PNOZmulti Special Applications

Configurable Control System PNOZmulti

Operating Manual – No. 1002337-EN-02

This document is a translation of the original document.

Suggestions and comments for improving this documentation will be gratefully received.

SD means Secure Digital.

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1.1 Overview of documentation

1 Introduction

The introduction is designed to familiarise you with the contents, structure and specific order of this manual.

2 Muting

This chapter describes the muting function with units from the configurable control system PNOZmulti.

3 Safety Mat/Safe Edge

This chapter describes the use of pressure-sensitive protective devices with the PNOZmulti.

4 Burners

This chapter describes how to control and monitor burners with the configurable control system PNOZmulti.

1.2 Definition of symbols

Information that is particularly important is identified as follows:

DANGER!
This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!
This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!
This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE
This describes a situation in which the unit(s) could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

INFORMATION
This gives advice on applications and provides information on special features.

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2.1 Introduction

This chapter describes the muting function with units from the configurable control system PNOZmulti. The safe inputs and outputs from base units and expansion modules are suitable.

NOTICE
With a muting application, please refer to the operating manuals provided with the units. Please also refer to the PNOZmulti technical catalogue.

2.2 Safety

2.2.1 Intended use

The muting logic element is used to temporarily suspend safety functions (ESPE/AOPD) without interrupting the process (muting) in accordance with EN 61496-1. For a limited time period and a specific operational phase (e.g. when feeding materials), it will suspend the effect of safety devices during the working process. Once completed, it will reset the safety function.

Use of this operating mode and the arrangement of the sensors are machine or plant-specific and depend on the risk assessment of the machine or plant.

Be sure that you observe the warning notes given in the other parts of this configuration guide and in the PNOZmulti technical catalogue. These are highlighted visually through the use of symbols.

CAUTION!
Failure to observe the safety regulations in this configuration guide and in the PNOZmulti technical catalogue will render the warranty invalid.

2.2.2 Standards

Knowledge of and compliance with the relevant standards and directives are a prerequisite for using the muting function. The following gives an overview of the most important standards:

- EN 61496-1: Safety of machinery – Electrosensitive protective equipment
- EN 60947-5-3: Low voltage switchgear and controlgear - Control circuit devices and switching elements
- EN 999: Safety of machinery - The positioning of protective equipment

Please note this is not an exhaustive list of safety standards and directives.

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2.2 Safety

2.2.3 Safety guidelines

WARNING!
The following information must be heeded! Failure to comply with these guidelines could result in **serious injury or death**.

- Refer to EN 61496-1 and EN 60947-5-3 when configuring, setting up and operating the muting device.
- Refer to EN 999 with regard to the positioning of the AOPD.
- Measures must be taken to exclude common cause failures, e.g. by the use of non-equivalent signals or diverse sensors.
- Muting switches should be positioned so that it is impossible for a person to trigger the muting function.
- The vehicle should be designed to make it impossible for people to ride on it.
- Limit the size of the entry area by applying appropriate safety measures. People must not be able to enter the danger zone during the muting phase.
- If various transport speeds are being used, consider the total duration of the muting phase.
- Remember that a new muting phase can only be introduced once the previous phase has been completed.
- Maintenance gates should be provided if you secure equipment through muting.
- Please note that if the maintenance gates are opened, the plant **absolutely must** be brought to a standstill in accordance with the risk classification.
- Use of muting sensors with contacts: Supply the contacts of the muting sensors via test pulse outputs (test pulses).
- Use of ESPE as muting sensors: Test pulses cannot be used. For this reason, be sure to use a N/O contact as sensor 1 and a N/C contact as sensor 2 for fault detection (shorts across contacts).
- Laying the connection cable to the sensors in a way that is protected against shorts (i.e. separate) may provide an alternative to non-equivalent sensors.

2.3 Configuration in the PNOZmulti Configurator

2.3.1 Functions

- Muting via light beam devices or limit switches
- Override option in case of fault
- Max. muting time can be set
- Muting sensors can be monitored for simultaneity
- Configuration of bounce time for contact-based muting sensors
- Sequence of the muting sensors can be monitored
- Operating modes
  - Sequential muting
  - Parallel muting
  - Cross muting

2.3.2 Input parameters

- Muting sensor 1
  N/O contact of muting sensor 1
  Muting sensor 1 = 0: Not operated
  Muting sensor 1 = 1: Operated
- Muting sensor 2
  N/O contact of muting sensor 2
  Muting sensor 2 = 0: Not operated
  Muting sensor 2 = 1: Operated
- Light curtain
  Light curtain = 0: Interrupted
  Light curtain = 1: Not interrupted
  Assign the light curtain input parameter to the output of the light curtain function element. The light curtain function element must be configured with an automatic reset.
- Muting sensor 3
  N/O contact of muting sensor 3
  Muting sensor 3 = 0: Not operated
  Muting sensor 3 = 1: Operated
- Muting sensor 4
  N/O contact of muting sensor 4
  Muting sensor 4 = 0: Not operated
  Muting sensor 4 = 1: Operated
- Muting override
  Muting override = 1: Suspend the muting function if a fault occurs (override) to override the muting channel.
- Reset = 0/1 pulse edge: Reset muting after an error or start the muting time.

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2.3 Configuration in the PNOZmulti Configurator

2.3.3 Output parameters

- Enable
  Enable = 0: Error detected (e.g. simultaneity exceeded)
  Enable = 1: The enable is granted if no error has been detected.
- Muting active
  Display of muting status (e.g. for activating a lamp)
  Muting active = 0: No muting (light curtain not suspended)
  Muting active = 1: Muting active (light curtain suspended)

2.3.4 Monitoring times

- Maximum muting time
  This setting is used to adjust the maximum permitted muting time.
  Permitted value range: 1 ... 900s (= 15 minutes)
- Simultaneity
  This setting is used to define the maximum time (synchronisation time) which is permitted to elapse between the actuation (0/1-pulse edge) of muting sensors 1 and 2 or muting sensors 3 and 4.
  Permissible value range for parallel muting and cross muting: 1 ... 3 s
  Permitted value range for sequential muting: 1 ... 30 s
- Bounce time
  This setting can be used to set the time up to the point at which the muting sensors finally make contact.
  Permitted value range: 50 ..0.800 ms

2.3.5 Suspension of muting (override)

If there are faults, the muting station can be overridden via the muting override input parameter.

- **Start-up condition**
  Muting override can be switched on if at least one of the muting sensors is active. The enable output and *muting active* output parameter are set during the override. The override is monitored and has a maximum duration that corresponds to the set muting time.
- **Switch-off condition**
  Muting override is switched off if
  – the muting time has elapsed
  or
  – no muting sensor is active and the light curtain is clear
  or
  – muting override is reset to 0 (release override button).

2.3 Configuration in the PNOZmulti Configurator

CAUTION!
The following additional safety requirements apply to the muting override:
- The override switch must have a hold-to-run control device (touch-operated switch).
- The override switch must be installed in a fixed position outside the danger zone.
- The danger zone and the muting station must be visible from the override switch position.
- The danger zone must be identified as clear before the override switch is operated and while it is operated.

2.3.6 Reset

Reset resets the muting element after a fault or during start-up if
- no muting sensor is operated
  and
- the light curtain is clear.

CAUTION!
The following additional safety requirements apply for the reset button:
- The danger zone and the muting station must be visible from the reset button position.
- The reset button may not be operated until the danger zone has been viewed and has been identified as clear.

2.3.7 Restarting the muting time

Reset resumes muting and restarts the muting time if
- muting was ended as a result of the muting time having elapsed (e.g. by the conveyor feed stopping)
  and
- the muting sensors are returning feasible signals and the light curtain has not been interrupted.

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2.4 Operating modes

The following operating modes can be implemented:

- Sequential muting
- Parallel muting
- Cross muting

WARNING!
"During muting safe conditions shall be provided by other means" (EN 954-1). For example, this may be achieved by the conveyed item blocking access to the danger zone. Even openings in or between the individual parts of the conveyor flow must never enable access.

2.4.1 Terminology

- **Muting On**
  "Muting On" is the switch condition for switching on the muting function. When muting is switched on, the *Muting active* output parameter has a 1 signal and time monitoring runs.
- **Muting Off**
  "Muting Off" is the switch condition for ending the muting function. When the muting function is ended, output parameter *Muting active* has a 0 signal.

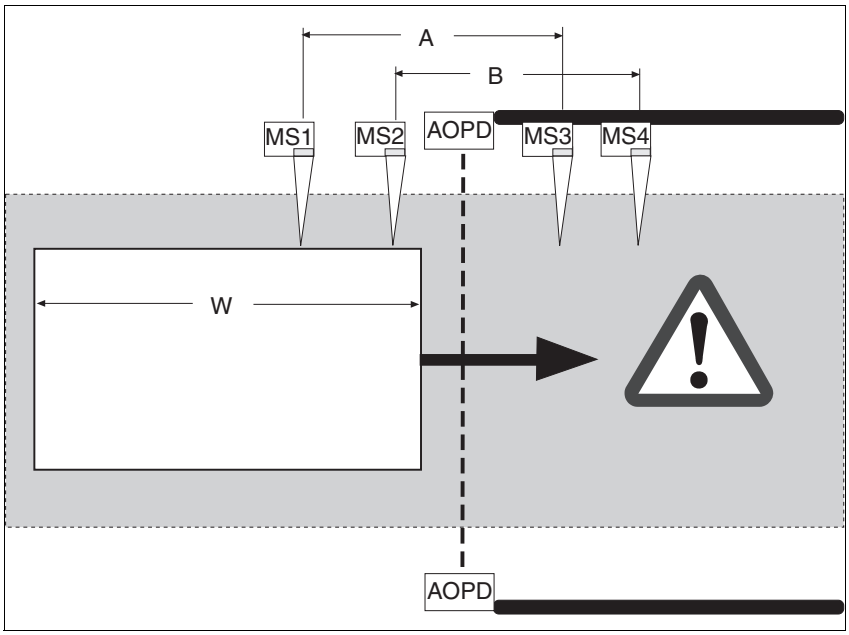
INFORMATION
You will find important additional information on the use of sensors or contacts in the section entitled "Safety".

2.4 Operating modes

2.4.2 Sequential muting

2.4.2.1 Position of the muting sensors

- The distance between the muting sensors MS1 and MS2 / MS3 and MS4 should be as large as possible.
- Vehicle length W must be greater than the distance between MS1 and MS3 or MS2 and MS4 (W > A and W > B).
- MS2 and MS3 must be positioned as close as possible in front of/behind the AOPD.



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2.4 Operating modes

2.4.2.2 Switch conditions in sequential mode

Muting On

Entering the danger zone:

1. Muting sensors MS1 and MS2 must be operated consecutively (first MS1, then MS2) within the configured simultaneity period. Muting is activated by operating MS2.
2. Muting sensors MS3 and MS4 must be operated consecutively (first MS3, then MS4) within the configured simultaneity period.
3. MS1 and MS2 must be cleared consecutively (first MS1, then MS2).
4. MS3 and MS4 must be cleared consecutively (first MS3, then MS4).

Leaving the danger zone:

1. Muting sensors MS4 and MS3 must be operated consecutively (first MS4, then MS3) within the configured simultaneity period. Muting is activated by operating MS3.
2. MS2 and MS1 must be operated consecutively (first MS2, then MS1).
3. MS4 and MS3 must be cleared consecutively (first MS4, then MS3).
4. MS2 and MS1 must be cleared consecutively (first MS2, then MS1).

Muting Off

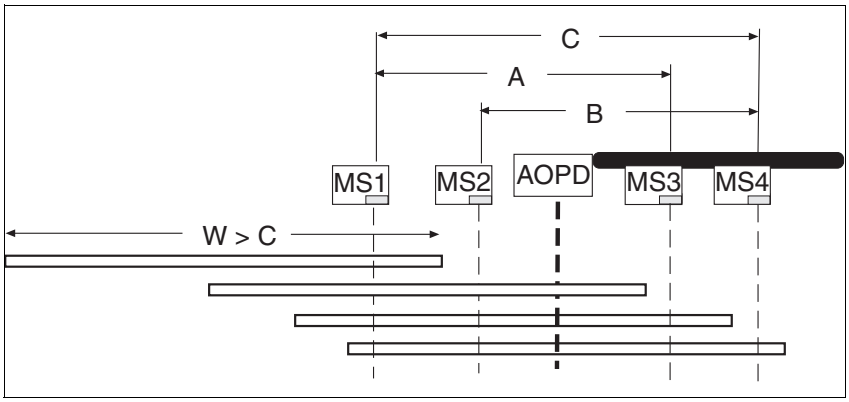
Suspension of the safety function is cancelled as soon as the penultimate muting sensor, MS2 or MS3, is no longer operated, i.e. only one muting sensor remains operated.

2.4 Operating modes

2.4.2.3 Sequence errors

The muting sensors must be operated in a specific sequence in sequential mode. Once a particular directional movement has started (entry or exit), it must be fully completed. Any deviation from the sequence shown causes the enable output (enable = 0) and the output parameter *Muting active* to reset.

Vehicle length W greater than distance C between MS1 and MS4
All sensors are temporarily operated as the vehicle passes through. The first muting sensor (MS1 upon entering, MS4 upon exiting) only becomes clear once all muting sensors have been operated.



