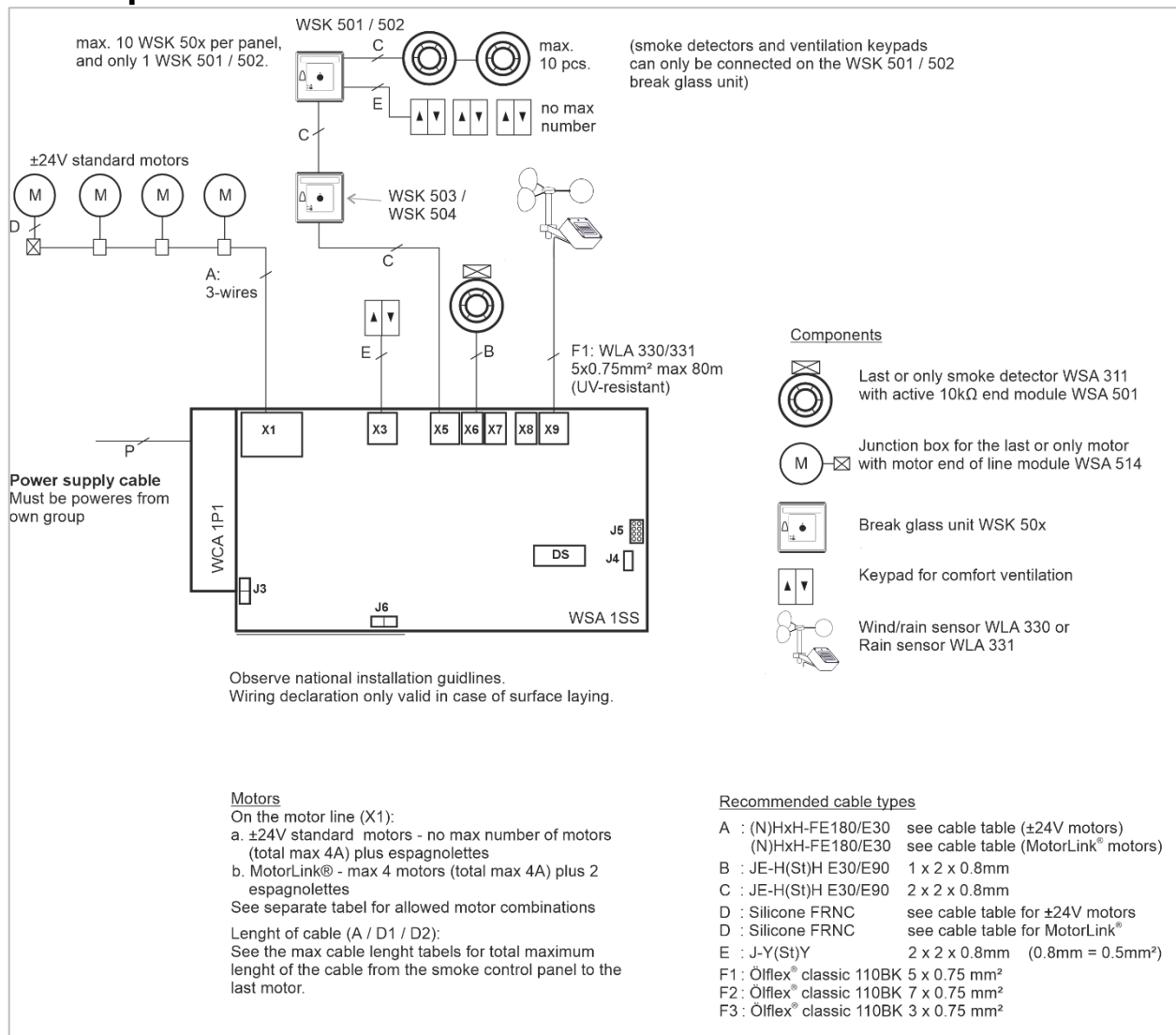
8.2.4 Max. cable length – Pyrotechnic gas generator

Pyrotechnic gas generator**						
Do not use the PE wire / green/yellow wire!						
cable cross section [a]	3 wire * 0.75mm ²	3 wire * 1.50 mm ²	5 wire 1.50 mm ² 2 wire parallel	3 wire * 2.50 mm ²	5 wire 2.50 mm ² 2 wire parallel*	3 wire * 4.00 mm ²
Total actuator current [I]						
1A	42m	84m	168m	140m	280m	224m

* flexible stranded cores are only suitable with attached ferrules. Max. 1 core / ferrule per terminal.

**WSC 104 has been tested with Chemring type 1.3.

9 Cable plan for connection to WSC 104

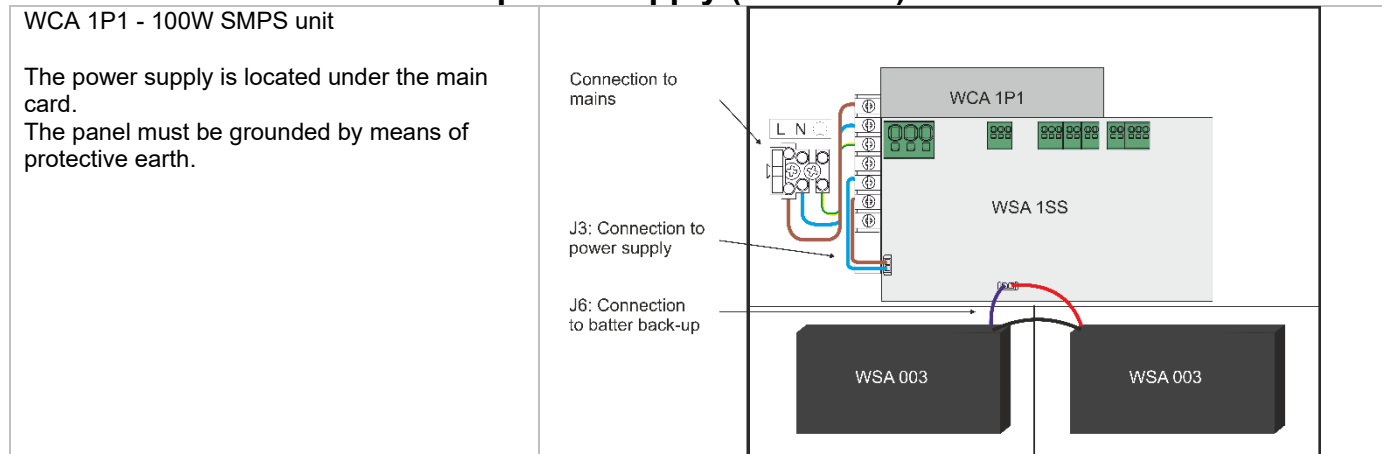


The above plan shows the WSC 104 with 24 VDC standard actuators connected.

