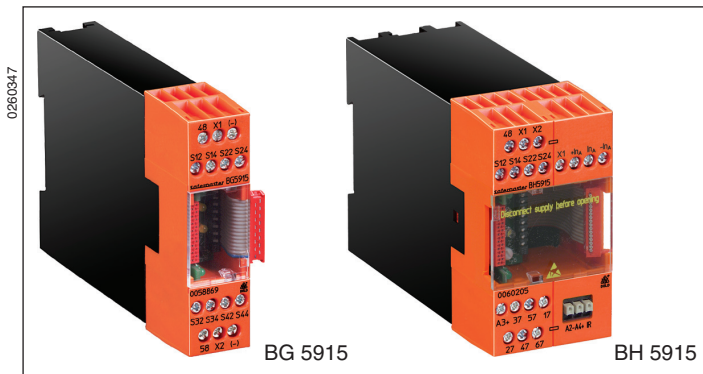
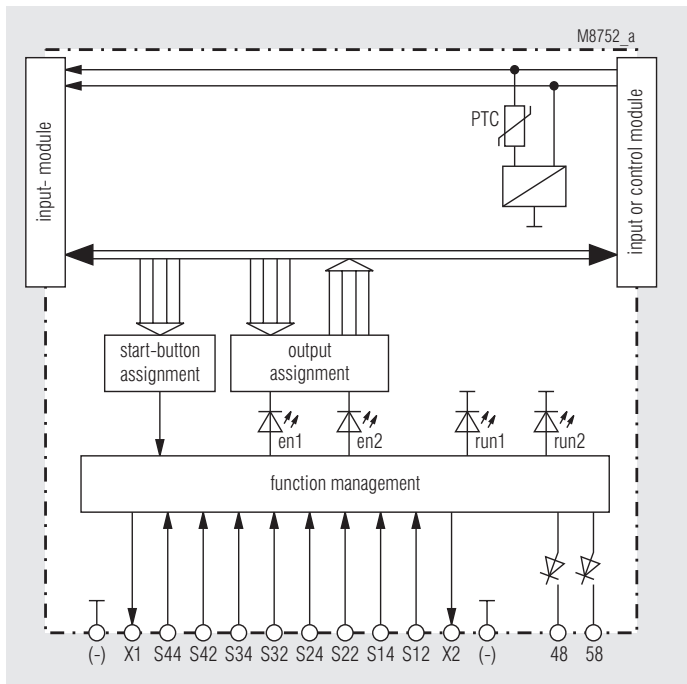


## Multi-Function Safety System SAFEMASTER M Input Module BG 5915.08/\_1\_\_\_, BH5915.08/\_1\_\_\_

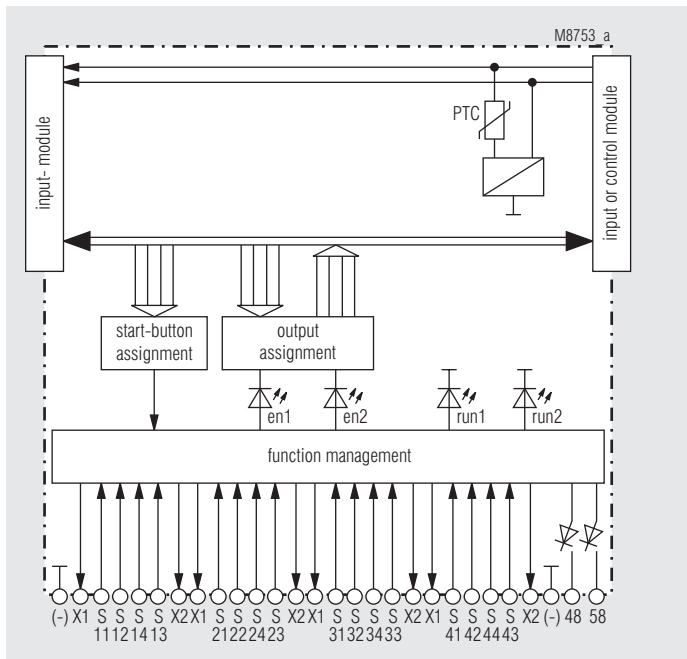


- According to
  - Performance Level (PL) d and category 4 to EN ISO 13849-1: 2008
  - SIL Claimed Level (SIL CL) 3 to IEC/EN 62061
  - Safety Integrity Level (SIL) 3 to IEC/EN 61508
- Input module with enabling inputs
- for connection of 2 channel
  - safety gates
  - e-stop buttons
  - light curtain (LC) Type 4
  - change over switch
  - enabling switch
- Function combination and behaviour of enabling inputs selectable on rotary switches
- Broken wire and short circuit monitoring function with error indication
- 2 semiconductor outputs for status indication
- LEDs for status indication
- Width: 22.5 mm (BG 5915) or 45 mm (BH 5915)

### Block Diagrams



BG 5915



BH 5915

### Approvals and Markings



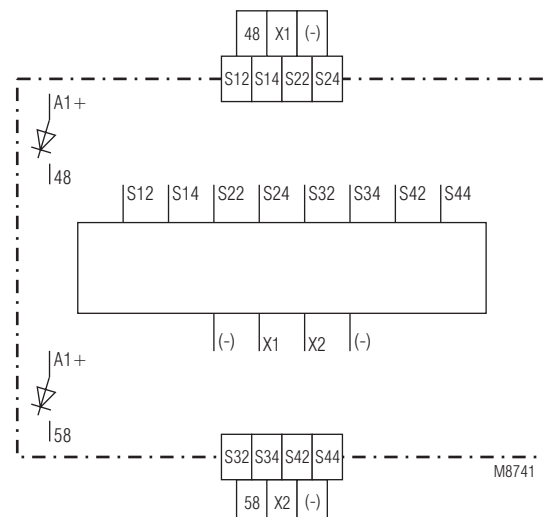
### Applications

Realization of fail-safe control circuits for protection of people and machinery.