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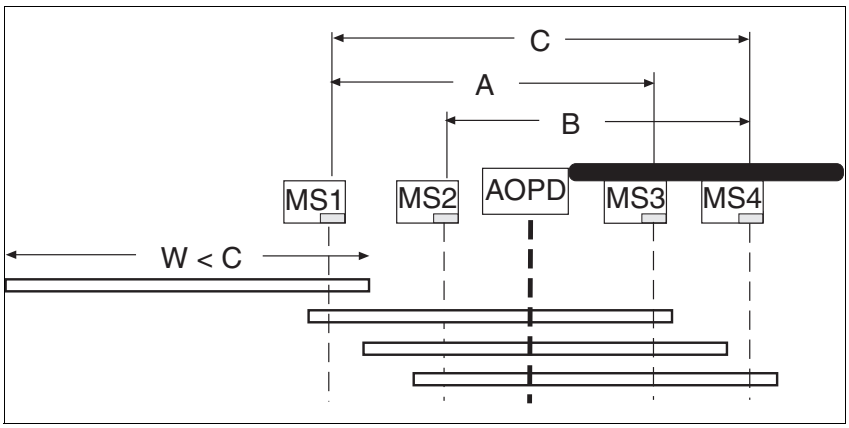
2.4 Operating modes

Vehicle length W less than distance C between MS1 and MS4
As the vehicle passes through, the first muting sensor becomes clear (MS1 upon entering, MS4 upon exiting) before the last muting sensor has been operated.



MS1	MS2	MS3	MS4	Travel direction	
0	0	0	0		
1	0	0	0		
1	1	0	0		
1	1	1	0		
1/0	1	1	1/0		
0	1	1	1		
0	0	1	1		
0	0	0	1		
0	0	0	0		

2.4 Operating modes

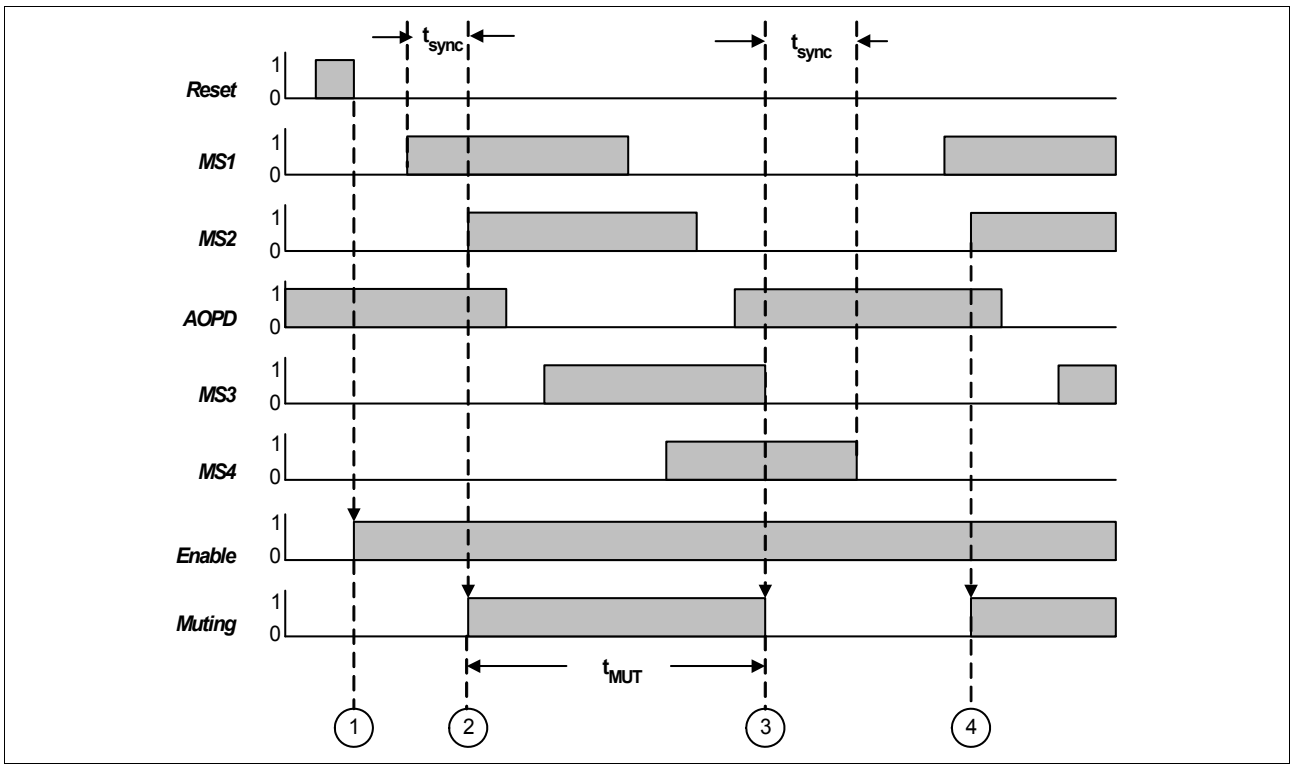
2.4.2.4 Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and linked further within the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset (reset)
- Bit 3: Sensor status unfeasible, override required
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, simultaneity period exceeded on muting sensors 1 and 2, only one sensor operated
- Bit 10: Feasibility error, simultaneity period exceeded on muting sensors 3 and 4, only one sensor operated

2.4.2.5 Timing diagram (example)

Vehicle length W less than distance C between MS1 and MS4



Key:

t_{sync} = Simultaneity

t_{MUT} = Muting time

①: Set enable with reset

②: Start muting via MS1/MS2

③: End muting by clearing MS3

④: Restart muting via MS1/MS2

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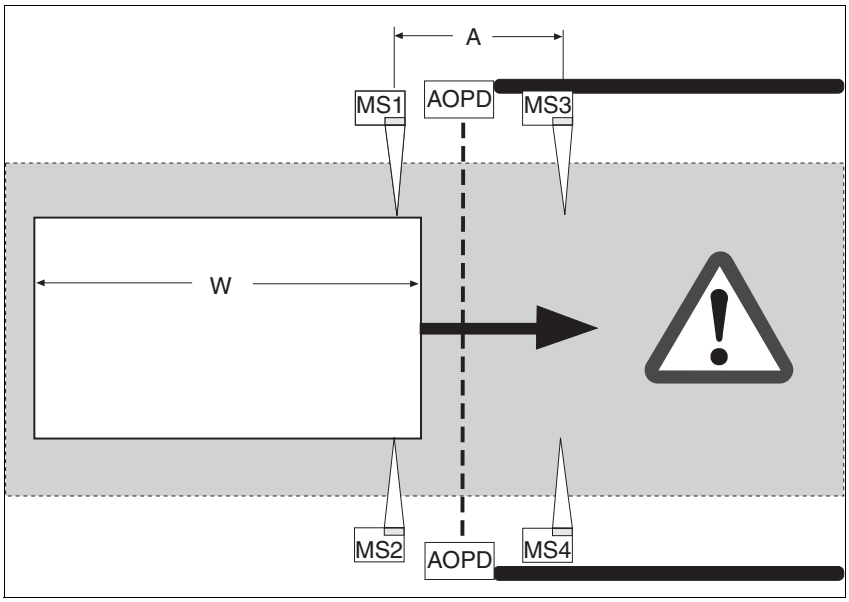
2.4 Operating modes

2.4.3 Parallel muting

2.4.3.1 Position of the muting sensors

- Muting sensors MS1 and MS2/MS3 and MS4 must be positioned at the same height to the left and right of the vehicle.
- The vehicle length W must be greater than distance A between MS1 and MS3/MS2 and MS4.
- The distance between the light curtain and the muting sensor must be as short as possible.



2.4 Operating modes

2.4.3.2 Switch conditions in parallel mode

Muting On

Entering the danger zone:

1. Muting sensors MS1 and MS2 must be operated within the configured simultaneity period. Muting is activated.
2. Muting sensors MS3 and MS4 must be operated within the configured simultaneity period, before MS1 and MS2 are cleared.

Leaving the danger zone:

1. Muting sensors MS3 and MS4 must be operated within the configured simultaneity period. Muting is activated.
2. Muting sensors MS1 and MS2 must be operated before MS3 and MS4 are cleared.

Muting Off

Suspension of the safety function is cancelled as soon as the penultimate muting sensor, MS3/MS4 upon entering or MS1/MS2 upon exiting, is no longer operated. In other words, only one muting sensor remains operated.

2.4.3.3 Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and linked further within the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset (reset)
- Bit 3: Sensor status unfeasible, override required
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, simultaneity period exceeded on muting sensors 1 and 2, only one sensor operated
- Bit 10: Feasibility error, simultaneity period exceeded on muting sensors 3 and 4, only one sensor operated

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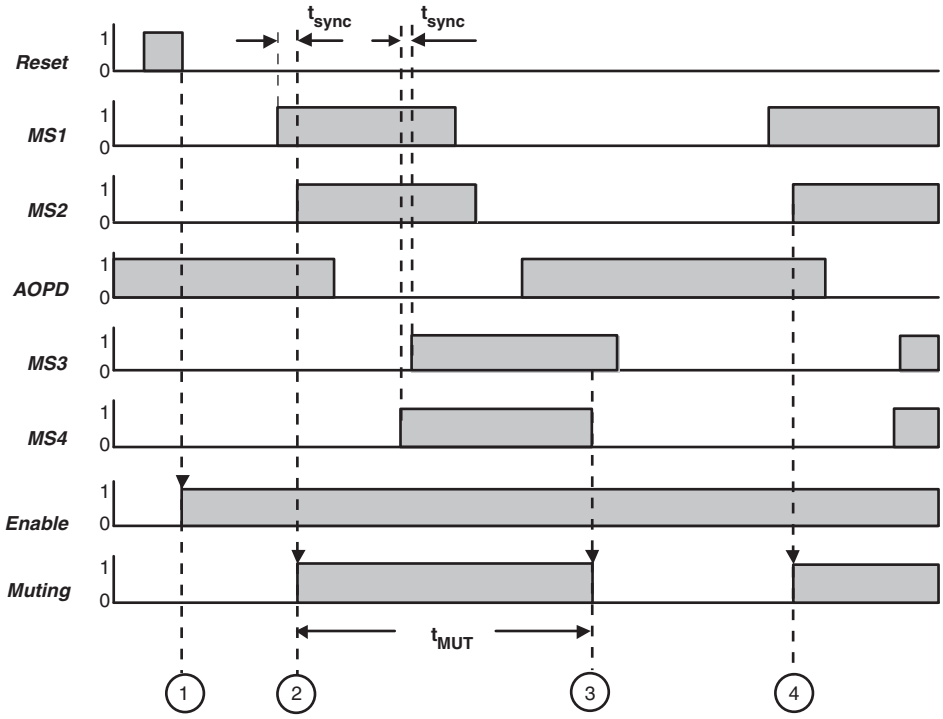
2.4 Operating modes

2.4.3.4 Timing diagram (example)



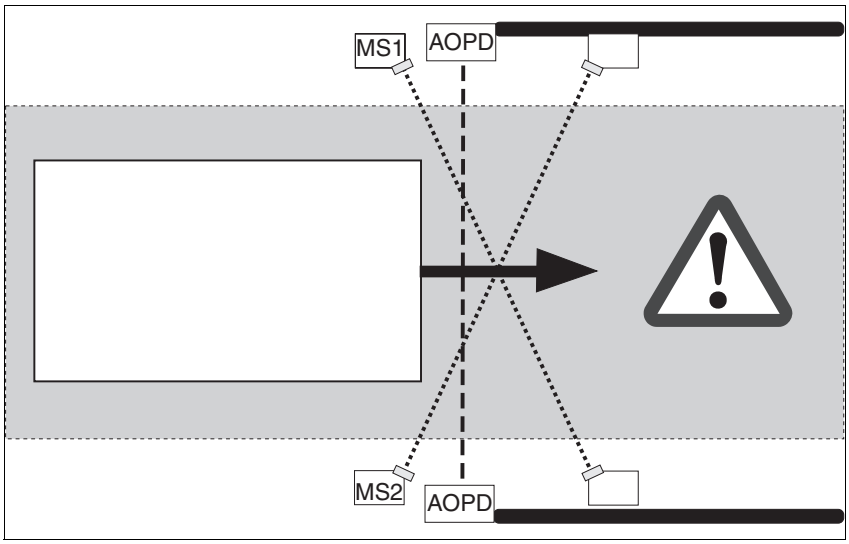
Key:
t_{sync} = Simultaneity
t_{MUT} = Muting time
①: Set enable with reset
②: Start muting via MS1/MS2
③: End muting by clearing MS3 or MS4
④: Restart muting via MS1/MS2

2.4 Operating modes

2.4.4 Cross muting

2.4.4.1 Position of the muting sensors

- Muting sensors may be reflective or send/receive light beam devices, for example. The beams must always intersect within the danger zone.
- The muting sensors must be positioned in such a way that the light curtain is interrupted before the beam intersection can be reached from outside the danger zone.
- Muting sensors MS3 and MS4 are not used.



WARNING!
Loss of safety function due to incorrect position of muting sensors
Depending on the application, serious injury or death may result.
Ensure that you comply with the installation dimensions shown in the figure overleaf.