10 Description of card and mains connection

The panel includes a power supply unit (SMPS) and a main card.

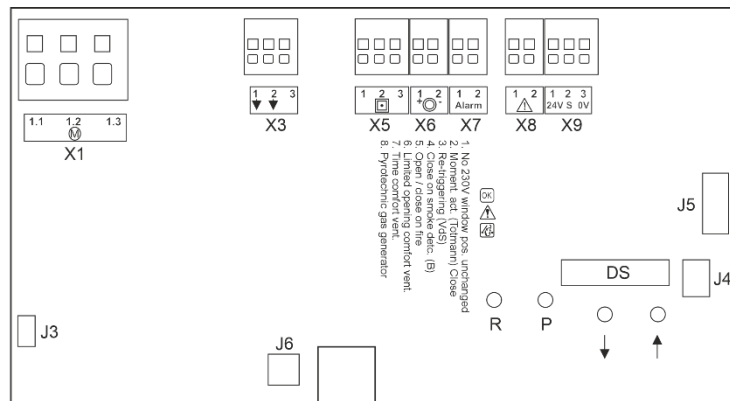
10.1 Mains connection and power supply (WCA 1P1)



10.2 Main card WSA 1SS

The WSA 1SS contains the following:

- 1 motor line for 24 VDC standard or MotorLink® actuators
- 1 input for keypads for comfort ventilation
- 1 input for break glass units
- 1 input for smoke detector
- output for alarm signal
- output for fault signal to Fire Alarm System
- Input for rain sensor station (WLA 330 / 331)
- Connection of power supply
- Connection for battery back-up
- Connection for USB device



X1	1.1 24V / 0V 1.2 Cable monitoring / MotorLink 1.3 0V / 24V	X9	9.1 24V 9.2 Rain 9.3 GND / 0V
X3	3.1 Open 1.1 3.2 Close 1.2 3.3 GND / 0V	DS	DIP switches 1-8
X5	5.1 24V 5.2 Comm. 5.3 0V	J3	Connection to power supply
X6	6.1 + 6.2 -	J4	USB device
X7	7.1 Normally open. Closed = Alarm 7.2	J5	No function
X8	8.1 Normally closed. Open = Fault 8.2	J6	Battery pack connection
		↓ ↑	Close and open all windows Auto configuration
		R / P	Reset / Programming

X1

The WSA 1SS card has 1 motor lines for connection of 24 VDC standard actuators, MotorLink® actuators or pyrotechnic gas generator.

24 VDC standard actuators

- 1.1 24 VDC / 0V
- 1.2 Cable monitoring
- 1.3 0V / 24 VDC

MotorLink® actuator

- 1.1 0V
- 1.2 Communication
- 1.3 24 VDC

Pyrotechnic gas generator

- 1.1 24 VDC
- 1.2
- 1.3 0V

The number of actuators on the motor line depends on the actuator type, the total power consumption of actuators connected to the motor line may not exceed 4A.

Besides actuators also locking actuators (espagnolettes actuators) type WMB 801/802, WMB 811/812, WMB 815/816 and WMB 817/818 can be connected. The power consumption of the locking actuators is not to be included in the 4A as actuators and locking actuators do not run at the same time.

All actuators on the motor line will run/be operated simultaneously.
All actuators on the motor line must be of the same type.

Connection / cable diameter: flexible max. 6 mm² / solid max. 10 mm².
Cable length: see the chapter "Cable dimensioning".

Standard 24 VDC actuators

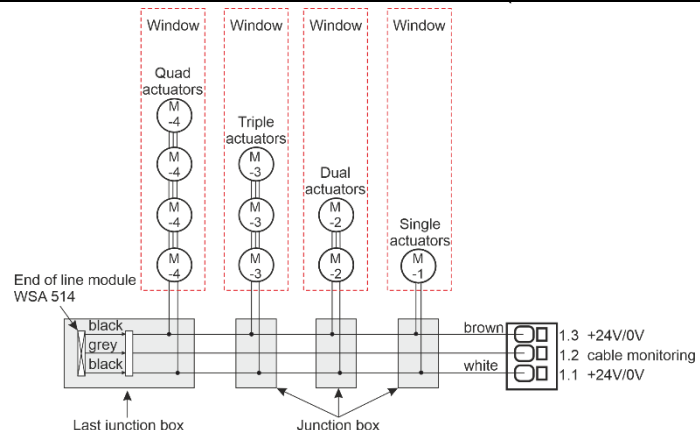
Examples with 4A power consumption

- a) 4 pcs. WMX 826-1
- b) 2 sets of 2 pcs. WMX 826-2
- c) 1 pcs. WMU 884-1

Cable monitoring

When using 24 VDC standard actuators or non-WindowMaster actuators an "end of line motor module" type WSA 514 must be added in the last junction box. Actuators cables are always monitored.

Connection of standard actuators on motor line X1 (with cable monitoring)