**Note:** This module is intended for applications in which mixed safety functions affect one common output.

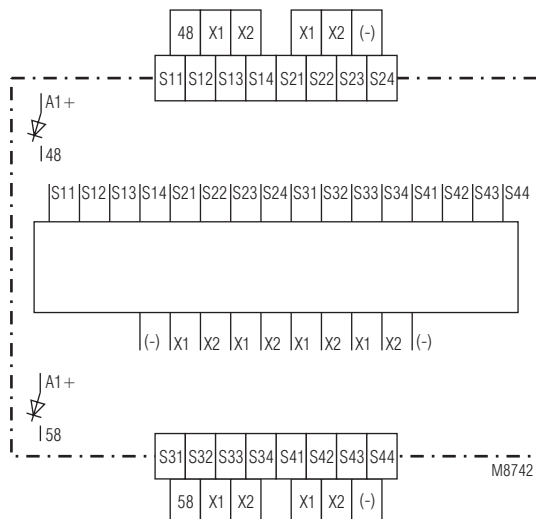
Further input modules with other combinations of functions are provided (e.g. BG 5913.08/\_0\_\_\_, BH 5913.08/\_0\_\_\_, BG 5913.08/\_1\_\_\_, BG 5913.08/\_2\_\_\_, BG 5913.08/\_3\_\_\_, BG 5914.08/\_0\_\_\_, BH 5914.08/\_0\_\_\_ oder BG 5914.08/\_1\_\_\_).

### Circuit Diagram



BG 5915

## Circuit Diagram



BH 5915

## General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

## Function

The input module operates several functions (e.g. 3 e-stop or 2-e-stop+1 enabling input) independent of each other. The module activates if for a selected function all enabling conditions are fulfilled. within a group functions can be selected that behave differently (see description of function)

## Notes

Die Module BG 5915 und BH 5915 unterscheiden sich wie folgt:

- The modules BG 5915 have 8 inputs with one common ground (A2) and a width of only 22.5 mm.
- For applications that require fully galvanic separated inputs the BH 5915 with 45 mm width is designed.

## Indication

Green LEDs: on, when all inputs are present and start button activated.

White LEDs Run 1/  
Run 2 and outputs  
48 and 58: indicate the current status of the module.

## Indication

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED Run 1	Two-hand control not active (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Wait for start	one input function not available
LED Run 2	all relays inactive due to system error	all relays inactive due to system error	no system error

## Indication of System Errors

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

## Error codes\*

- 0) (both white LEDs are off):  
Another input module indicates a system error.
- 1) To 4): not used
- 5) Incorrect setting of function:  
- The rotary switches for channel 1 and 2 has different or incorrect positions  
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)
- 6) LED Run 1 flashes: Undervoltage  
LED Run 2 flashes: Overvoltage
- 7), 8) Not used
- 9) Connection error between the input modules  
No terminating connector available.  
- Control or input module defective
- 10), 11), 12), 13) a. 14) Internal errors

\* number of short flashing impulses, followed by a longer space

## Indication of Function Errors

Function errors are indicated by the white LED Run 1 and by the output 48. During this time, the white LED Run 2 remains on. Output 58 remains on as long as the error is pending; it flashes regularly while waiting for the assigned start signal.

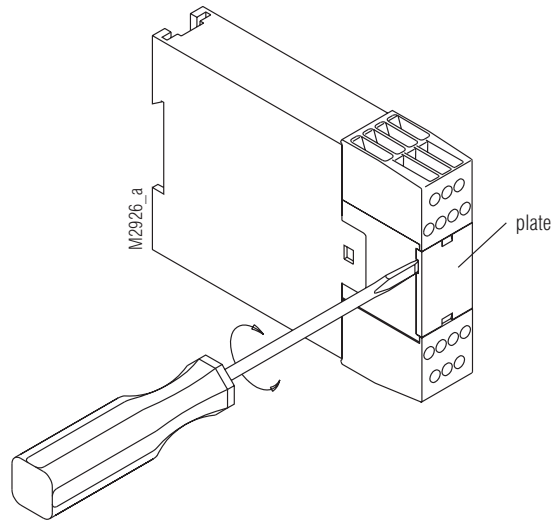
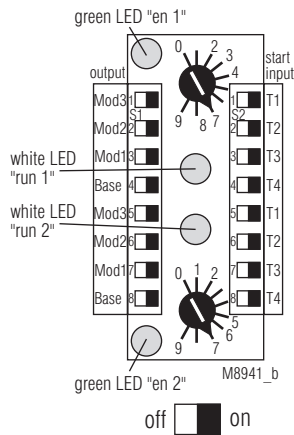
## Error codes\*

- 1) Gate open  
- Enabling switch open, all other protection contacts closed operating mode 3, only on start-up
- 2) E-stop contacts or double contact open, light curtain interrupted
- 3) Timing error: The signals of a selected function are not activated in the required time (250ms with e-stop or light curtain and gate function). For a new activation both channels must be off.
- 4) Error at start or simulation input (kept pressed to long) activated on power up or during a failure.
- 5) Input error (short-circuit, interruption)
- 6) Error in the control unit (input or output error detected in the control unit)

\* number of short flashing impulses, followed by a longer space

## Setting of the Module

The control unit is assigned to the start inputs T1...T4 and the safety outputs via the DIP switches. The input function is set by means of the rotary switches. To prevent accidentally adjustments the setting switches are covered by a front plate and are redundant.



base = Output of control Unit  
mod = Output of output module

### Notes:

- Settings to the unit must be performed by skilled personnel while the unit is off-load.
- Before the front cover is removed, potential equalization must be provided.

Maximum 3 input modules can be connected in series to the left connector of a control unit. the termination plug moves always from the control unit to the last module in the chain.