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2.4 Operating modes

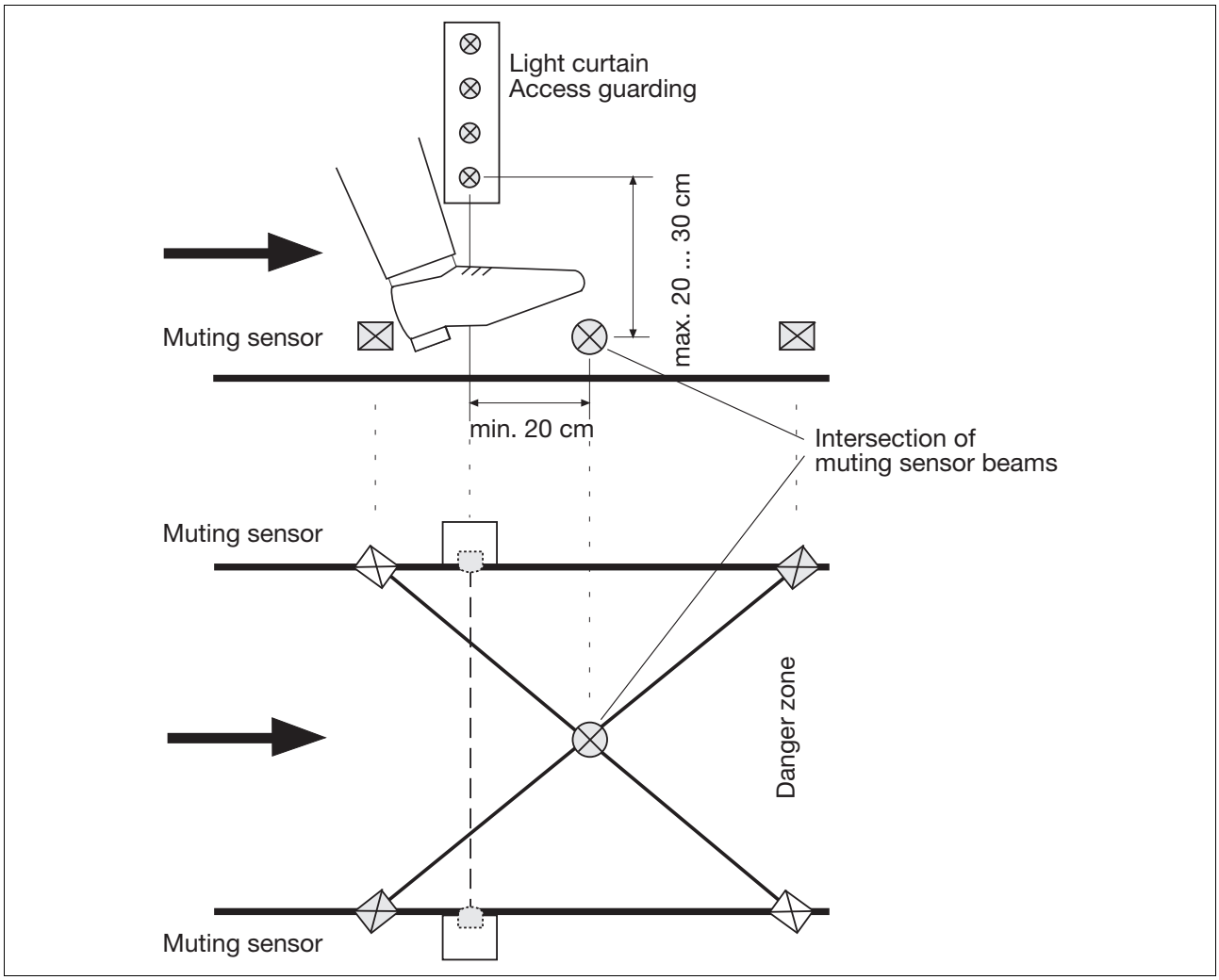

Fig. 2-1: Position of the muting sensors (side view and plan view)

2.4 Operating modes

2.4.4.2 Switch conditions in cross mode

Muting On

Muting sensors MS1 and MS2 must be operated within the configured simultaneity period.

Muting Off

The suspension of the safety function is lifted when one muting sensor at most is still operated.

2.4.4.3 Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and linked further within the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset (reset)
- Bit 3: Sensor status unfeasible, override required
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, simultaneity period exceeded on muting sensors 1 and 2, only one sensor operated

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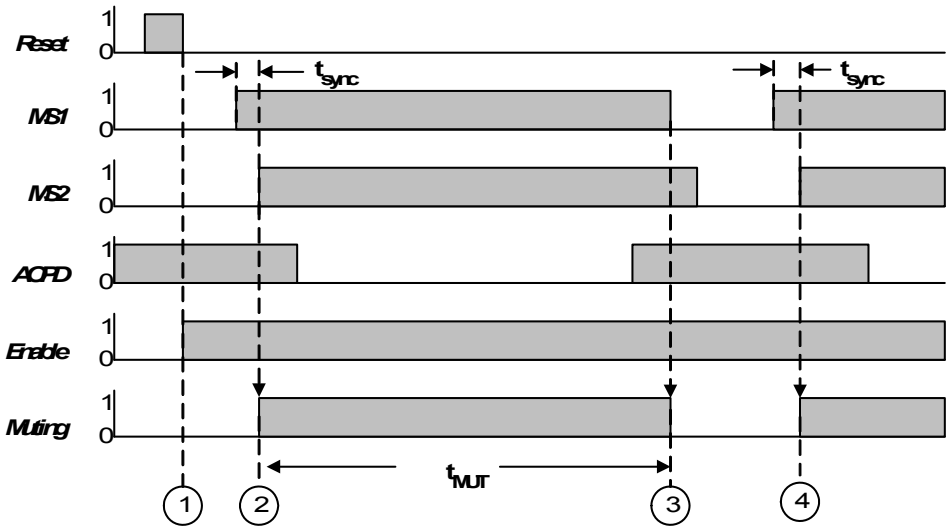
2.4 Operating modes

2.4.4.4 Timing diagram (example)



Key:
t_{sync} = Simultaneity
t_{MUT} = Muting time

①: Set enable with reset
②: Start muting via MS1/MS2
③: End muting by clearing MS1 or MS2
④: Restart muting via MS1/MS2

3.1 Introduction

This chapter describes the use of pressure-sensitive protective devices (safety mats and safe edges) with the PNOZmulti.

Please refer to the following:
- The operating manuals provided with the PNOZmulti units
- The PNOZmulti technical catalogue
- The certificate showing approved pressure-sensitive protective devices
- The installation manual and user information provided by the safety mat/safe edge manufacturer (see "Intended use").

Safety mat

A safety mat is a protective device which detects a person standing on it or stepping on to it. The safety mat comprises a sensor which responds to the application of pressure, a control unit and an output signal switching device.

With a safety mat, the effective sensing area is deformed locally when the sensor is operated.

Safe edge

A safe edge is a protective device which is designed to detect contact from a person or any part of a person's body. It comprises:
- A sensor, which generates a signal when pressure is applied to part of its surface, whereby:
  - Its length is greater than its width
  - Its cross section is constant across its length
  - Cross-sectional width is greater than 8 mm
  - The effective sensing area is deformed locally to actuate the sensor
- A control unit that responds to a signal from the sensor and generates an output signal that it sends to the machine control system.

3.2 Safety

3.2.1 Intended use

Base units from the configurable control system PNOZmulti and PNOZmulti Mini plus the expansion module PNOZ mi1p are suitable for connecting pressure-sensitive protective devices.

- The units may only be used as a safety system in conjunction with the approved pressure-sensitive protective devices (see certificate showing approved pressure-sensitive protective devices).
- The pressure-sensitive protective devices must be connected to the inputs on the PNOZmulti units via the PSEN im1 interface or type 1N4007 diodes (see "Commissioning the safety system").
- Only pressure-sensitive protective devices without installed terminating resistors are suitable.
- The following are not permitted: Walking aids such as canes and wheeled vehicles
- The configurable control system PNOZmulti is used as a control unit and as an output signal switching device in accordance with EN 1760-1, 09/97.

CAUTION!
When pressure-sensitive protective devices are connected to PNOZmulti units, the units (including the coated version) may only be operated at an ambient temperature of 0 to +60 °C.

3.2.2 Safety guidelines

Do not install and commission the safety system until you have read and understood this chapter, the technical catalogue and the installation manual from the safety mat/safe edge manufacturer.

You must also be familiar with the applicable regulations for health and safety at work and accident prevention.

- In particular you should refer to EN 1760-1 and EN 1760-2.
- In terms of faults the safety system complies with Category 3, PL d of EN ISO 1349-1 and SIL CL 2 of EN IEC 62061. With the safety mat it's important to consider Note 3 to Clause 4.15 of EN 1760-1
- The categories for safety mats on machines in accordance with EN 13849-1 are specified in type C standards.

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3.3 Function description

The pressure-sensitive safety device is supplied with PNOZmulti test pulse outputs. The test pulses are evaluated by PNOZmulti inputs (see section titled "Commissioning the safety system"). Short across contacts and open circuits are detected.

3.4 Configuration in the PNOZmulti Configurator

- Operating modes
  - Automatic reset (start):
    After the pressure-sensitive protective device has been activated, the output immediately returns to "1" once the pressure-sensitive protective device is cleared.
  - Manual reset (start):
    The output does not return to "1" until the reset button has been pressed. This eliminates the possibility of the reset button being overridden, triggering automatic activation. A reset is only possible if the pressure-sensitive protective device is not activated.
- Start-up test
  The start-up test prevents an automatic restart after a power failure and subsequent return of voltage. The unit checks whether the non-activated pressure-sensitive protective device was activated and cleared after supply voltage was applied.
- The output of the pressure-sensitive protective device function element is "1" if the pressure-sensitive protective device has **not** been activated. This safety function must be retained when this signal is linked further within the PNOZmulti Configurator:
  - Semiconductor outputs: High signal
  - Relay outputs: Safety contacts closed

3.4.1 Allocation of test pulses to inputs

The test pulses can only be connected to the inputs as follows:

Input 1: Test pulse T0
Input 2: Test pulse T1

or

Input 1: Test pulse T2
Input 2: Test pulse T3

INFORMATION
Test pulses that you use for the pressure-sensitive protective device cannot be reused for test pulses in conjunction with other safety devices.

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3.5 Commissioning the safety system

When using the pressure-sensitive protective device, please note the following:

- The following are not permitted: Walking aids such as canes and wheeled vehicles

3.5.1 Preparing for commissioning

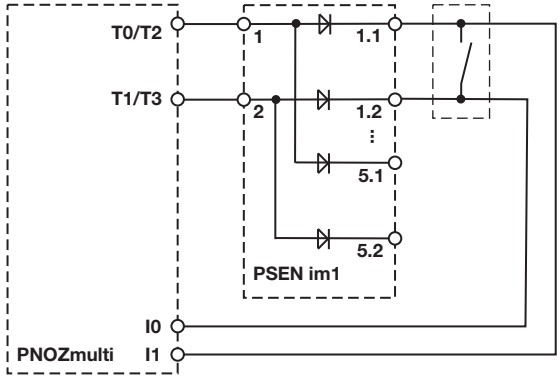
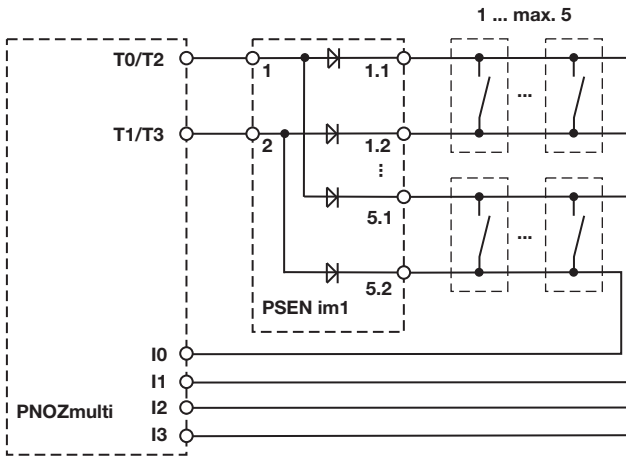
Please note the following when preparing for commissioning:

- Cables that have to be laid outside the control cabinet must be protected from mechanical damage, e.g. by installing them in a conduit.
- Pressure-sensitive protective devices may not be fitted with a terminating resistor.
- The configured test pulse outputs should be used exclusively for test pulses on the pressure-sensitive protective devices. Be sure to note the information provided in "Technical details".

3.5 Commissioning the safety system

3.5.2 Preparing for operation

- Connect the pressure-sensitive protective device to the test pulse outputs and the inputs (in examples I0 to I3).
- Please note:
  Always connect the pressure-sensitive protective devices to the PNOZmulti units via
  - interface PSEN im1,
  - diodes of type 1 N4003 ...1N4007,
  - or via the terminal block with filter, order no. 774 195, 774 196.
    0 V may not be connected to the terminal block!

Input circuit	
Connecting **one** pressure-sensitive protective device, max. area of pressure-sensitive protective device = 8 m^2	
Connecting multiple pressure-sensitive protective devices, permitted per dual-pole input: max. 5 pressure-sensitive protective devices in series, max. area of pressure-sensitive protective device = 8 m^2	

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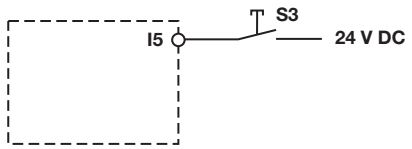
3.5 Commissioning the safety system

- Set the reset features through wiring of the reset circuit (in example I5). Only effective if ***manual reset*** is configured in the PNOZmulti Configurator.

Manual reset	

3.6 Operation

The safety system can only be started if the pressure-sensitive protective device has not been activated. The unit detects the operating mode set on start-up.