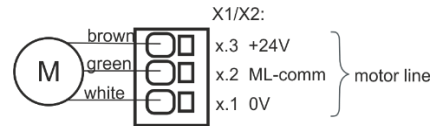
MotorLink® actuators

Examples with actuators per motor line

Ex. 1: 4 pcs. WMX 823-1

Ex. 2: 2 pcs. WMU 882-2

Ex. 3: 3 pcs. WMU 826-3



ML-comm = MotorLink™ communication

Allowed actuator combinations on a MotorLink® motor line

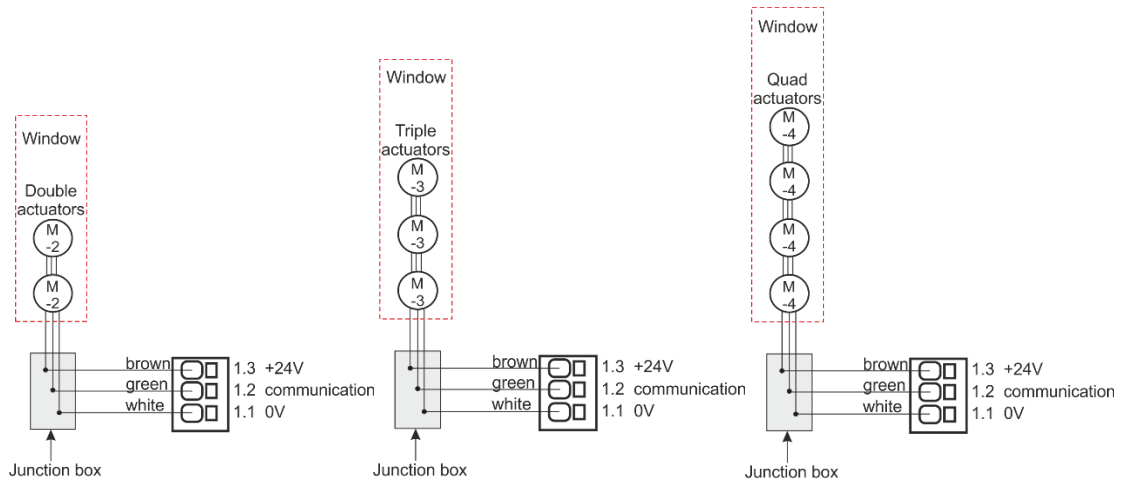
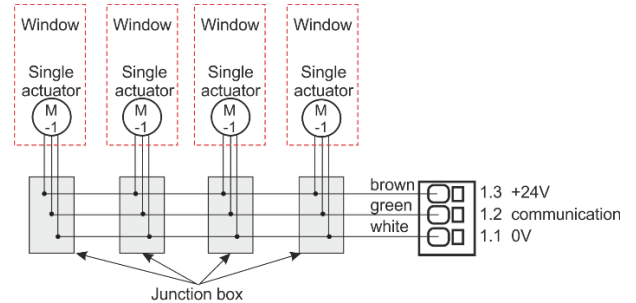
The motor line can be connected to one of the below shown combinations.

-1 (single): one window with one single window actuator. Up to four windows each with one single window actuator can be connected.

-2 (double): one window with two double window actuators.

-3 (triple): one window with three triple window actuators.

-4 (quad): one window with four quad window actuators.



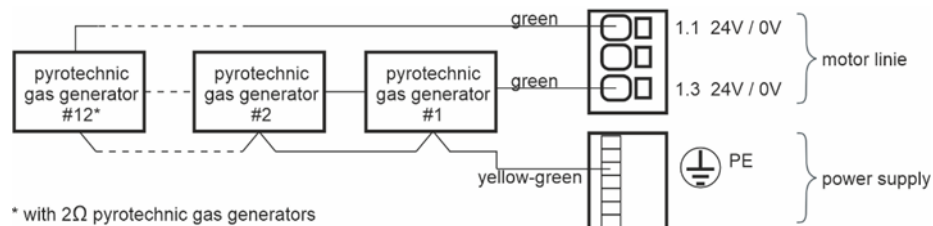
Cable monitoring

When using actuators with MotorLink® the actuators are monitored by data communication. When the team-size does not match, an error is indicated on the diodes.

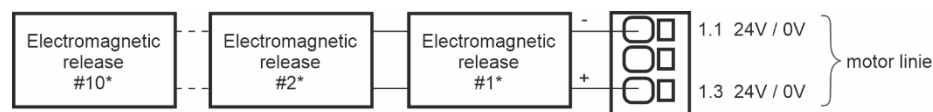
Pyrotechnic gas generator or electromagnetic release

When a pyrotechnic gas generator or an electromagnetic release is connected to the smoke panel, DIP-switch 8 must be set to ON, see "DIP-Switch configuration".

A pyrotechnic gas generator is connected to the smoke panel via the motor line and PE.



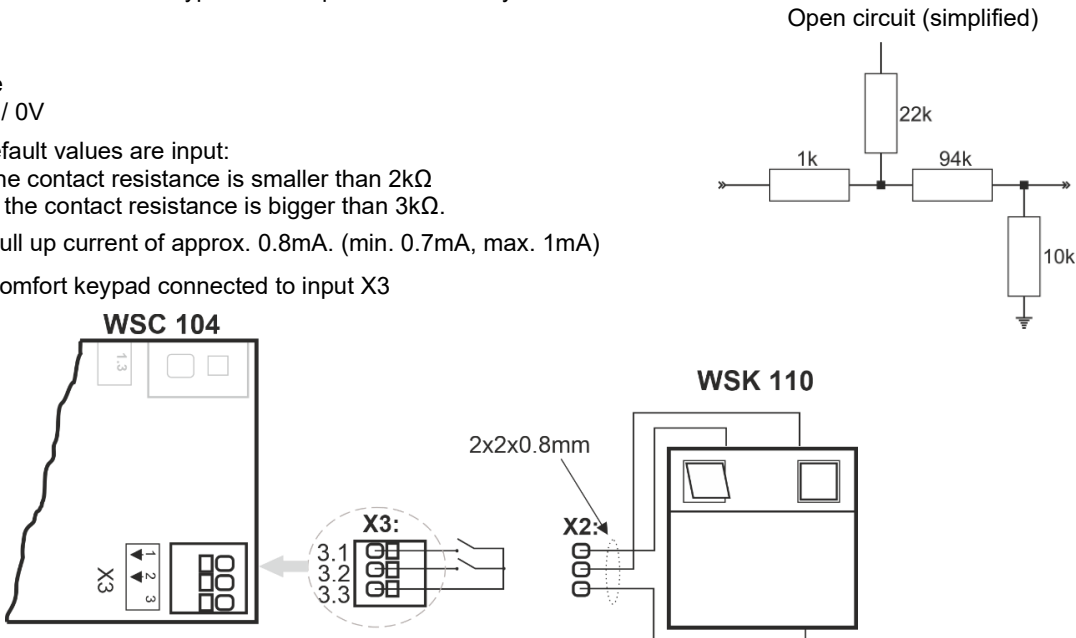
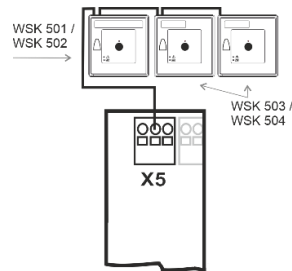
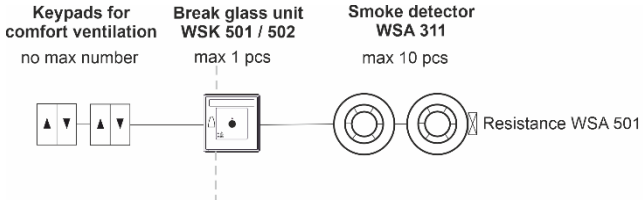
An electromagnetic release is connected to the smoke panel via the motor line.