### Function setting

Poti	S12	S14	S22	S24	S32	S34	S42	S44
0	E-stop 1 or LC 1 (Manual-Start)		E-stop 2 oder LC (Manual-Start)		change over switch closed			
	E-stop 1 or LC 1 (Manual-Start)		E-stop 2 or LC (Manual-Start)				E-stop 3 or LC 3 (Automatic-start)	
1	E-stop 1 or LC 1 (Automatic-Start)		E-stop 2 or LC (Automatic-Start)		change over switch closed			
	E-stop 1 or LC 1 (Automatic-Start)		E-stop 2 or LC (Automatic-Start)				E-stop 3 or LC 3 (Automatic-Start)	
2	Gate 1 (250 ms)							
			Gate 2 (250 ms)		Gate 3 (250 ms)		Gate 4 (250 ms)	
3	Double contact 1 (3s) Manual-Start		Double contact 2 (3s) Manual-Start		LC (250 ms) Manual-Start			
							Enabling switch (250 ms) (Automatic-Start)	
4	Setting not allowed (faliure 5)							
5	Setting not allowed (faliure 5)							
6	Setting not allowed (faliure 5)							
7	Setting not allowed (faliure 5)							
8	Setting not allowed (faliure 5)							
9	Setting not allowed (faliure 5)							



This module is enabled as soon as all conditions are fulfilled at a certain function. E.g. at setting position 2 enabled when (gate 1) or (gate 2 and gate 3) or (gate 2 and gate 4) are closed.

### Notes:

With a LC type 4 (according to IEC/EN 61496-1), short-circuit monitoring takes place in the light curtain itself.

\* LC Light curtain

## Description of the different functions

**Note:** In this section all possible functions are described, that are available on the module. Which function is active depends on the setting of the selector switches of the module.

### Function Safety Gate

To detect a closed the following sequence has to be used:

1. All door contacts have to be open
2. All door contacts have to be activated in the required time span. If one contact comes to late all contacts have to be opened before they can be closed again.
3. The module is enabled as soon as all single functions in a group allow enabling.
4. The module is disabled as soon as one contact in the group is opened.

If no time is specified in the Table „Function setting“ the the default time to close the contacts is 3 s.

The required reclosing of already closed doors can be simulated by a start button that is assigned to the input module.

### Function E-Stop

An E-stop is operated as follows:

1. All contacts of the e-stop button must change from all open to all closed within the required time span or have to be closed already on power up of the module to enable the unit. If one contact is delayed all contacts have to be opened before a restart can be done.
2. If autostart is selected the unit is enabled as soon as all contacts are closed. If manual start is selected the assigned start button has to be pressed in addition.
3. The module is enabled as soon as all single functions in a group fulfill the enabling conditions.
4. The module is disabled as soon as one contact in the group is opened.

If no time is specified in the Table „Function setting“ the the default time to close the contacts is 250 ms.

### Function Light Curtain (LC)

The function is equal to the estop function, only the wiring is different as the e-stop has contacts and the light curtain semiconductor outputs

**Note:** The module must only be used as safety device for light curtains with selftesting type 4 according to EN 61496. The shortcircuit detection of the input circuit has to be done by the light curtain.



### Function Push Button or Selector Switch

The behavior is the same as with e-stop in automatic start mode. If no time is specified in the Table „Function setting“ the the default time to close the contacts is 250 ms.

## Function Enabling Switch (only for override function)

To enable a module the following sequence has to be operated:

1. Before detection activated signal from the enabling switch all its contacts have to be open
2. All contacts must be activated within the required time span.
3. As soon as one contact of the enabling switch gets inactive the module is disabled and condition 1. must be fulfilled again. If no time is stated in the function table the the time span to close all contacts is 500 ms.

**Note:** During override with the enabling switch the overridden function is active in the background. I.e. that the safety outputs open after end of override, when during override e.g. the contact of a door with manual reset are opened and closed again.



### Function Start- or Simulation Button

the start or simulation button must not be operated longer than 3 sec to activate the module. The start button to be used is selected via dip switch setting from the available start inputs of the control unit and assigned to the module.

It is possible to assign several start buttons to one module.