3.6.1 Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and linked further within the program.

- Bit 0: Pressure-sensitive protective device clear, enable issued
- Bit 2: Pressure-sensitive protective device activated
- Bit 3: Waiting for reset
- Bit 4: Waiting for start-up test
- Bit 6: Open circuit detected, signal error

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3.7 Technical Details

Technical details	
Reaction time (from activation of the pressure-sensitive protective device until an instantaneous safety output drops out)*	**< 200 ms**
Max. area of pressure-sensitive protective devices per dual-pole input	**8 m^2**
Max. number of pressure-sensitive protective devices connected in series per dual-pole input	**5**
Min. cross section of external conductor	**0.5 mm^2**
Max. cable length, PNOZmulti - pressure-sensitive protective device	**100 m**
Max. resistance of safety mat/safe edge	**150 Ohm**

*The stated reaction time is the maximum value for pressure-sensitive protective devices. For details of the specific reaction time in conjunction with the respective approved safety mat or safe edge, please refer to the certificate showing approved pressure-sensitive protective devices.

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4.1 Introduction

This chapter describes how to control and monitor burners with the base units PNOZ m3p from the configurable control system PNOZmulti. Control and monitoring of a burner is configured in the PNOZmulti Configurator using the burner element.

When using the burner element please also refer to:

- The operating manuals provided with the PNOZmulti units
- The online help for the PNOZmulti Configurator.

4.2 Safety

4.2.1 Intended use

The burner logic element can only be used in conjunction with the base unit PNOZ m3p.
The burner logic element in the PNOZmulti Configurator is designed to control and monitor burners in accordance with the standards:

- EN 298: Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
- EN 12953-7: Shell boilers
- EN 12952-8: Water-tube boilers and auxiliary installations
- EN 50156-1: Electrical equipment for furnaces
- EN 61508: SIL 3: Functional safety of safety-related electrical/electronic/programmable electronic systems
- EN 230: Automatic burner control systems for oil burners
- EN 267: Automatic forced draught burners for liquid fuels (draft)
- EN 298: Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
- EN 676: Automatic forced draught burners for gaseous fuels
- EN 746-2: Industrial thermoprocessing equipment
- EN 1643: Valve proving systems for automatic shut-off valves for gas burners and gas appliances

The relay output module PNOZ mo5p has diverse relay outputs and is therefore suitable for activating safety valves on a burner in accordance with EN 50156.

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4.3 Configuration in the PNOZmulti Configurator

4.3.1 Functions

The burner logic element contains all the functions needed to control and monitor burners.

These include
monitoring of
- Safety chains
- Combustion air pressure
- Ignition
- Flame monitoring
- External compound controller
- Tightness control

and control of:
- Safety valves
- Ignition valves
- Vent valve
- Ignition
- External compound controller
- Combustion air blower

The following oil and gas burner types can be controlled and monitored:
- Master burner with direct ignition
- Master burner with indirect ignition and joint flame monitoring
- Master burner with indirect ignition and separate flame monitoring
- Slave burner with direct ignition
- Slave burner with indirect ignition and joint flame monitoring
- Slave burner with indirect ignition and separate flame monitoring

The required burner type and necessary monitoring and control functions can be set in the PNOZmulti Configurator (see Monitoring functions/settings for the burner cycle). This will influence the burner cycle.

A burner cycle has several phases (steps). The configuration determines which steps are carried out (see Burner cycle).

Provided the input signals match the set values within a step, the program cycle will be continued. The system will pass to the next step as soon as the configured step time has elapsed.

If the input signals do not match the set values within a step, an error will be detected. This will lead either to a fault lockout or a safety shutdown, depending on the input signal and configuration.

4.3 Configuration in the PNOZmulti Configurator

4.3.2 Monitoring functions/settings for the burner cycle

4.3.2.1 Combustion air pressure monitoring, activating the combustion air blower, compound controller monitoring

You can set whether the activated burner is a master burner or a slave burner.

- **Master burners**
  Master burners have their own combustion air supply, which is controlled and monitored directly. The following monitoring/control functions are performed on master burners:
  - The combustion air pressure is monitored. For this, the "AirP" input must be linked to the device that monitors the required air amount (generally an air pressure monitor).
  - The combustion air blower is activated via the "BLOW" output.
  - The compound controller can be activated and monitored. This is necessary when an electronic compound controller is present (see section below, entitled "Compound controller").
- **Slave burners**
  Slave burners do not have their own combustion air supply. As a result, no monitoring takes place. This burner type is used for multi-burners, for example, which are fitted with a central combustion air supply and a monitoring function.

WARNING!
Loss of safety function due to incorrect use of the *Slave burner* type
If the ***Slave burner*** type is used to avoid pre-purge and a combustion air supply is not guaranteed, serious injury or death may result, depending on the application.
Only use the slave burner type if the combustion air supply is guaranteed elsewhere.

Please also note the following with the *Slave burner* type:

- The "AirP" input must be connected to a signal indicating the presence of a central combustion air supply that is functioning correctly. There is no check to ensure that this input is at rest position when the burner is switched off.
- The burner cannot be started (signal at the "Start" input) until it is guaranteed that there is no flammable mixture within the combustion chamber or associated areas or within the exhaust system.

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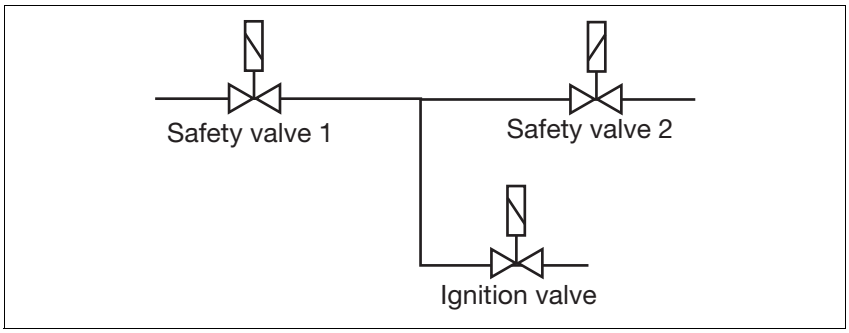
4.3 Configuration in the PNOZmulti Configurator

4.3.2.2 Ignition

The ignition transformer is activated via the "IGNT" output.

You can select two types of ignition in the PNOZmulti Configurator:

- **Direct ignition**
  With direct ignition, no separate ignition burner is present. The main burner is ignited directly via the ignition transformer.
- **Indirect ignition**
  With indirect ignition, a separate ignition burner is present. The main burner is ignited by an ignition flame, which is ignited via an ignition transformer. Fuel may not be supplied to the main burner until the ignition burner has been ignited and the ignition flame is stable.
  The ignition valve is activated via the IV output.
  The following setting options are available for the behaviour of the ignition flame:
  – Ignition valve is closed after ignition,
    i.e. the ignition flame is to be extinguished once the main burner is successfully ignited, or
  – (only possible when separate flame monitoring is configured (see section entitled "Flame monitoring")): Ignition valve remains open after ignition,
    i.e. the ignition flame is to stay lit once the main burner is successfully ignited.
  The ignition valve must be positioned as follows:



4.3 Configuration in the PNOZmulti Configurator

4.3.2.3 Flame monitoring

Flame monitoring is used to establish and signal the presence of a flame. To ensure that the signal is actually a result of the flame and not of some external light source, the absence of the flame is monitored during a burner cycle (e.g. during pre-purge). With direct ignition, the main flame is monitored.
With indirect ignition you can select between two types of flame monitoring:

- **Joint flame monitoring**
  Ignition flame and main flame are monitored jointly. The FLAM input for the main flame must be logically linked to flame monitoring. The FLAI input for the ignition flame will not then be evaluated.
- **Separate flame monitoring**
  Ignition flame and main flame are monitored separately; each have their own flame monitoring device.

4.3.2.4 Compound controller

If master burners have an external electronic compound controller, the compound controller must be activated and monitored via the burner element

The compound controller controls and monitors the fuel/air ratio. The regulating devices for the amount of combustion air and fuel are activated for this purpose.

- The "PURG" output is activated during the step: "Compound controller to pre-purge position". This output signal is intended to switch the compound controller to the pre-purge position (maximum amount of combustion air).
- During the steps "Pre-purge ...", a signal is expected at the "PUR" input from the compound controller, indicating that the compound controller is in "pre-purge" position. This signal must not occur until the airflow rate required for pre-purge is present.
- The "IGNI" output is activated during the step: "Compound controller to ignition position". This output signal is intended to switch the compound controller to the ignition position (optimum fuel/air ratio for ignition).
- During the steps "Ignition ...", a signal is expected at the "IGN" input from the compound controller, indicating that the compound controller is in "ignition" position. This signal must not occur until the optimum fuel/air ratio for ignition is present.

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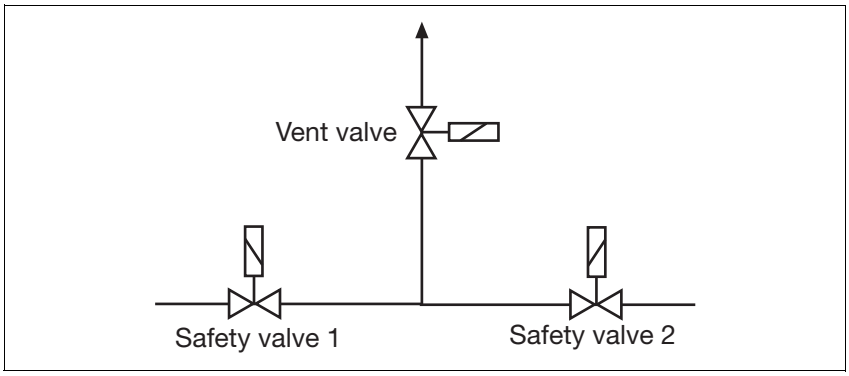
4.3 Configuration in the PNOZmulti Configurator

4.3.2.5 Tightness control

You can select whether to carry out tightness control. With tightness control, the section between the two safety valves will first be vented, then refilled and the pressure measured. The pressure is monitored at the "GP" input.
The plant must undergo a hazard analysis to determine whether tightness control is necessary. The hazard analysis should also determine whether venting is permitted via safety valve 2.

The following configuration options are available:

- Vent via the vent valve (the vent valve is activated via the VV output)
  The vent valve must be positioned as follows:



or

- Vent via safety valve 2
- Continuous vent (in which case, tightness control is not carried out)
- No tightness control and no continuous vent

It's also possible to configure when tightness control is to be carried out:

- Tightness control prior to ignition
- Tightness control after the burner has shut down. (Even with this setting, tightness control will be carried out prior to ignition if the previous burner cycle was interrupted due to an error.)

4.3 Configuration in the PNOZmulti Configurator

4.3.2.6 High temperature

"High temperature" mode can be activated via the "HTmp" input if the conditions for high temperature in high temperature plants have been met in accordance with EN 746-2 and the fuel in the combustion chamber self-ignites safely.
As the fuel in the combustion chamber self-ignites in high temperature mode, the burner cycle will change.

The following steps are no longer performed in high temperature mode:
- Any steps in connection with pre-purge and post-purge
- Tightness control
- Pre-ignition
- Afterburn

Flame monitoring is also deactivated; the outputs for activating "Compound controller for pre-purge position" (PURG) and the ignition transformer (IGNT) are no longer activated.

WARNING!
Potential loss of safety functions in "High temperature" mode!
If the conditions for high temperature in accordance with EN 746-2 are not met, safety-related steps in "High temperature" mode will no longer be carried out. Depending on the application, serious injury or death may result.
Make sure that "High temperature" mode is only active when the conditions for high temperature in accordance with EN 746-2 are met.

In any of the steps within the cycle, the "HTmp" input can be used to switch between high temperature mode and normal mode (see also section entitled "Inputs and outputs").

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4.3 Configuration in the PNOZmulti Configurator

4.3.2.7 Plant-dependent monitoring functions

Plant-dependent monitoring functions, which are intended to trigger a burner shutdown where necessary (e.g. when the temperature is too high), must be incorporated into the safety sequences. In other words, they must be linked to inputs CHA1, CHA2 or CHAi.

Monitoring functions which are intended to be active from burner start-up to burner shutdown must be linked to either CHA1 or CHA2.

Monitoring functions which are only intended to be active during ignition and burner operation must be linked to CHAi (see also section entitled "Inputs and outputs").

4.3.2.8 Shutdown types

A controlled shutdown can be performed via the "Stop" input (e.g. if energy is no longer required). The burner is then brought to a stop.

WARNING!
Loss of safety function due to incorrect use of the "Stop" input!
If the "Stop" input is used to reproduce a safety shutdown or fault lockout, serious injury or death may result, depending on the application.
Only use the "Stop" input for a controlled shutdown.

An error is detected if the input signals within a step do not match the values set for the monitoring operation. This will lead either to a fault lockout or a safety shutdown, depending on the input signal and configuration. With both shutdown types, all outputs on the burner element are shut down immediately and the sequence program is aborted.

- Safety shutdown
  After a safety shutdown, the burner cycle is automatically restarted after a configurable period, if there is no error present.
- Fault lockout
  With a fault lockout, if there is no error present, it is necessary to reset and then manually restart to enable a new burner cycle.