* med 24VDC /150mA electromagnetic release

An end of line motor module (WSA 514) is not to be connected when pyrotechnic gas generators or electromagnetic releases are connected, but the cables are still being monitored.

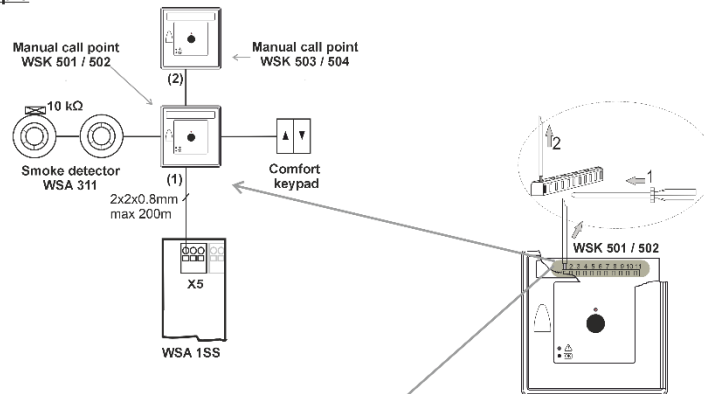
Max. 12 pyrotechnic gas generators or max. 10 electromagnetic releases can be connected to the smoke panel.

	IMPORTANT an auto configuration is not to be carried out when pyrotechnic gas generators nor electromagnetic releases are connected! When DIP switch 8 is changed from ON to OFF and no pyrotechnic gas generators nor electromagnetic releases are connected, an auto configuration must be performed. Note Connection of pyrotechnic gas generators or electromagnetic releases requires firmware version from 1.04.
X3	For connection of comfort keypads. X3 is potential free / dry contact. <u>Data</u> 3.1 Open 3.2 Close 3.3 GND / 0V With the default values are input: "Active" if the contact resistance is smaller than 2kΩ "Inactive" if the contact resistance is bigger than 3kΩ. Input has pull up current of approx. 0.8mA. (min. 0.7mA, max. 1mA) Example: comfort keypad connected to input X3 
X5	For connection of WSK-Link™ units; break glass unit type WSK 50x or fireman's override switch WSK 510. <u>Data</u> 5.1 + 5.2 Communication 5.3 0V Up to 10 break glass units type WSK 503 or WSK 504 can be connected to the smoke panel. If keypad and smoke detector are to be connected to the break glass unit, WSK 501 or WSK 502 are to be used. Max. one of these break glass unit on the panel, the remaining units (up to nine) must be of type WSK 503 or WSK 504. Up to 10 fireman's override switches type WSK 510 can be connected to the smoke panel. If both break glass units and fireman's override switches are connected to the smoke panel, max 10 units in total can be connected and still only one of these units can be a break glass unit type WSK 501/502. Break glass unit must not be connected in a ring bus. The cable length from the smoke control panel to the last break glass unit must not exceed 200m.  Keypads and smoke detectors can also be connected to a break glass unit type WSK 501 / 502. Up to 10 break glass units can be connected to a panel. But only 1 of these 10 can be a type WSK 501 / 502 to which keypads or smoke detectors can be connected. The remaining break glass units must be type WSK 503 / 504. 

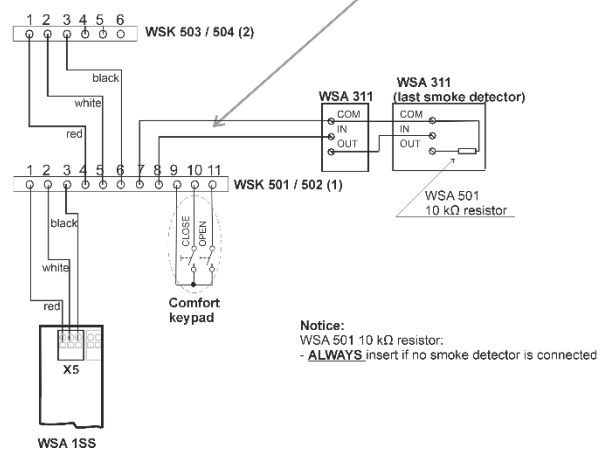
Example:

A smoke zone and connected components; 1 break glass unit type WSK 501 / 502 and 1 break glass unit type WSK 503 / 504, 2 smoke detectors WSA 311, 1 resistor WSA 501 and 1 comfort keypads.

Example



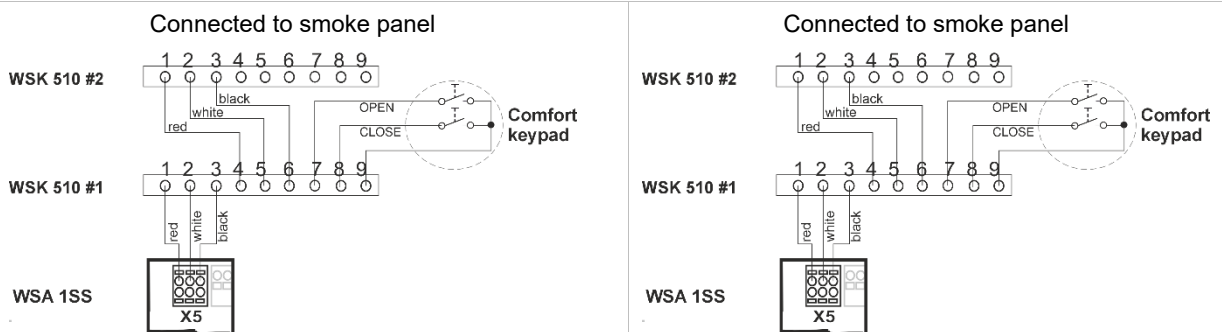
Wiring diagram for example



When there is no smoke detector connected to the WSK 501 / 502 a 10kΩ resistor must be connected to the break glass unit on terminal 7 and 8. When a smoke detector is connected to the break glass unit, the 10kΩ resistor must be connected to the last smoke detector. See chapter 8 "Cable plan for connection to WSC 104" for cable types and lengths.

Connection to Fireman's override switch type WSK 510

The WSK 510 can be connected directly to the smoke panel or to a break glass unit type WSK 50x. The WSK 50x and the WSK 510 can be connected in an arbitrary order, the max number must however not exceed 10.



Comfort keypads can be connected to WSK 510. Smoke detectors cannot be connected to WSK 510. Per panel up to 10 Fireman's override switches can be connected. Please see WSK 510 instruction for configuration.