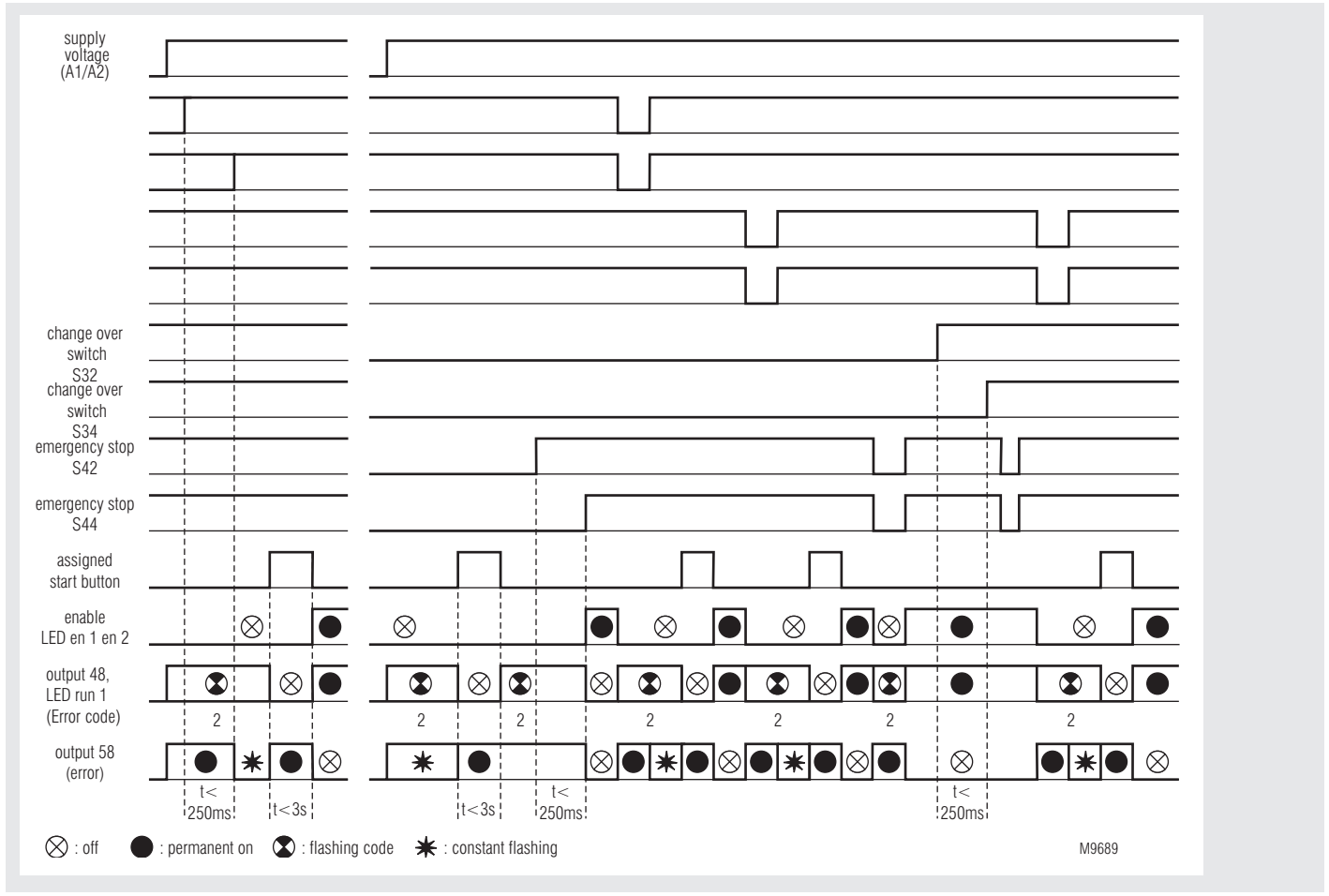
### Connection of Actuators

The actuators have to be connected as stated in the connection diagrams. When actuators with semiconductor outputs are used the module does not detect any crossfaults between the signals. The crossfault then must be detected by the actuator itself. E.g. light barrier type 4 to EN 61469).

# Function Diagramm

Potentiometer = 0

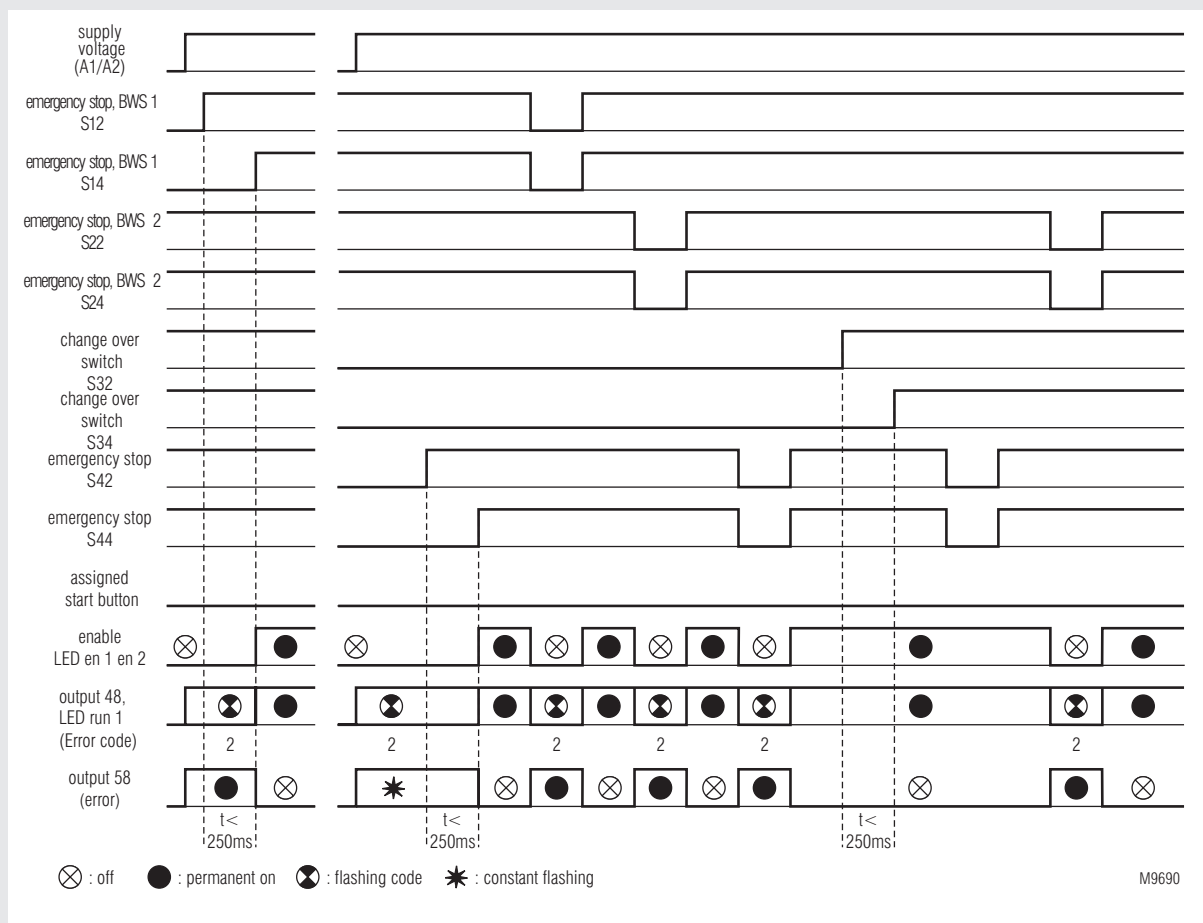
Function 1	S12, S14: E-Stop, manual start	S22, S24: E-Stop, manual start	S32, S34: change over switch closed	
Function 2	S12, S14: E-Stop, manual start	S22, S24: E-Stop, manual start	S32, S34: change over switch open	S42, S44: E-Stop, automatic start