4.3 Configuration in the PNOZmulti Configurator

For the following steps you can select which shutdown type will occur in the event of an error in the PNOZmulti Configurator:

- Safety chain 1 broken (input CHA1)
- Safety chain 2 broken (input CHA2)
- Ignition and operation safety chain broken (input CHAi)
- No air pressure during operation (during start-up: fault lockout)
- Faulty flame signal during operation (during start-up: fault lockout)

Please note:

The plant must undergo a hazard analysis to determine whether a safety shutdown is permitted for an error.

4.3.2.9 Step times

You can set a time for most of the steps within a cycle (see View burner cycle, define step times). The time determines how long the step will be active. While the step is active, the inputs must conform to the pre-defined set values. Once this time has elapsed, the next step will be started (see also Burner cycle).

When configuring the step times, please note the following with the steps below:

- Steps 5 - 9 "Pre-purge...)
  The total duration of steps 5 - 9 for pre-purge must not be less than the minimum duration for pre-purge calculated via the plant's hazard analysis.
- Step 13 "Ignite ignition flame / 1st safety time"
  The configured step time must not be longer than the 1st safety time. The maximum duration of the 1st safety time is calculated based on a hazard analysis of the plant.
- Step 15 "Ignite ignition flame / 2nd safety time"
  The configured step time must not be longer than the 2nd safety time. The maximum duration of the 2nd safety time is calculated based on a hazard analysis of the plant.

A step time cannot be set for the following steps: "Burner switched off", "Check start conditions" and "Burner in operation/control enable".

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4.4 Burner cycle

4.4.1 Steps

Each step has a fixed step identifier (0 ... 31).
The steps are performed consecutively within the burner cycle (step 1 first, then step 2).
Some steps are only important internally and are not displayed (e.g. step 4). That's why some numbers from 0 to 31 are not listed as steps.
The length of the steps depends on the configuration and the burner cycle. There are steps for which you can set a step time in the PNOZmulti Configurator; others have a fixed step time, or the step time depends on the burner cycle.

A step time cannot be set for the following steps. They are run in each burner cycle, irrespective of the configuration.

- Step 0: Burner switched off
- Step 1: Check start conditions
- Step 18: Burner in operation/controller enable

A step time can be set for the following steps. Your configuration will determine which of these steps are performed in your burner cycle.

- Step 2: Start-up combustion air blower
- Step 3: Compound controller to pre-purge position
- Step 5: Pre-purge/tightness control: Vent
- Step 6: Pre-purge/tightness control: Test air pressure
- Step 7: Prepurge/tightness control, filling:
- Step 8: Prepurge/tightness control, test fuel pressure
- Step 9: Continue pre-purge
- Step 10: Compound controller to ignition position
- Step 12: Pre-ignition
- Step 13: Ignite ignition flame/1st safety time
- Step 14: Stabilise ignition flame
- Step 15: Ignite main flame/2nd safety time
- Step 16: Stabilise main flame
- Step 17: Burner in operation/start position
- Step 20: Afterburn
- Step 21: Post-purge
- Step 22: Run down combustion air blower
- Step 24: Tightness control, vent
- Step 25: Tightness control, test air pressure
- Step 26: Tightness control, filling
- Step 27: Tightness control, test fuel pressure

4.4 Burner cycle

4.4.2 Errors during the burner cycle

An error is detected if the input signals within a step fail to match the values set for the monitoring operation. This will lead either to a fault lock-out or a safety shutdown, depending on the input signal and configuration. Some of the monitoring functions during a burner cycle depend on the step, while others are continuous. In other words, some monitoring processes occur in a specific step, while others may be active across the whole cycle.

- **Step-dependent errors**

  With step-dependent errors, the set value of the input signals in the various steps may vary.

  E.g.: With combustion air monitoring, the input must have a "0" signal during the "Check start conditions" step and a "1" signal during the "Burner in operation" step.

  The following monitoring functions have errors that depend on the specific step:

  – Combustion air monitoring
  – Flame monitoring of ignition flame
  – Flame monitoring of main flame
  – Tightness control
  – Compound controller not in pre-purge position
  – Compound controller not in ignition position
  – Ignition and operation safety chain

- **Step-independent errors**

  Where errors are independent of the specific step, the same set value applies for each step: The input must have a "1" signal.

  The following monitoring functions have errors that are independent of the specific step:

  – Safety chain 1
  – Safety chain 2

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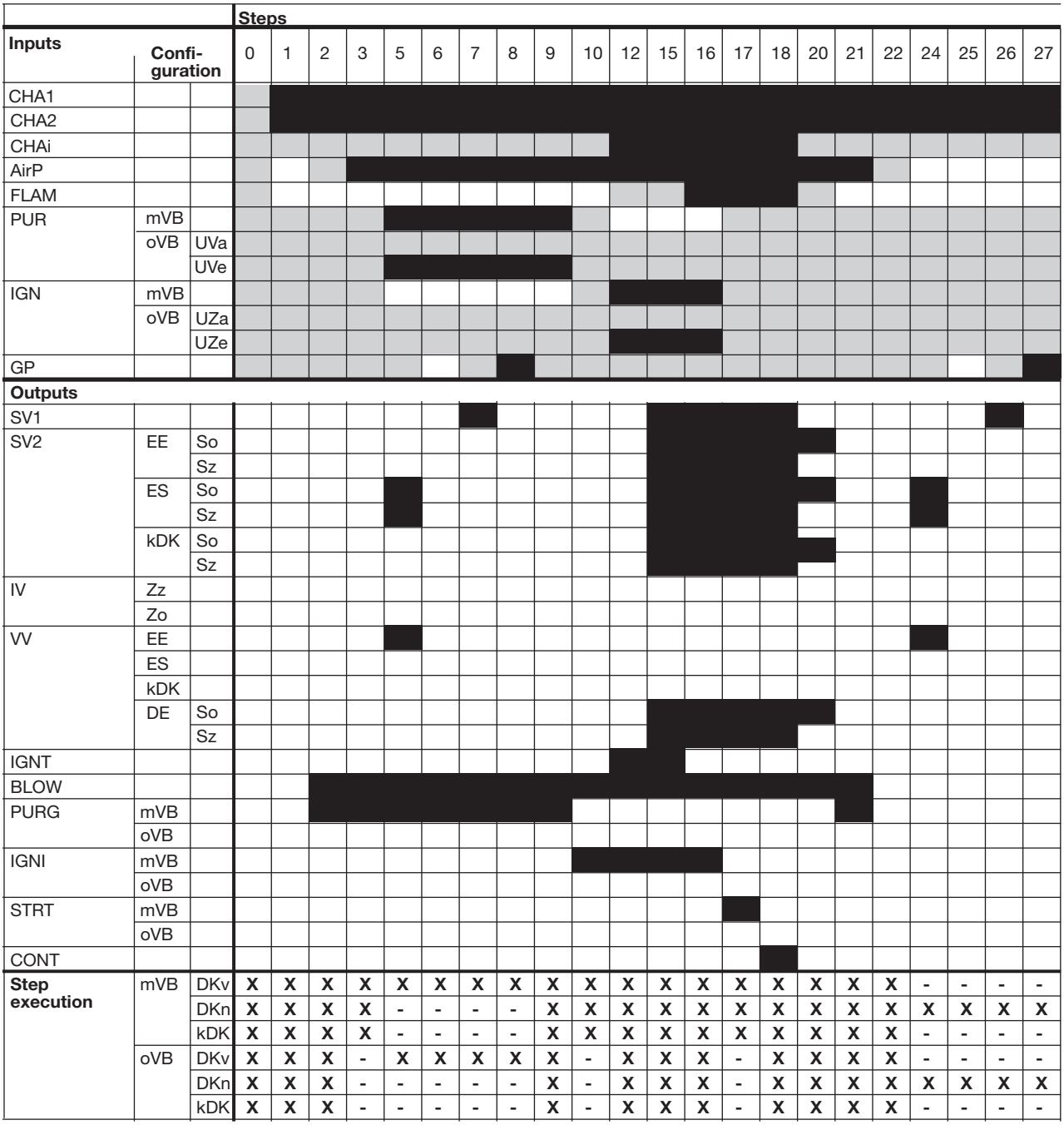
4.4 Burner cycle

4.4.3 Master burner with direct ignition



Inputs	Configuration		Steps 0	1	2	3	5	6	7	8	9	10	12	15	16	17	18	20	21	22	24	25	26	27
CHA1																								
CHA2																								
CHAi																								
AirP																								
FLAM																								
PUR	mVB																							
	oVB	UVa																						
		UVe																						
IGN	mVB																							
	oVB	UZa																						
		UZe																						
GP																								
Outputs																								
SV1																								
SV2	EE	So																						
		Sz																						
	ES	So																						
		Sz																						
	kDK	So																						
		Sz																						
IV	Zz																							
	Zo																							
VV	EE																							
	ES																							
	kDK																							
	DE	So																						
		Sz																						
IGNT																								
BLOW																								
PURG	mVB																							
	oVB																							
IGNI	mVB																							
	oVB																							
STRT	mVB																							
	oVB																							
CONT																								
Step execution	mVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	-	-	-	-
	oVB	DKv	X	X	X	-	X	X	X	X	X	-	X	X	X	-	X	X	X	X	-	-	-	-
		DKn	X	X	X	-	-	-	-	-	X	-	X	X	X	-	X	X	X	X	X	X	X	X
		kDK	X	X	X	-	-	-	-	-	X	-	X	X	X	-	X	X	X	X	-	-	-	-

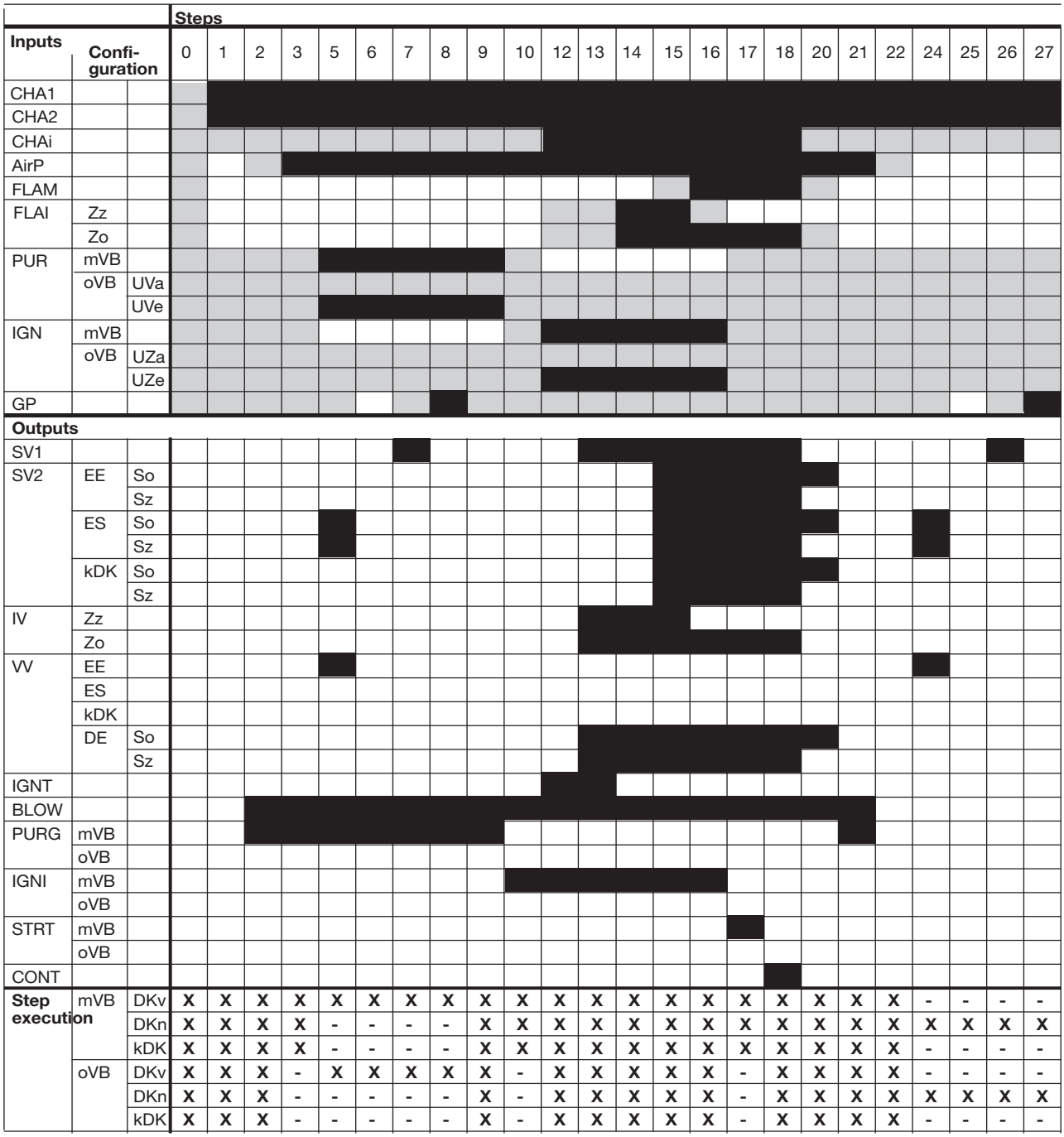
Configuration:
mVB: Cycle with compound controller
oVB: Cycle without compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control, no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
So: Safety valve 2 open during afterburn
Sz: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitoring active
Signal must be/is '0'

Step execution
X Step is executed
\- Step is not executed

4.4 Burner cycle

4.4.4 Master burner with separate flame monitoring



Configuration:
mVB: Cycle with compound controller
oVB: Cycle with compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control, no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
So: Safety valve 2 open during afterburn
Sz: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitorint active
Signal must be/is '0'