		Smoke detector type			
		WSA 300 (max. 10 pcs.)	WSA 311 (max. 10 pcs.)	Hekatron MSD 523 (max. 5 pcs.)	Hekatron SSD 521/a (WSA 200 6101)
Connect to WSA 1SS	X6.1	L1 In	In +	2	2
	X6.2	L2	Com -	1	1
Connect to WSK	p 7	L2	Com -	1	1
	p 8	L1 In	In +	2	2
ALWAYS connect 10 kΩ in between		L2 and L1 Out	Com – and Out +	1 and 3	1 and 3

X8	Solid state output for transmission of fault signal to 3rd party systems e.g., Fire Alarm System <u>Data</u> 8.1 } Normally closed. Open = Fault 8.2 } Solid state output for transmission of fault signal to 3rd party systems. A fault must last min. 20 seconds before the relay indicates a fault. Data Max. voltage: 30 V_p (peak) Max. current: 150 mA Typical On-resistance: 4.7 Ω Max. On-resistance: 8 Ω Max. switching speed: 2 ms
X9	For connection of rain sensor. Connection of wind / rain sensors type WLA 330 or rain sensor WLA 331. <u>Data</u> 9.1 24 VDC 9.2 Rain (potential free / dry contact) (10kΩ resistor is to be moved to the Rain sensor) 9.3 GND / 0V With the default values are input: "Active" if the contact resistance is smaller than 4kΩ "Inactive" if the contact resistance is bigger than 8kΩ. For values between 4 and 8kΩ the result will depend on the supply voltage. Input has pull up approx. 1mA. (min. 0.7mA, max. 1.4mA) Example: Wind/rain and rain sensors WLA 330 and WLA 331– the settings of the sensors are set on the sensor. The diagram illustrates the wiring for three sensors: WSA 1SS, WLA 330, and WLA 331. WSA 1SS is a rectangular unit with terminals 9.1 (24V), 9.2 (S), and 9.3 (0V). WLA 330 and WLA 331 are similar units with terminals 1 through 6, a 10KΩ resistor, and a switch labeled 'off on'. A 5x0.75mm² (UV resistant) cable is shown connecting the sensors. The cable has a central shielded section and two outer conductors. The connections are as follows: WSA 9.1 to WLA 6, WSA 9.2 to WLA 5, WSA 9.3 to WLA 4, WLA 3 to WLA 2, WLA 1 to WLA 1, and WLA 6 to WLA 6. The 10KΩ resistor is connected between WLA 3 and WLA 4. The switch is connected between WLA 2 and WLA 1.
J3	Connection for power supply
J4	USB device. Used for remote control and update of firmware
J5	No function
J6	Connection for battery (power back-up)
R / P	Reset / Programming (used for firmware updates)
DS	DIP switch blocks with 8 DIP switches 1 – No 230V window position unchanged 2 – Momentary action open / close 3 – Re-triggering by alarm (VdS) 4 – Close on Smoke detector 5 – Open / close on fire 6 – Limited opening comfort ventilation 7 – Time comfort ventilation 8 – Pyrotechnic gas generator See section 11 for further detail

LED	Shows the status of the panel Red = alarm Yellow = fault Green fast flickering = all OK (CPU working), Green constant = CPU communication stopped (possible reset or contact WindowMaster)
↓ ↑	Close / open all windows. When pressed together right after power has been connected or when pressed together for more than 7 seconds the panel configures / registers connected components.

11 DIP switch configuration

For easy configuration the smoke panel includes 8 DIP switches. The factory setting for all the DIP switches is OFF.

DIP switch	Description on the panel	Description	DIP switch position	Possible consequence
1	No 230V window pos. unchanged	No 230V window position unchanged	ON: No change in position in case of power failure OFF: The windows close in case of power failure.	This function becomes suspended when DIP switch 2 is ON.
2	Moment. act. Open / Close	Momentary action OPEN / CLOSE (Comfort ventilation)	ON: The window actuators run for as long as the comfort keypad is pressed. Applies only to comfort keypads connected to X3. OFF: The windows close / open completely when pressing the comfort keypad once.	
3	Re-triggering (VdS)	VdS triggering by alarm	ON: When the alarm is triggered, the actuators will, in accordance with VdS 2581, for a duration of 30min. be triggered to shortly reverse and open every second minute. OFF: Normal alarm	
4	Close on smoke detc. (B)	Smoke detector – CLOSE (Primarily used in Switzerland)	ON: When the alarm is triggered by a signal on the smoke detector input, X6 or terminals 7/8 on the break glass unit, the windows will close. A following operation of a break glass unit will leave the system in alarm but trigger the actuators to open the windows. Break glass units have higher priority than smoke detectors. OFF: Regardless of if the alarm is triggered by smoke detectors input or the break glass units, the window actuators will open the windows	
5	Open / Close on fire	The windows open or close in case of fire alarm from break glass unit	ON: The windows close in case of fire alarm activation from pressing the alarm button on the break glass unit. OFF: The windows open in case of fire alarm activation from pressing the alarm button on the break glass unit.	
6	Limited opening comfort. vent	Window opening is limited (Only by comfort ventilation)	ON: The window opening is limited to 30% (18 seconds stroke time) during comfort ventilation OFF: The windows will open 100% during comfort ventilation When DIP switch 6 is changed from OFF to ON and 24 VDC motors are connected to the panel, close the motors completely and wait 2 minutes. This must be repeated every time the central unit is restarted/started. This ensures that comfort ventilation is working.	See note below
7	Time comfort vent.	Window opening is time limited (Only by comfort ventilation)	ON: The windows will close after 30min. during comfort ventilation OFF: The windows will close when triggered by safety signal or close command	

DIP switch	Description on the panel	Description	DIP switch position	Possible consequence
8	Pyrotechnic gas generator	Pyrotechnic gas generator is connected	ON: A pyrotechnic gas generator is connected OFF: Window actuators are connected When DIP switch 8 is changed from ON to OFF the panel must be re-configured, see section 13 "Configuring of panel".	

Note. The "Limited opening comfort ventilation" set by DIP switch 6 is during a grace time period disabled and the windows will in this period open 100% when given a manual open command.

Grace time periods:

MotorLink™ actuators:

- 30 sec. after the windows were closed with a safety signal (0% max opening command) or a reset after alarm

24V standard actuators:

- Safety signal: 2 min after the windows were closed with a safety signal (0% max opening command)
- Reset after alarm: 30 sec after the windows were closed with a reset after alarm.