**Function Diagram**

**Potentiometer = 1**

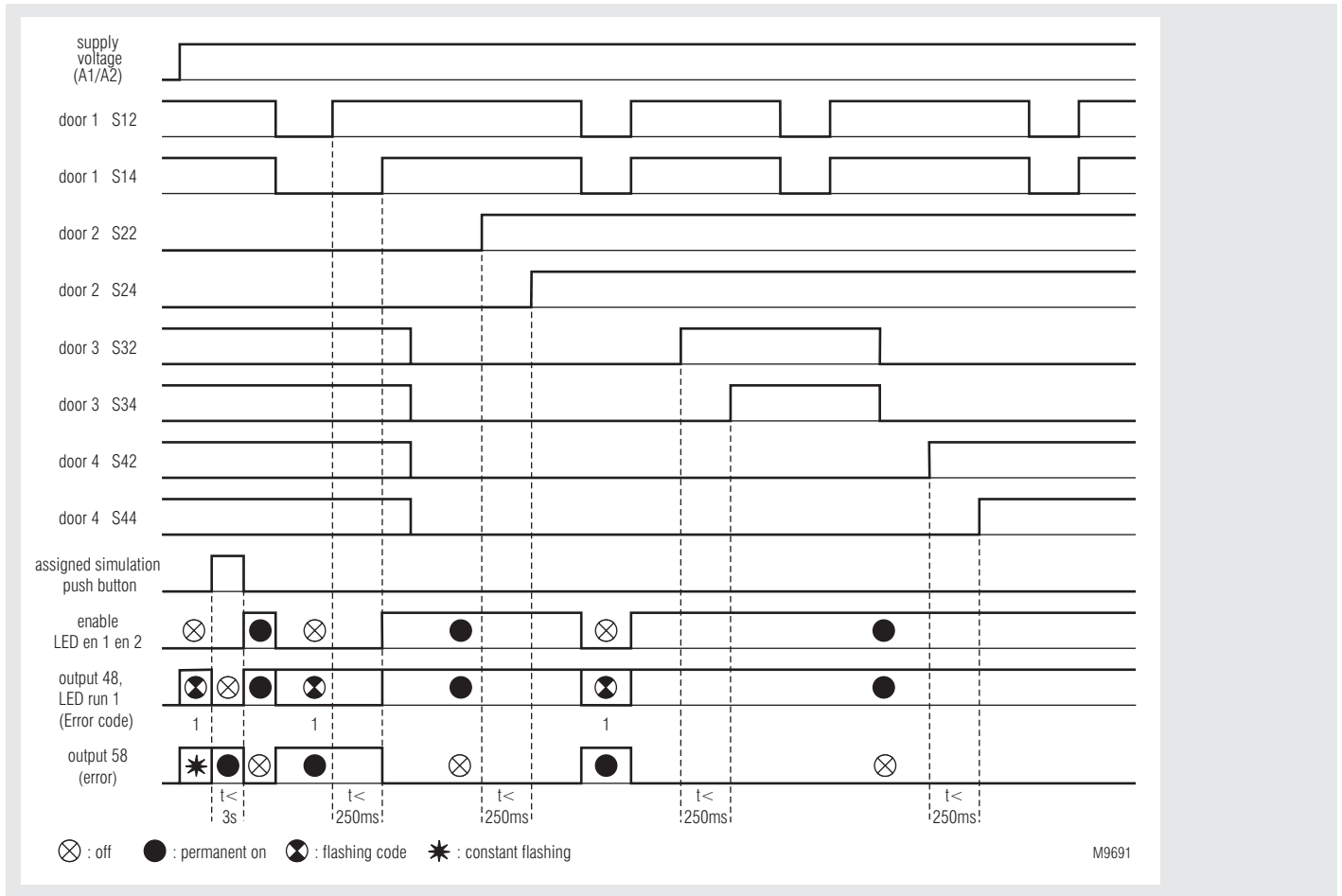
Function 1	S12, S14: E-Stop, automatic start	S22, S24: E-Stop, automatic start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, automatic start	S22, S24: E-Stop, automatic start	S32, S34: Change over switch open	S42, S44: E-Stop, automatic start



## Function Diagram

### Potentiometer = 2

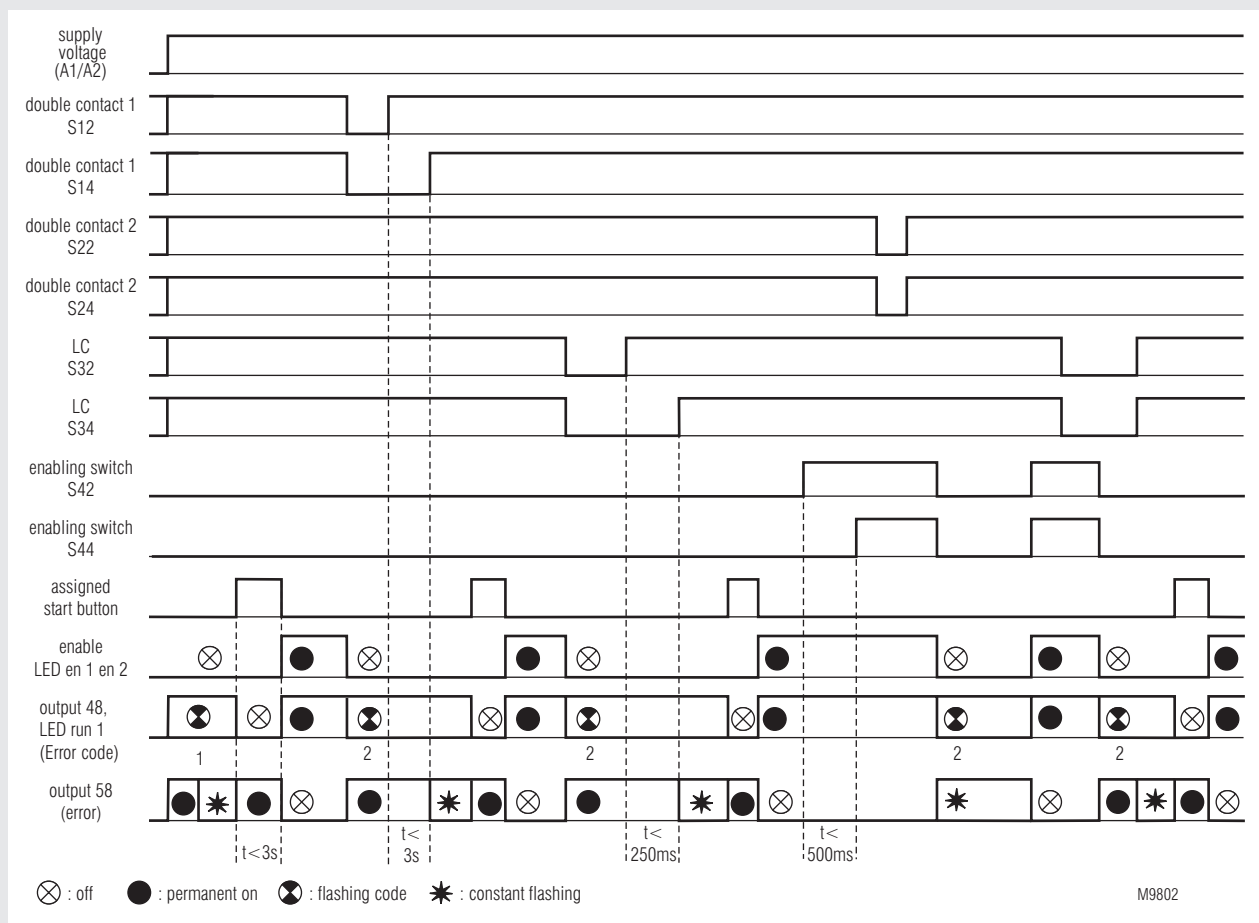
Function 1	S12, S14: door 250 ms monitoring time			
Function 2		S22, S24: door 250 ms monitoring time	S32, S34: door 250 ms monitoring time	
Function 3		S22, S24: door 250 ms monitoring time		S42, S44: door 250 ms monitoring time