Step execution:
X Step is executed
\- Step is not executed

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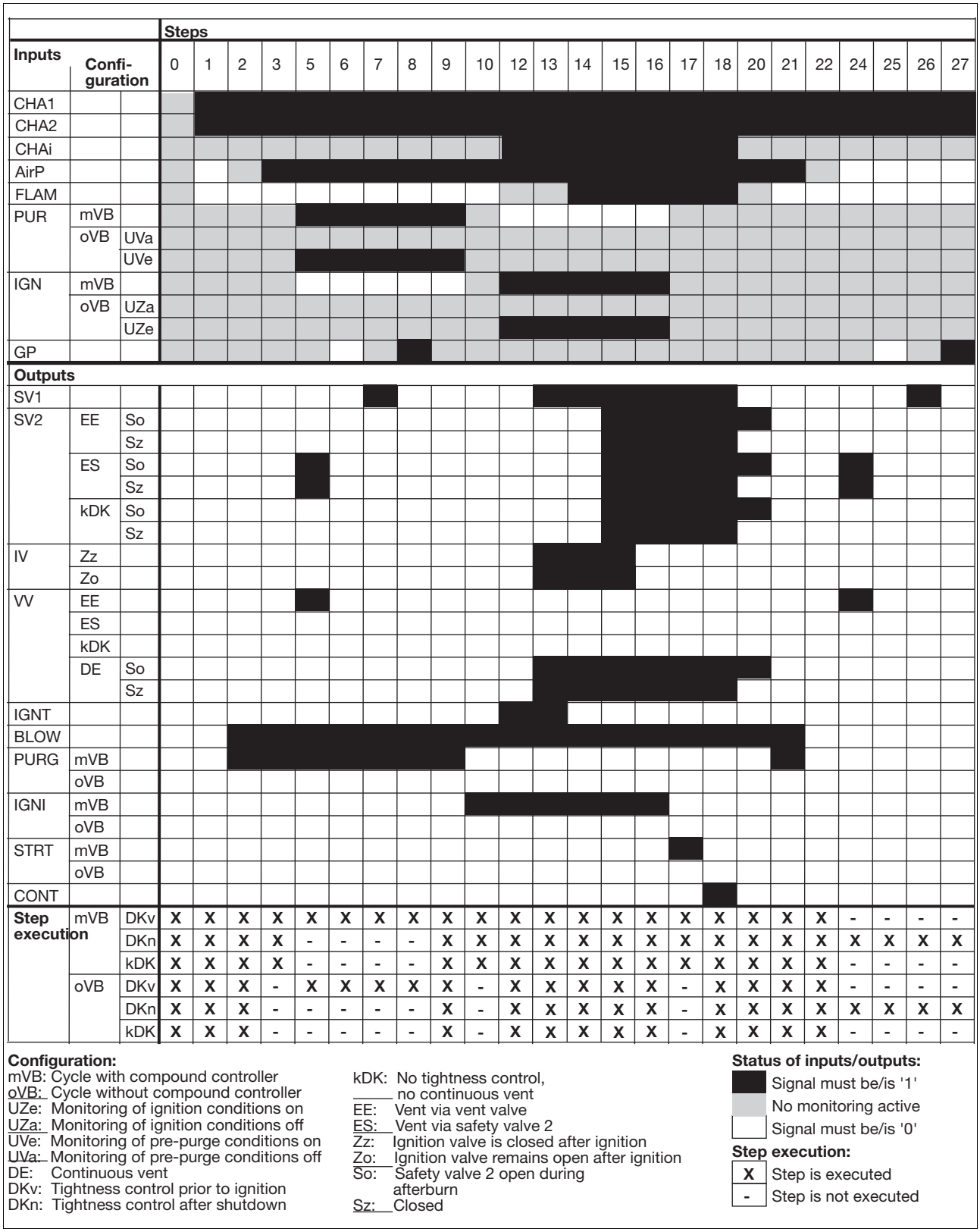
4.4 Burner cycle

4.4.5 Master burner with joint flame monitoring



Inputs	Configuration		Steps 0	1	2	3	5	6	7	8	9	10	12	13	14	15	16	17	18	20	21	22	24	25	26	27
CHA1																										
CHA2																										
CHAi																										
AirP																										
FLAM																										
PUR	mVB																									
	oVB	UVa																								
		UVe																								
IGN	mVB																									
	oVB	UZa																								
		UZe																								
GP																										
Outputs																										
SV1																										
SV2	EE	So																								
		Sz																								
	ES	So																								
		Sz																								
	kDK	So																								
		Sz																								
IV	Zz																									
	Zo																									
VV	EE																									
	ES																									
	kDK																									
	DE	So																								
		Sz																								
IGNT																										
BLOW																										
PURG	mVB																									
	oVB																									
IGNI	mVB																									
	oVB																									
STRT	mVB																									
	oVB																									
CONT																										
Step execution	mVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
	oVB	DKv	X	X	X	-	X	X	X	X	X	-	X	X	X	X	X	-	X	X	X	X	-	-	-	-
		DKn	X	X	X	-	-	-	-	-	X	-	X	X	X	X	X	-	X	X	X	X	X	X	X	X
		kDK	X	X	X	-	-	-	-	-	X	-	X	X	X	X	X	-	X	X	X	X	-	-	-	-

Configuration:
mVB: Cycle with compound controller
oVB: Cycle without compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control,
_____ no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
So: Safety valve 2 open during afterburn
Sz: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitoring active
Signal must be/is '0'

Step execution:
X Step is executed
\- Step is not executed

4.4 Burner cycle

4.4.6 Slave burner with direct ignition

Inputs	Configuration		Steps 0	1	5	6	7	8	12	15	16	18	20	24	25	26	27
CHA1																	
CHA2																	
CHAi																	
AirP																	
FLAM																	
IGN	UZa																
	UZe																
GP																	
Outputs																	
SV1																	
SV2	EE	So															
		Sz															
	ES	So															
		Sz															
	kDK	So															
		Sz															
IV	Zz																
	Zo																
VV	EE																
	ES																
	kDK																
	DE	So															
		Sz															
IGNT																	
CONT																	
Step execution	mVB	DKv	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	-	-	-	-
	oVB	DKv	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	-	-	-	-

Configuration:
mVB: Cycle with compound controller
oVB: Cycle without compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control, no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
Safety valve 2 open during
Sz: afterburn
So: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitoring active
Signal must be/is '0'

Step execution:
X Step is executed
- Step is not executed

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4.4 Burner cycle

4.4.7 Slave burner with separate flame monitoring

Inputs	Configuration		Steps 0	1	5	6	7	8	12	13	14	15	16	18	20	24	25	26	27
CHA1																			
CHA2																			
CHAi																			
AirP																			
FLAM																			
FLAI	Sz																		
	So																		
IGN	UZa																		
	UZe																		
GP																			
Outputs																			
SV1																			
SV2	EE	So																	
		Sz																	
	ES	So																	
		Sz																	
	kDK	So																	
		Sz																	
IV	Zz																		
	Zo																		
VV	EE																		
	ES																		
	kDK																		
	DE	So																	
		Sz																	
IGNT																			
CONT																			
Step execution	mVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	X	X	-	-	-	-
	oVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	X	X	-	-	-	-

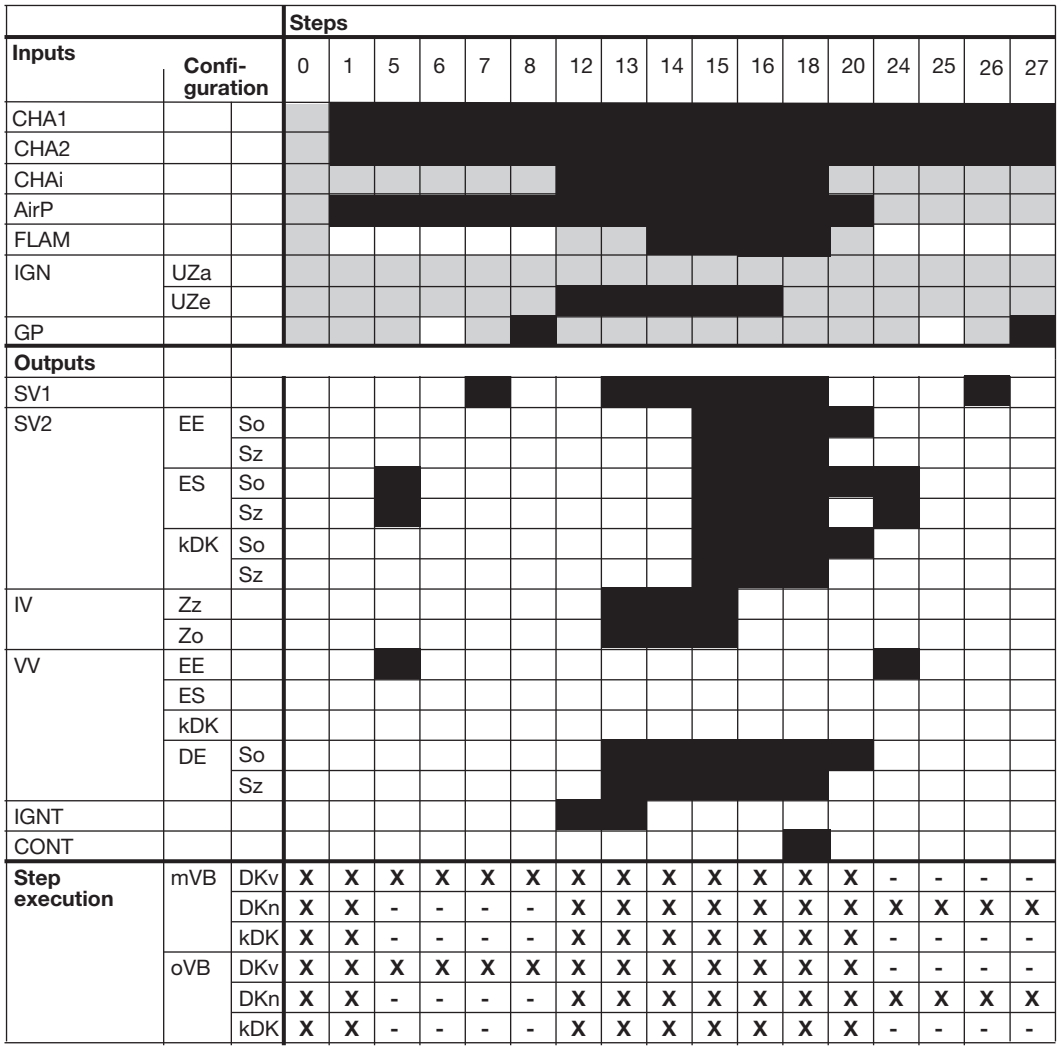
Configuration:
mVB: Cycle with compound controller
oVB: Cycle without compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control, no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
So: Safety valve 2 open during afterburn
Sz: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitoring active
Signal must be/is '0'

Step execution:
X Step is executed
- Step is not executed

4.4 Burner cycle

4.4.8 Slave burner with joint flame monitoring



Inputs	Configuration		Steps 0	1	5	6	7	8	12	13	14	15	16	18	20	24	25	26	27
CHA1																			
CHA2																			
CHAi																			
AirP																			
FLAM																			
IGN	UZa																		
	UZe																		
GP																			
Outputs																			
SV1																			
SV2	EE	So																	
		Sz																	
	ES	So																	
		Sz																	
	kDK	So																	
		Sz																	
IV	Zz																		
	Zo																		
VV	EE																		
	ES																		
	kDK																		
	DE	So																	
		Sz																	
IGNT																			
CONT																			
Step execution	mVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	X	X	-	-	-	-
	oVB	DKv	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-
		DKn	X	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X
		kDK	X	X	-	-	-	-	X	X	X	X	X	X	X	-	-	-	-

Configuration:
mVB: Cycle with compound controller
oVB: Cycle without compound controller
UZe: Monitoring of ignition conditions on
UZa: Monitoring of ignition conditions off
UVe: Monitoring of pre-purge conditions on
UVa: Monitoring of pre-purge conditions off
DE: Continuous vent
DKv: Tightness control prior to ignition
DKn: Tightness control after shutdown
kDK: No tightness control, no continuous vent
EE: Vent via vent valve
ES: Vent via safety valve 2
Zz: Ignition valve is closed after ignition
Zo: Ignition valve remains open after ignition
So: Safety valve 2 open during afterburn
Sz: Closed

Status of inputs/outputs:
Signal must be/is '1'
No monitoring active
Signal must be/is '0'

Step execution:
X Step is executed
- Step is not executed

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4.4 Burner cycle

4.4.9 Example: Viewing the burner cycle in the PNOZmulti Configurator

The steps listed above will be performed during the burner cycle, depending on the configuration.
Once you have made the settings for your configuration in the PNOZmulti Configurator, you can then view the burner cycle. The following information may be displayed:

- An overview of your configuration
- The steps that are performed with this configuration
- The set status of the inputs and the status of the outputs during the respective steps

Example:
You have made the following settings in the PNOZmulti Configurator:

Burner type	Master burner, indirect ignition, separate flame monitoring
Cycle with compound controller	Activated
Ignition valve	Closed after ignition
Type of tightness control	Vent via vent valve
Time of tightness control	During pre-purge
Afterburn	Safety valve 2 is closed during afterburn
Temperature	Enable 'High temperature' operating mode

The following 2 tables are displayed in the PNOZmulti Configurator: ***Set status of inputs*** and ***Status of outputs***. Your own individual burner cycle is represented in these tables.