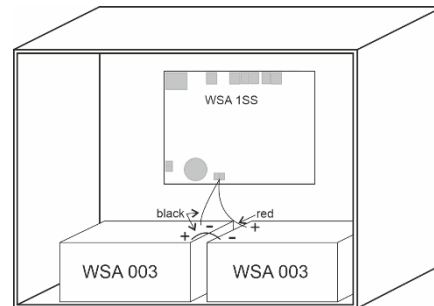
The safety signal can for example be a rain signal or a reset after smoke and heat ventilation activation. Once the grace time period has expired, the limited window opening is again active.

12 Back-up batteries

Connect 2 pcs. back-up batteries type WSA 003

See section 17 "Maintenance" for further information.

Batteries must be connected before 230 V.



Panel with back-up batteries.

13 Configuration of panel

The smoke panel is configured by pressing the two keys "↑" and "↓" on the main card, at the same time for 5-10 seconds.

The smoke panel must be configured

- After re-installation, changes, or change of actuators
- When / if MotorLink® actuators are connected
- If the cables have been moved
- When components are removed from the panel
- If there has been a fault on the WSK-Link™. Error blink sequence 6, see section 14.1.
- When DIP switch 8 is changed from ON to OFF

Note, during reconfiguration the actuator output can be activated in both directions.

If the yellow diode on the main card blinks after a configuration, an error has occurred in the configuration, see section 14 "Fault detection via LED" for identification of errors.

13.1.1 Motor line

Actuators are to be connected on the motor line. 24 VDC standard actuators or actuators with MotorLink® can be connected to the motor line, the motor line can only be connected to one type of actuators – either 24 VDC standard or MotorLink® actuators. The panel will automatically detect the type of actuator, that are connected to the panel.

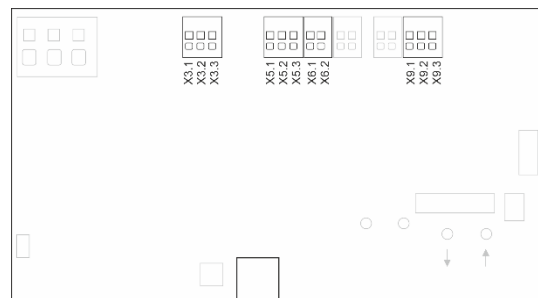
13.1.2 Smoke zone

Depending on the settings on the DIP-switches the actuators will either open or close when the smoke panel is triggered, see section 11.

13.1.3 Local input

The four inputs on the panel are pre-configured with the functions as shown below.

X3 Comfort keypads
X5 Break glass unit
X6 Smoke detector
X9 Rain sensor

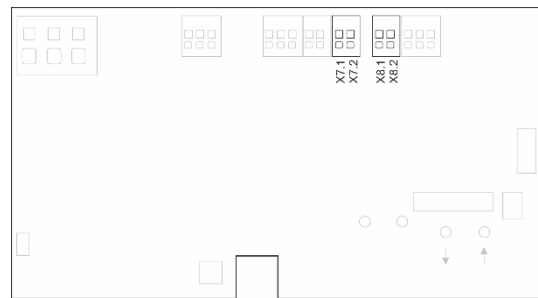


Inputs on the smoke panel

13.1.4 Local output

The outputs on the panel are pre-configured with the function as shown below.

X7 Fire alarm active
X8 Any error on the panel



Outputs on the smoke panel

14 Fault detection via LED

14.1 Fault detection on the smoke panel

In case of error on the panel, the yellow diode on the main card will blink and via blink sequence indicate an error message. Depending on the type of error, the message will consist of 2 or 3 blink sequences, separated by a second pause. The first blink in an error message has a duration of one second, and thereby indicates when the error message (1st blink sequence) begins. The remaining blinks of the error message have a duration of 0.5 seconds. The error message is repeated until the error has been rectified. Between 2 error messages there is a pause of 2 sec.

Example of an error message

"One blink of 1 second + 6 blinks of 0.5 seconds (7 blinks in all) – 1sec. pause – 2 blinks – 1 sec. pause – 1 blinks".

1. There is an error on a local input.
2. The error is on input X9.1, to which a rain sensor might be connected.
3. The error is due to no connection to the sensor or the 10 kΩ resistor not being mounted in the sensor.

If there are more errors on the panel simultaneously, they are shown with priority, i.e., the error message for the most critical error is shown first and repeated until rectified. Then the error message number 2 is shown and repeated as well until the error is rectified etc. Below table, list the most common errors.

Error message					
1. Blink sequence		2. Blink sequence		3. Blink sequence	
Number of blinks	Error on	Number of blinks	Error on or error type	Number of blinks	Error type
1	System	1	Internal error (Watchdog reset)		
		2	Internal error (Program CRC)		
3	Smoke zone	1	Max. temp. threshold in the panel has been exceeded – re-configure and check the panel, see section 13 for re-configuration of the smoke panel		

Error message					
1. Blink sequence		2. Blink sequence		3. Blink sequence	
Number of blinks	Error on	Number of blinks	Error on or error type	Number of blinks	Error type
5	Actuator	1	X1 (actuator output)	1	Actuator configuration – check the actuators, check the configuration, when using 24 VDC standard actuators check the termination
				2	Expected number of actuators, the found and expected number of MotorLink® actuators does not match – check actuator connections
				4	Internal error
				5	Auto configuration failed to identify the actuators. - Check the number of MotorLink® actuators connected - Check fuses - May also be caused by hardware defect.
6	WSK-Link™	1	Bus	1	Closed ring – this version does not allow break glass units connected in a closed ring, check connection of break glass units, and disconnect the ring and re-configure
				2	Problem on X5 (break glass unit) – communication with the break glass unit cannot be established
		2	WSK	1	Problem (short circuit, cable problem or termination) with break glass unit #2 connected to a break glass unit– check connection of break glass unit and termination smoke detector input
				3	Offline break glass unit, one or more break glass unit is offline – check and re-configure
				4	Break glass unit sensor (smoke detector connected to break glass unit) – check connection between break glass unit and smoke detector, check termination
				5	The break glass unit version is too old – break glass units must be replaced
7	Local input	1	X6 (smoke detector)	1	Termination – check connection of detectors as well as termination
		2	X9 (rain sensor)	1	Termination – check connection of sensor as well as termination
10	Power supply	1	Internal error		
		2	Mains – check connection		
		3	Back-up batteries – check connection or replace the batteries		
		4	Max. temp. in the panel has been exceeded – re-configure and check the panel, see section 13 for re-configuration of the smoke panel		
		5	Internal error		

If other errors or an “Internal error” are indicated, please contact WindowMaster.