**Function Diagram**

**Potentiometer = 3**

Function 1	S12, S14: double contact 1	S22, S24: double contact 2	S32, S34: (LC) manual start	
Function 2				S42, S44: enabling switch

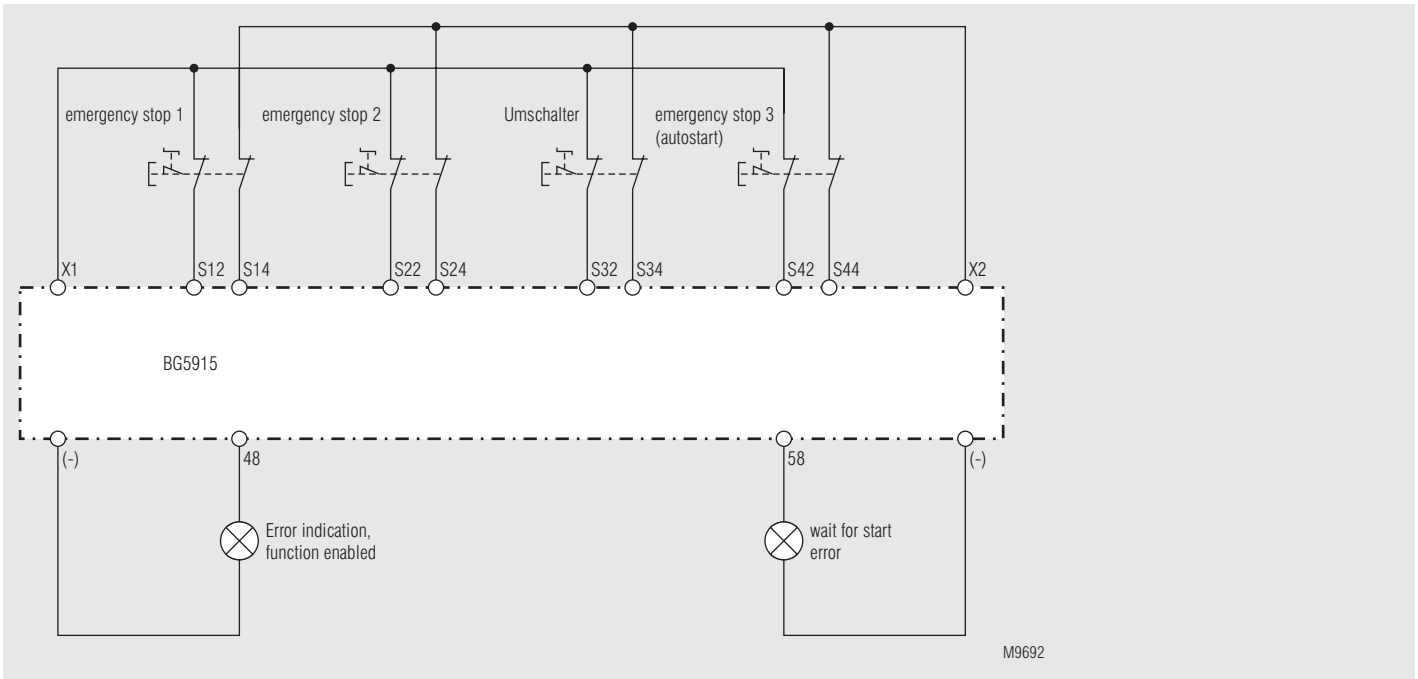


**Potentiometer= 4 to Potentiometer = 9:**

These settings are not used at the moment. they are reserved for possible applications in future. When one of these settings is selected, the module goes in error state indicating system failure 5.