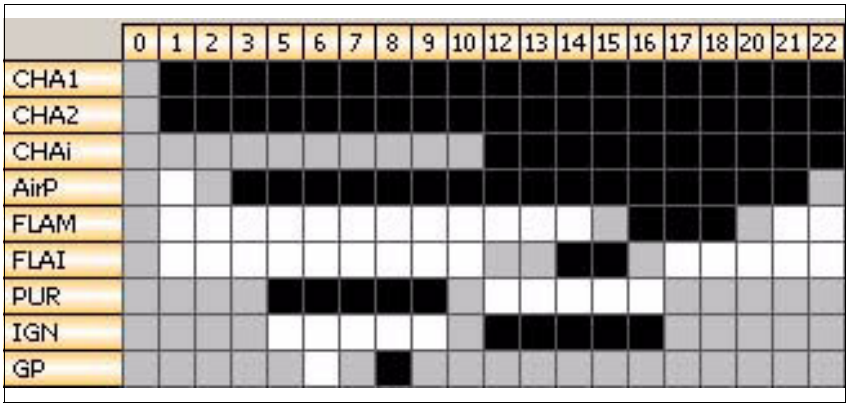
The first row contains all the steps that will be performed during the burner cycle (step identifiers 0 ... 31).
The first column contains all the inputs/outputs used in your application.

The field markings show the set status of the inputs and the status of the outputs during the respective steps:

Black	An input must = "1" in the step concerned, or an output = "1" in the step concerned.
White	An input or output must = "0" in the step concerned, or an output = "0" in the step concerned.
Grey	Monitoring of an input is deactivated in the step concerned, i.e. it is not evaluated.

4.4 Burner cycle

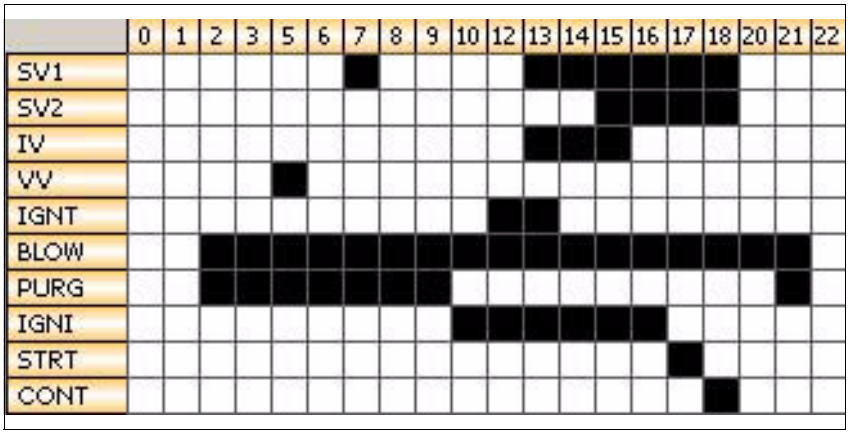
Set status of inputs



Examples:

- In step 2, "Start-up combustion air blower", the safety chain must be closed (input CHA2 = 1)
- In step 1, "Check start conditions", a main flame must not be detected (input FLAM = 0).

Status of outputs



Examples:

- In step 5 "Pre-purge/tightness control: Vent", the vent valve is activated (output VV = 1).
- In step 9 "Continue pre-purge", the ignition transformer is not activated (output IGNT = 0).

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4.5 Inputs and outputs

4.5.1 Element's inputs

4.5.1.1 Operation

- **Start: Switch burner on**
  The cycle is started via the start signal. The system can only be started if no error is present.
  Start = 0, no action
  Start = 1, switch burner on (pulse edge 0 -> 1)
- **Stop: Switch burner off**
  Shutdown of the burner is started via the stop signal.
  Stop = 0, no action
  Stop = 1, switch off burner
- **Reset: Fault lockout/reset error**
  The reset input is used to cancel the restart interlock after a fault lockout. A reset signal resets the cycle to "Burner switched off" status; the burner cycle can be restarted using the start signal.
  Reset = 0, no action
  Reset = 1, reset (pulse edge 0 -> 1)

4.5.1.2 Monitoring functions

- **CHA 1: Safety chain 1**
  The inputs can be assigned to any signals. We recommend that you connect E-STOP pushbuttons, which switch off the burner in an emergency, or plant-dependent monitoring functions, such as temperature or pressure monitoring devices, for example.
  CHA 1 = 0: Safety chain interrupted
  CHA 1 = 1: Safety chain closed
- **CHA 2: Safety chain 2**
  Safety chain 2 has the same function as safety chain 1. Both safety chains are of equal value. They are differentiated to improve diagnostics.
  CHA 2 = 0: Safety chain interrupted
  CHA 2 = 1: Safety chain closed
- **CHAi: Ignition and operation safety chain**
  This input has the same function as safety chains 1 and 2. However, when there is a 0 signal, a fault lockout or safety shutdown will only occur in between the steps Pre-ignition and Burner in operation, inclusive. If the input has a 0 signal before or after this point, it will have no effect.
  CHAi = 0: Safety chain interrupted
  CHAi = 1: Safety chain closed

4.5 Inputs and outputs

- **AirP: Combustion air pressure monitoring**
  The combustion air pressure is monitored at this input.
  AirP = 0: Combustion air pressure absent
  AirP = 1: Combustion air pressure present
  On slave burners it is assumed that the furnace is fitted with a central combustion air supply. In this case, the "AirP" input must be connected to a signal indicating the presence of a correctly functioning combustion air supply.
- **FLAM: Flame monitoring of main flame**
  The main flame is monitored at this input. If a burner type with joint flame monitoring is configured, this input will also be used to monitor the ignition flame.
  FLAM = 0: Flame absent
  FLAM = 1: Flame present
- **FLAI: Flame monitoring for ignition flame**
  If a burner type with separate flame monitoring is configured, this input will be used to monitor the ignition flame.
  FLAI = 0: Ignition flame absent
  FLAI = 1: Ignition flame present
- **PUR: Compound controller in pre-purge position**
  At this input, a signal is expected from the compound controller, indicating that the compound controller is in "pre-purge" position. This signal must not come from the compound controller until the airflow rate required for pre-purge is present.
  PUR = 0: Compound controller not in pre-purge position
  PUR = 1: Compound controller in pre-purge position
- **IGN: Compound controller in ignition position**
  At this input, a signal is expected from the compound controller, indicating that the compound controller is in "ignition" position. This signal must not occur until the optimum fuel/air ratio for ignition is present.
  IGN = 0: Compound controller not in ignition position
  IGN = 1: Compound controller in ignition position
- **GP: Tightness control (gas pressure)**
  The pressure between the two safety valves is monitored at this input.
  GP = 0: Section vented (atmospheric pressure)
  GP = 1: Gas pressure present
- **HTmp: High temperature mode**
  This input is used to switch between "Normal mode" and "High temperature mode". It is only possible to switch to high temperature mode if ***Allow "High temperature" mode*** has been selected in the PNOZmulti Configurator.
  HTmp = 0: Normal operation
  HTmp = 1: High temperature

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4.5 Inputs and outputs

4.5.2 Element's outputs

- **SV1: Safety valve 1**
  Safety valve 1 is activated via this output. Safety valve 1 is on the fuel side.
  SV 1 = 0: Close safety valve 1
  SV 1 = 1: Open safety valve 1
  If the safety valves are activated via relay outputs, the special requirements of EN 50156 must be considered. We recommend that the safety valves are activated via the PNOZmulti expansion module PNOZ mo5p (see section entitled "Examples", under "Connecting the safety valves").
- **SV2: Safety valve 2**
  Safety valve 2 is activated via this output. Safety valve 2 is on the burner side.
  SV 2 = 0: Close safety valve 2
  SV 2 = 1: Open safety valve 2
  If the safety valves are activated via relay outputs, the special requirements of EN 50156 must be considered. We recommend that the safety valves are activated via the PNOZmulti expansion module PNOZ mo5p (see section entitled "Examples", under "Connecting the safety valves").
- **IV: Ignition valve**
  The ignition valve is activated via this output.
  IV = 0: Close ignition valve
  IV = 1: Open ignition valve
- **VV: Vent valve**
  The vent valve is activated via this output. If tightness control is not configured but continuous vent is, this valve must be designed to be "normally open". If neither tightness control nor continuous vent is configured, the output is inactive.
  VV = 0: Close vent valve
  VV = 1: Open vent valve
- **IGNT: Ignition transformer**
  The ignition transformer is activated via this output.
  IGNT = 0: Switch off ignition transformer
  IGNT = 1: Switch on ignition transformer

4.5 Inputs and outputs

- **BLOW: Combustion air blower**
  The combustion air blower is activated via this output.
  BLOW = 0: Switch off combustion air blower
  BLOW = 1: Switch on combustion air blower
- **PURG: Compound controller to pre-purge position**
  This output is used to signal to the compound controller to go to pre-purge position.
  PURG = 0: Compound controller not activated
  PURG = 1: Compound controller to pre-purge position
- **IGNI: Compound controller to ignition position**
  This output is used to signal to the compound controller to go to ignition position.
  IGNI = 0: Compound controller not activated
  IGNI = 1: Compound controller to pre-purge position
- **STRT: Compound controller: Start position**
  This output is used to signal to the compound controller to go to start position.
  STRT = 0: Compound controller not activated
  STRT = 1: Compound controller to start position
- **CONT: Control enable**
  This output provides the signal for the control enable.
  CONT = 0: No control enable
  CONT = 1: Control enable

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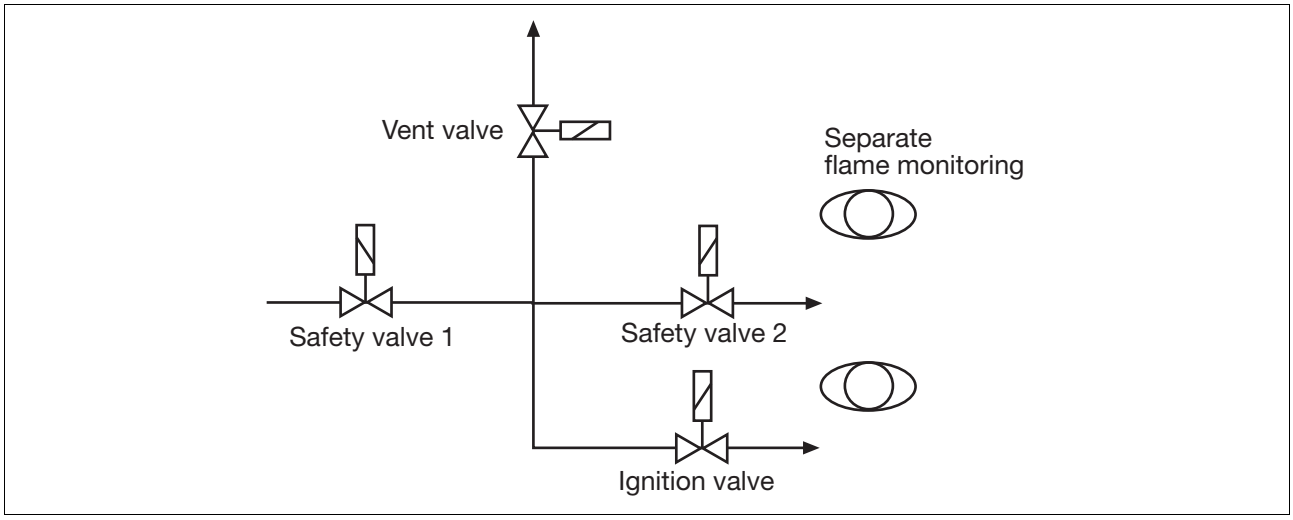
4.6 Configuration examples

4.6.1 Burner configuration

4.6.1.1 Burner structure



4.6.1.2 Burner properties

The burner has the following properties:

- The burner has its own combustion air supply.
- An electronic compound controller is present
- A separate ignition burner is present
- The ignition flame is extinguished once the main burner is successfully ignited.
- Ignition and main flame are each monitored using their own flame monitoring device.
- A tightness control check is carried out prior to ignition (during pre-purge).
- With tightness control, the section between the two safety valves is vented via the vent valve.
- Safety valve 2 is closed during afterburn.