14.2 Fault indication on break glass unit

If the smoke panel loses the mains connection, the green LED on the break glass unit (WSK 501 / 502 / 503 / 504) will flash indicating a warning. The green LED will flash until the system goes into alarm (check power supply (error message 10.2)). With the standard settings it can take up to 10min. before the loss of mains power is indicated as an error.

15 Hardware error

If there are any hardware errors on the panel it will be indicated by the yellow LED switched ON.

15.1 Error on the Power supply

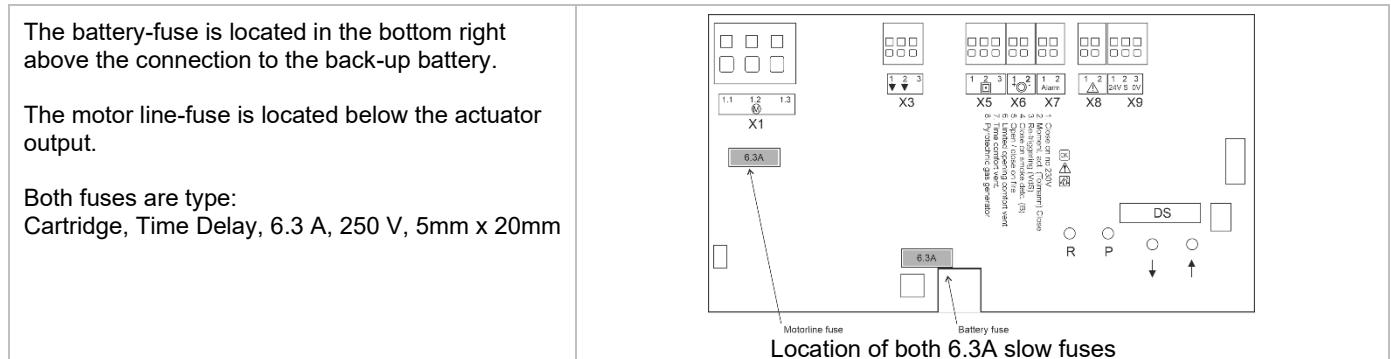
Mains power failure will trigger an error. Within the first minute after the failure has been detected, the green LED in the break glass unit will start to blink. After 10 minutes the green LED on the break glass unit will switch off and the yellow LED will switch on. The error will be indicated on the panel via LED blink sequence, see chapter 14.1 "Fault detection on the smoke panel", and the windows will close.

Furthermore, non-connected, wrong connected or "dead" batteries will also trigger a "Power supply" error indication.

15.1.1 Fuses – 6.3A slow

An "Battery status" error can also be triggered if the battery-fuse (6.3A slow) is blown.

Additionally, a "motor line status" error will be triggered if the motor line-fuse (6.3A slow) is blown.



16 Commissioning and test run

To commission and test the panel start by terminating the relevant peripherals – actuators, break glass units, smoke detectors, comfort switches – in it, next apply power and initiate the auto discovery and configuration process and then test the panels functionality.

We recommend that the commissioning of the smoke panel should be done by a competent smoke ventilation controls installer.

16.1 When the panel is completely installed, without the operating voltage applied

- Check all mechanical and electrical components for damage.
- Check all screw and plug connections for tightness and/or are securely fasten
- Check that all external components are installed:
 - 24 VDC actuators: Is the motor end module inserted in the last or only actuator?
 - Smoke detectors: Is the end of line module inserted in the last or only smoke detector?

16.2 With mains voltage, without accumulator

Adhere to the relevant regulations!

Connect the mains cables and apply the mains voltage.

16.3 With mains voltage, with accumulator

- Connect the accumulators to the black accumulator bridge according to the wiring diagram, then connect the red and the blue connection cable to the red and the black flat plug. Insert the batteries in the smoke ventilation panel according to section 12.
- Plug the red/blue cable on battery pack connection terminal J6, see section 10.2.
Note: Check correct polarity!
- Connect the mains cables and apply mains voltage. Batteries must be connected before mains.

16.4 Automatic configuration

With all the peripherals connected, press „↑“ and „↓“ at the same time for 5-10 seconds, to initiate the automatic peripheral discovery and configuration process.

When the process ends, approx. one minute, check for error indications. See section 15 "Hardware error" and section 14 "Fault detection via LED" for details.

The break glass unit WSK 5xx will only sound the acoustic fault signal if the call point door is closed or if the door contact is pressed.

16.5 Ventilation keypad

Open and close the windows using the keypads and observe closely that the actuators are not impaired in any position by the building structure.

Observe that the actuator cables are not being subject to pulling or pinching.

Check each ventilation keypad individually. Observe that the keypad connected on X3 operates the actuators connected on X1.

Observe that the keypad connected on X4 operates the actuators connected on X1.

16.6 Break glass unit WSK 50x

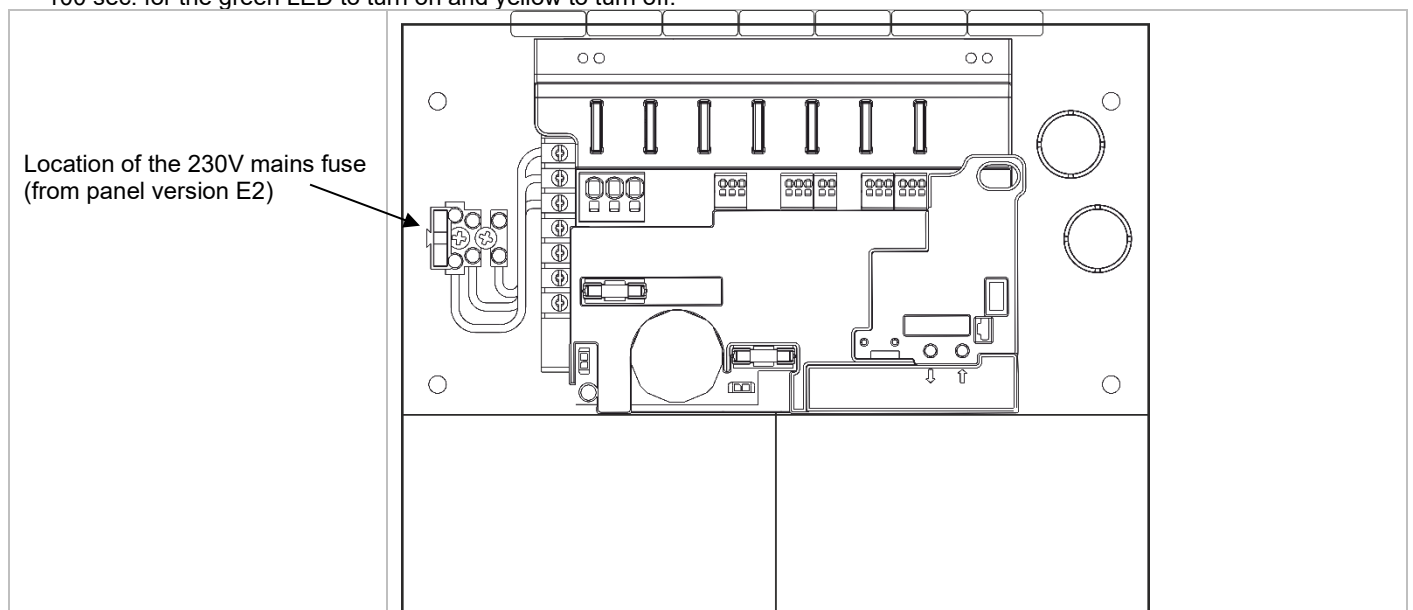
- Open the door and press the black Open button. Check that the actuators open through to the fully open position. Check that the red alarm LED (also in the panel) is ON; at the same time a permanent acoustic signal sounds (door contact on the break glass unit is pressed!).
- Press the Reset/Close button in the break glass unit. The actuators close to the end fully close position. The comfort ventilation function is released again.
- The red alarm LED (also in the smoke ventilation panel) and the acoustic smoke alarm are turned off.