## Application Examples



M9692

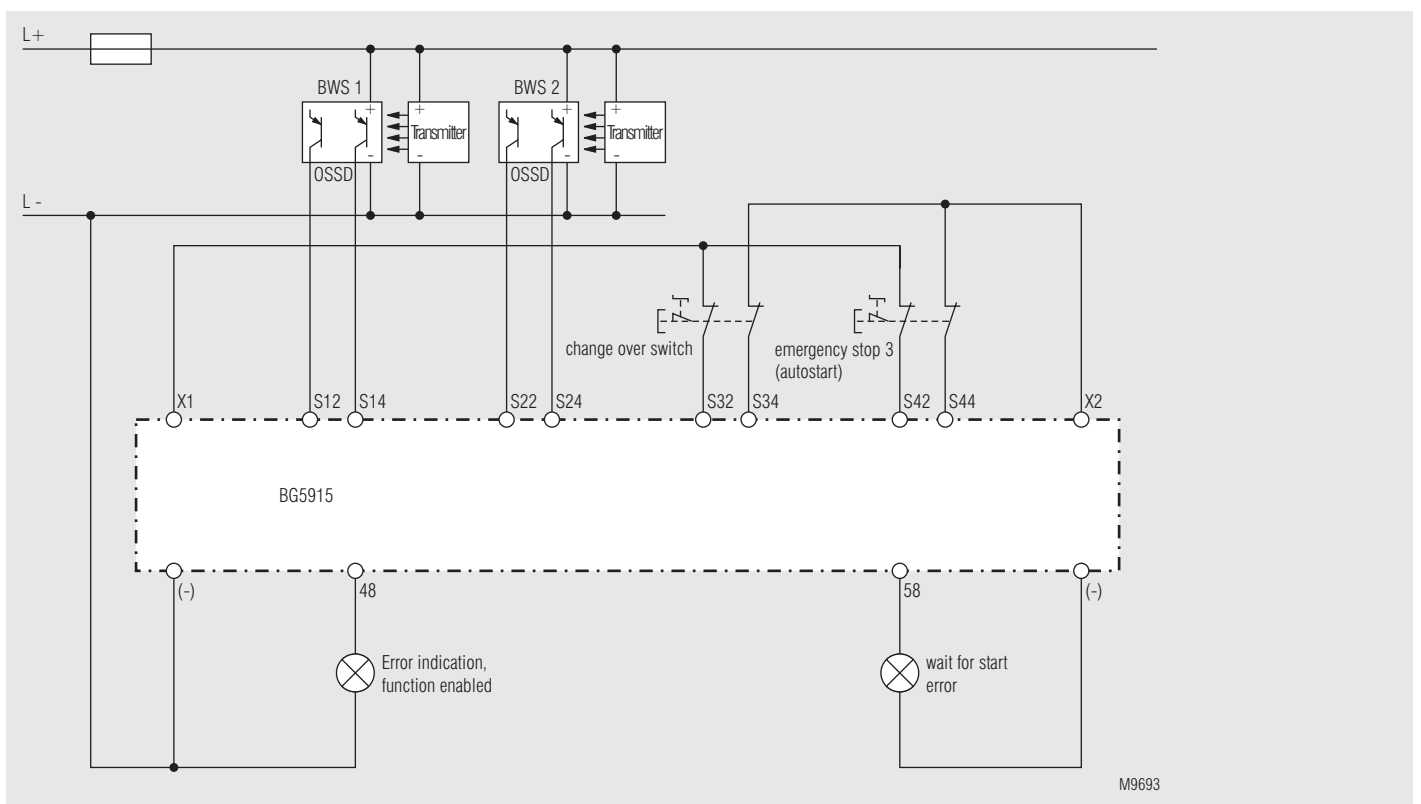
BG 5915.08/01MF0, Connection of E-Stop-buttons

### Potentiometer = 0

Function 1	S12, S14: E-Stop, manual start	S22, S23: E-Stop, manual start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, Manual start	S22, S23: E-Stop, manual start	S32, S34: Change over switch open	S42, S44: E-Stop, Auto start

### Potentiometer = 1

Function 1	S12, S14: E-Stop, Auto start	S22, S23: E-Stop, Auto start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, Auto start	S22, S23: E-Stop, Auto start	S32, S34: Change over switch open	S42, S44: E-Stop, Auto start