4.6 Configuration examples

4.6.1.3 Configuration in the PNOZmulti Configurator

Select burner type

Burner properties	Configuration
Own combustion air supply	Master burner
Separate ignition burner	Indirect ignition
Separate monitoring of ignition and main flame	Separate flame monitoring

⇨ Select ***Master burner, indirect ignition, separate flame monitoring***

Configure compound controller monitoring

Burner properties	Configuration
Electronic compound controller present	***Cycle with compound controller***

Configure combustion air pressure monitoring

Burner properties	Configuration
A bounce time must be stated for shutting down the combustion air blower	Debounce time: ***300 ms***

Configure ignition

Burner properties	Configuration
Ignition flame is extinguished once the main burner is ignited	Ignition valve ***Closed after ignition***

Configure tightness control

Burner properties	Configuration
Vent via vent valve	Type of tightness control ***Vent via vent valve***
Tightness control occurs prior to ignition	Time of tightness control ***Prior to ignition***

Configure settings for shutting down the burner

Burner properties	Configuration
Safety valve 2 is closed during afterburn.	***Safety valve 2 is closed during afterburn***

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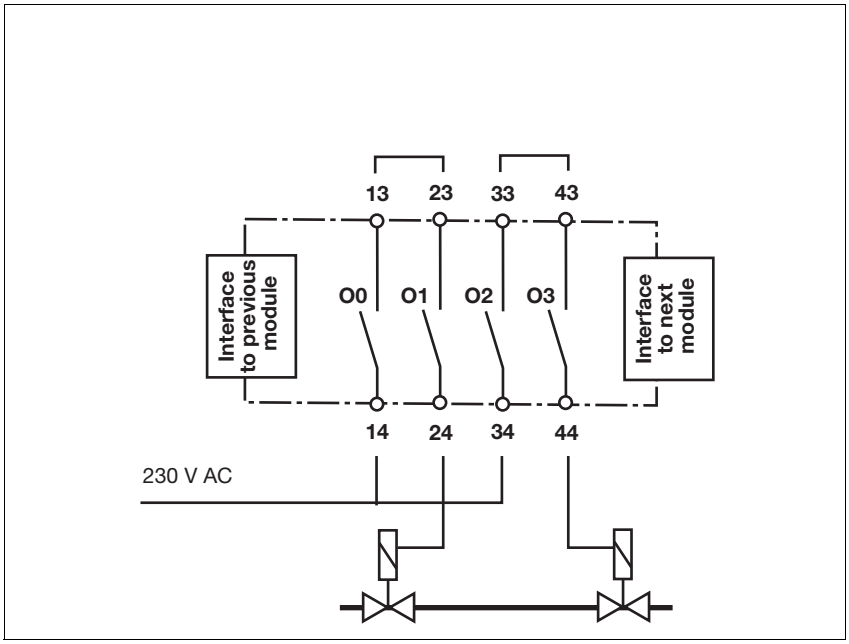
4.6 Configuration examples

4.6.2 Connecting the safety valves

If the safety valves are activated via relay outputs, diverse relays must be used.

The relay output module PNOZ mo5p is intended for that purpose. This module has 4 relay outputs:
Output O0 is diverse from O1,
Output O2 is diverse from output O3

Connecting the safety valves on a burner in accordance with EN 50156



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5.1 Introduction

This chapter describes the "Loop formation" function, in which LOOP inputs and outputs are configured in the PNOZmulti Configurator. This function is available from Version 8.1.0 of the PNOZmulti Configurator. Details of which base units support Version 8.1.0 are available in the "Product Modifications" document in the "Version overview" section.

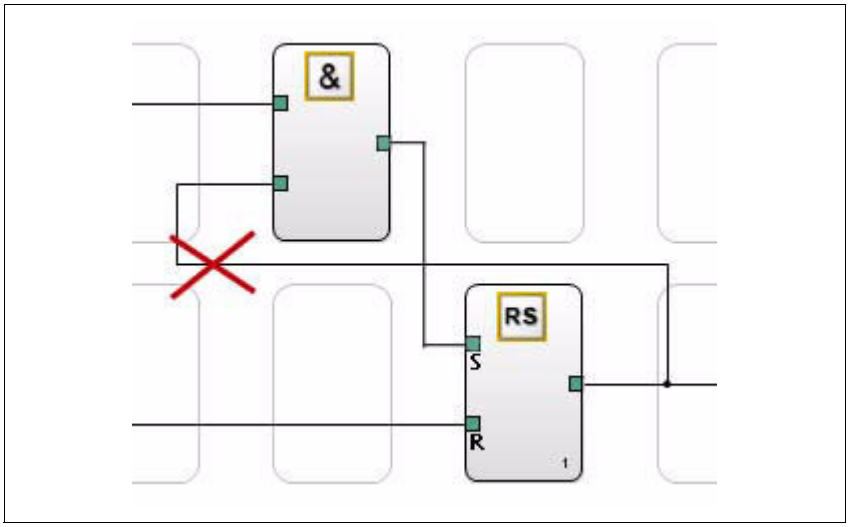
5.1.1 Intended use

The loop formation (LOOP) function is used to feedback output information to the inputs.

NOTICE
When forming a loop, please note that the switch-off delay of the connected output is increased (see section entitled "Function description").

5.2 Function description

The connection of an output to an input of the same element is detected as an invalid loop in the PNOZmulti Configurator and cannot be configured in the user program.



Such a loop is necessary in certain applications. For example, applications containing a step sequence, where the status of the previous step influences the step that follows.

To meet this requirement you can configure a LOOP output and one or more assigned LOOP inputs in the PNOZmulti Configurator.

The output information from the LOOP output is then made available to the assigned LOOP inputs.

NOTICE
When forming a loop, please note that the presence of the output signal at the LOOP input is delayed by up to one cycle (15 ms); as a result, the switch off delay of the connected output is increased by up to one cycle.

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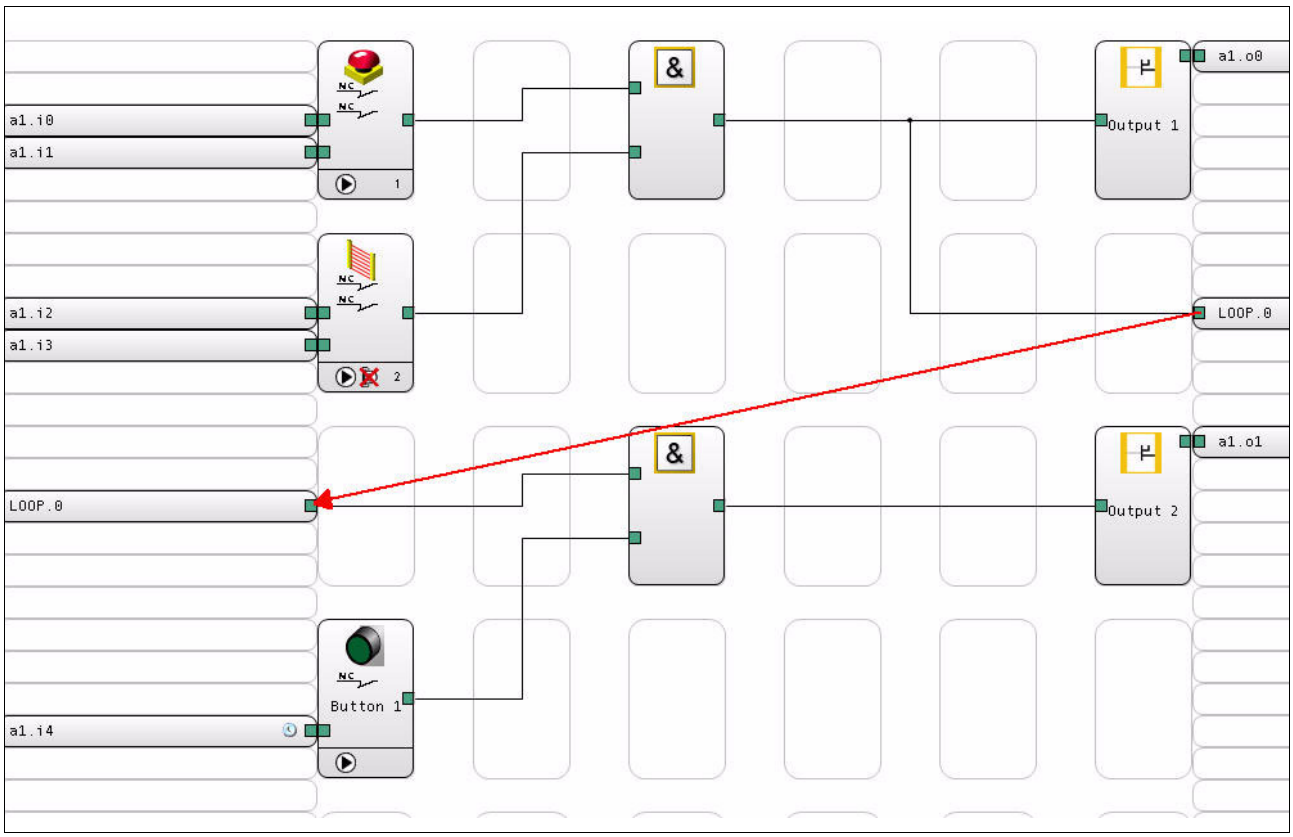
5.3 Example configurations

5.3.1 Application using one loop

In the example configuration below, the status of the "LOOP 0" output is made available one cycle later at the "LOOP 0" input. Logically, the "Output 2" output switches one cycle later than the "Output1" output.



Calculating the switch-off delay of semiconductor output "Output 2" (a1.o1) when the E-STOP pushbutton is operated (a1.i0/a1.i1)

System's cycle time	15 ms
Switch-off delay of semiconductor output	30 ms
Number of loops	1

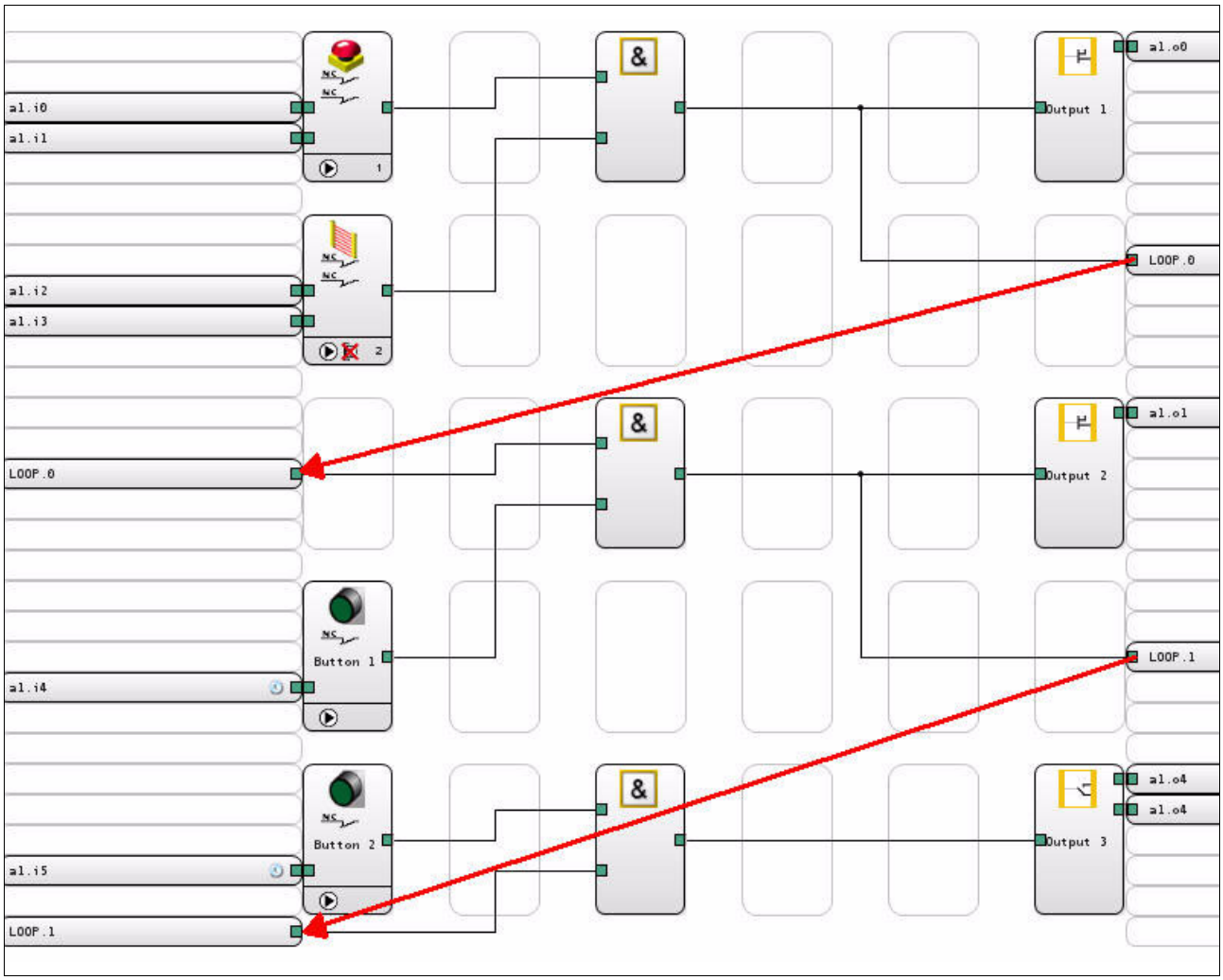
Switch-off delay of Output 2
= (Number of loops * Cycle) + Switch-off delay of semiconductor output
= (1*15 ms) + 30 ms
= 45 ms

5.3 Example configurations

5.3.2 Application using two loops

In the example configuration, the status of the "LOOP 0" output is made available one cycle later at the "LOOP 0" input. Logically, the "Output 2" output switches one cycle later than the "Output1" output.

One more cycle later, the status of output "LOOP1" is made available at the "LOOP1" input.
This means that the "Output 3" output switches 2 cycles later than the "Output1" output.



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5.3 Example configurations

Calculating the switch-off delay of relay output "Output 3" (a1.o4/ a1.o4) when the E-STOP pushbutton is operated (a1.i0/a1.i1)

System's cycle time	15 ms
Switch-off delay of relay output	50 ms
Number of loops	2

Switch-off delay of Output 3
= (Number of loops * Cycle) + Switch-off delay of relay output
= (2*15 ms) + 50 ms
= 80 ms

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1002337-EN-02, 2011-12 Printed in Germany

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