16.7 Smoke detectors

- Spray test aerosol on the smoke detectors.
- The actuators move open to the fully opened position. The red LED in the smoke detector, the red alarm LED (also in the panel) and the permanent acoustic signal in the break glass unit are ON.
- Press the Reset/Closed button in the break glass unit - the actuators close to the fully closed position. The comfort ventilation function is released again. The red alarm LED in the break glass unit and in the panel as well as the acoustic smoke alarm are turned off.

16.8 Emergency power supply test

- Remove the mains fuse from the panel. Wait 10 minutes. See also national guidelines.
- When a mains error has occurred the green LED in the break glass units will flash for 10 minutes. The green LED in the panel is still on and the yellow LED is turned off.
- After 10 minutes the green LED on the break glass unit will turn off and the yellow LED will turn on. In the panel and the yellow LED will blink with the sequence that indicates mains power error, see chapter 14. The acoustic fault signal on the break glass unit will switch on.
- Check that the break glass units are still working (section 16.6)
- Refit the mains fuse.
- The green LED on the panel is on, the yellow LED is off, the error indication on the break glass units is off. It can take up to 100 sec. for the green LED to turn on and yellow to turn off.



16.9 Wind/rain detector

- Open the actuators with the comfort ventilation keypads.
- Wet the rain sensor, the actuators will fully close.
- While the actuators are closing, press the Open button on the keypad. The actuators will open and automatically close again after 30 seconds.
- While the rain sensor is active (wet) activate the fire alarm. The actuators will open to the fully opened position (alternatively to the SHE position)

If the start-up was successful, close the doors of the break glass units and of the smoke ventilation panel.

If the start-up was unsuccessful (error with one of the test run processes), please see chapter 9 "Description of card and mains connection".

If necessary, check the wiring in accordance with the cable plan – see chapter 8 "Cable plan for connection to WSC 104".

If DIP switch #6 is set to ON, please see "DIP switch configuration" for window opening after a safety signal.

17 Maintenance

The panels of the smoke and heat exhaust ventilation system must be checked, serviced and, if necessary, repaired at least once a year by the manufacturer or an authorized partner

Remove all soiling from the units of the smoke and heat exhaust system. Check fastening and clamping screws for firm seating. Carry out a test run of the entire system (see chapter 15 'Commissioning and test run').

Only have defective units repaired in our factory. Only install original spare parts.

Check the operational condition at regular intervals. We recommend a WindowMaster service contract is taken out to ensure the right function of the smoke and heat exhaust system.

All back up batteries coming with the smoke control panel as standard; must be subjected to regular checks.

The smoke ventilation panel will signal fault on the batteries if the battery voltage is below 17 VDC.

Within the framework of the service, they must be replaced after the specified **maximum 4-year** operating period.

Dispose of used batteries according to the National regulation.

CAUTION: RISK OF EXPLOSION IF BATTERIES ARE REPLACED BY AN INCORRECT TYPE.

The expected minimum lifetime for the CompactSmoke™ is 10 years excluding the batteries.

CAUTION: Disconnect Pyrotechnic gas generator cables prior to doing any maintenance work to prevent activation by mistake. Remember to connect the device again when maintenance is concluded.

17.1 Maintenance agreements

Be aware that regular inspection of smoke ventilation systems is a legal requirement in most countries. The legislation requires that the smoke ventilation system's owner inspects and tests the system once every year.

WindowMaster offer maintenance agreements for the smoke ventilation system and every year we inspect the complete system to ensure it complies with the applicable legislation. Maintenance of the smoke ventilation system includes checking windows, window actuators and emergency power and checking that triggering and control functions are fully functional.

Contact our service department for further information:

UK: +44 1536 614 071 or service.uk@windowmaster.com
IE: +353 (0) 1903 9455 or service.ie@windowmaster.com
Other: +45 4567 0300 or info.dk@windowmaster.com

17.2 Replacement 1SS card

1. Disconnect the 230 V and the batteries.
2. Insert the 1SS replacement card.
3. Connect the batteries and turn on the 230 V.
4. Configure the panel again, see chapter 13 – Configuration of panel.
5. The system will be ready again after approx. 2 minutes.

18 Declaration of Conformity and Declaration of Performance

The smoke ventilation panels are manufactured and tested accordingly to the European requirements.

The total system is not to be put into service until a declaration of conformity for the total system has been made.

The "Declaration of Conformity" and the EN certificate are supplied with the panel as separate documents.

Appendix A - WSC 104 S 0101 – DIP Switch setting log

To keep the smoke panel in compliance with ISO 21927-9, changing the DIP switch setting must be logged.

Below table can be used to log the changes.

		DIP switch # 1	DIP switch #2	DIP switch #3	DIP switch #4	DIP switch #5	DIP switch #6	DIP switch #7	DIP switch #8
		No 230V window pos. unchanged	Moment. act. Open / Close	Re-triggering (VdS)	Close on smoke detc. (B)	Open / Close on fire	Limited opening comfort. vent	Time comfort vent.	Pyrotechnic gas generator
Factory setting		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
Date:	Changed By:								
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF
		ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF	ON / OFF