M9693

BG 5915.08/01MF0, connection at OSSD's of LC Typ 4 according to EN 61496

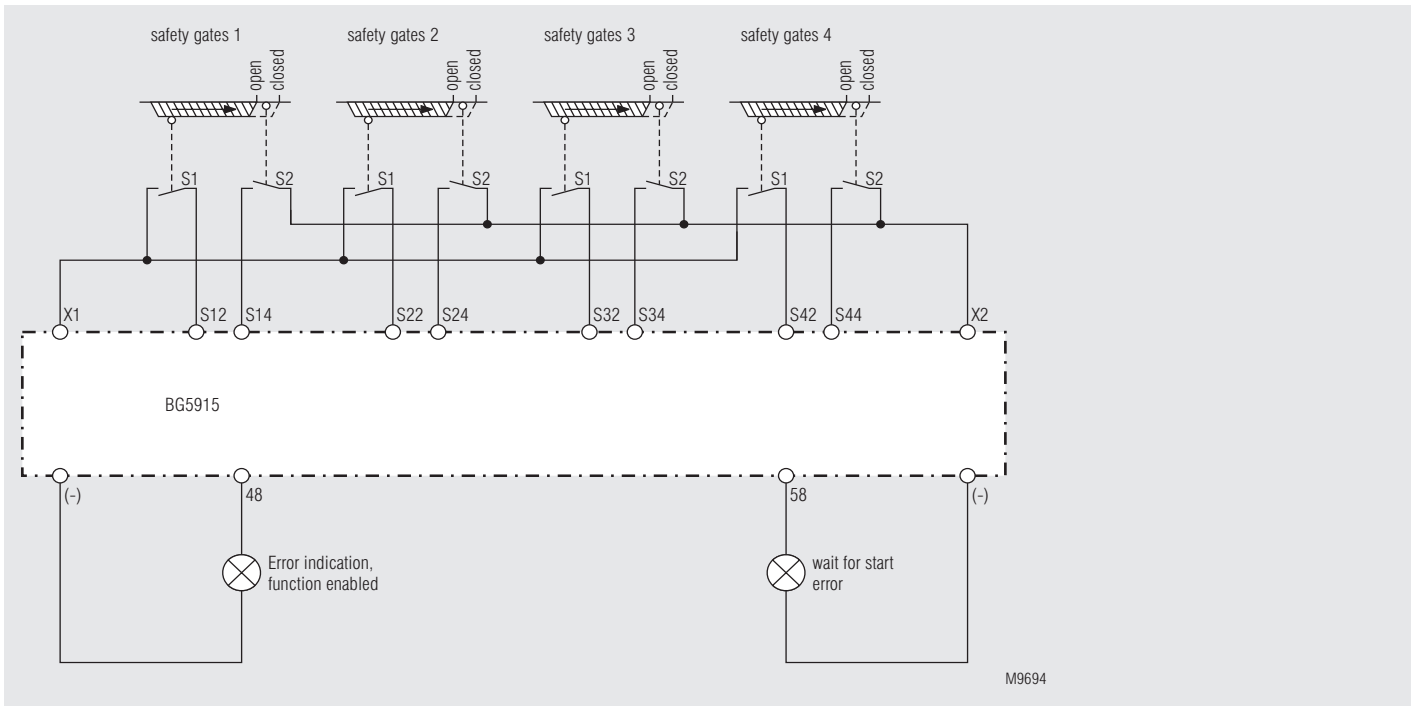
### Potentiometer = 0

Function 1	S12, S14: LC, Manual start	S22, S23: LC, Manual start	S32, S34: Change over switch closed	
Function 2	S12, S14: LC, Manual start	S22, S23: LC, Manual start	S32, S34: Change over switch open	S42, S44: E-stop, Auto start

### Potentiometer = 1

Function 1	S12, S14: LC, Auto start	S22, S23: LC, Auto start	S32, S34: Change over switch closed	
Function 2	S12, S14: LC, Auto start	S22, S23: LC, Auto start	S32, S34: Change over switch open	S42, S44: E-stop, Auto start

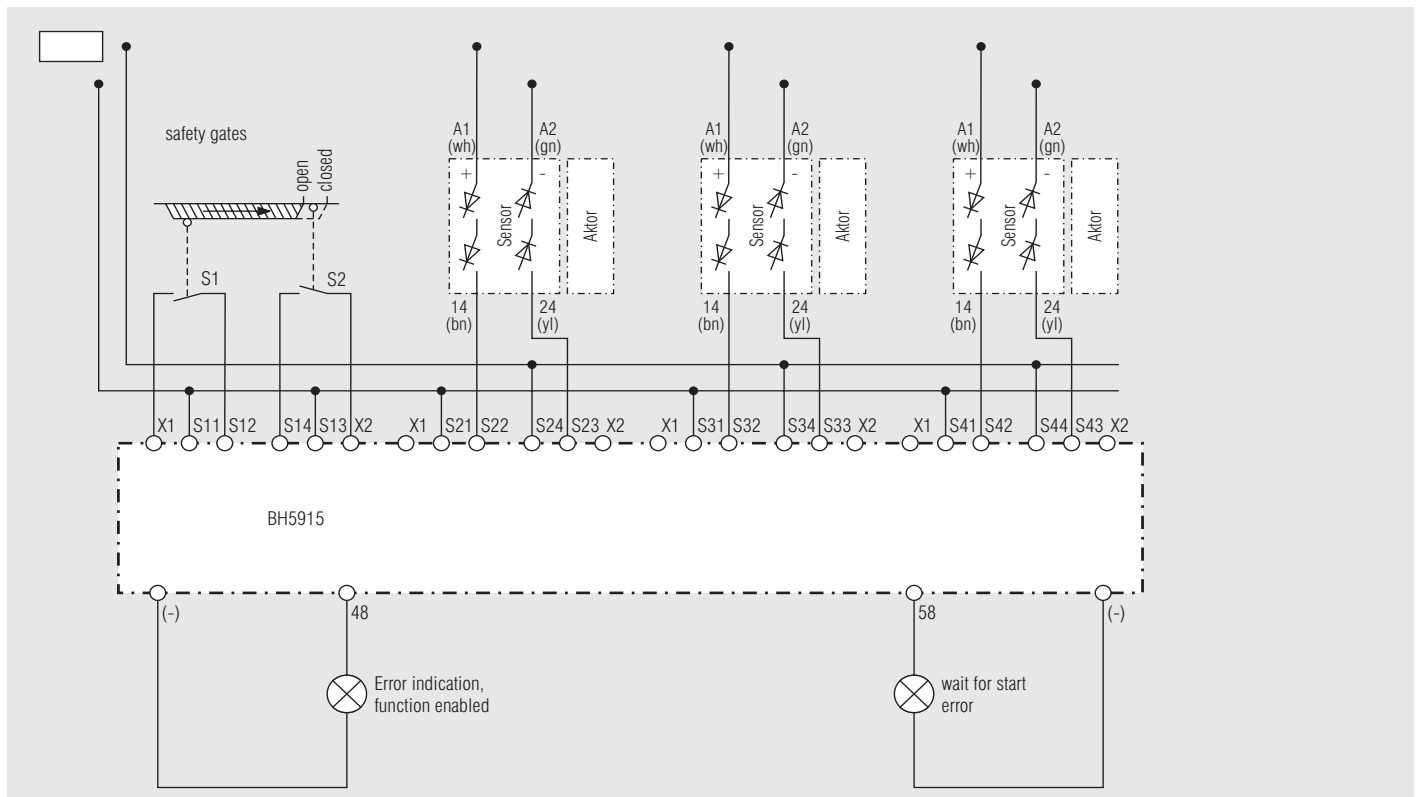
## Application Examples



BG 5915.08/01MF0, volt free contacts

Potentiometer = 2

Function 1	S12, S14: door 250 ms monitoring time			
Function 2		S22, S24: door 250 ms monitoring time	S32, S34: door 250 ms monitoring time	
Function 3		S22, S24: door 250 ms monitoring time		S42, S44: door 250 ms monitoring time

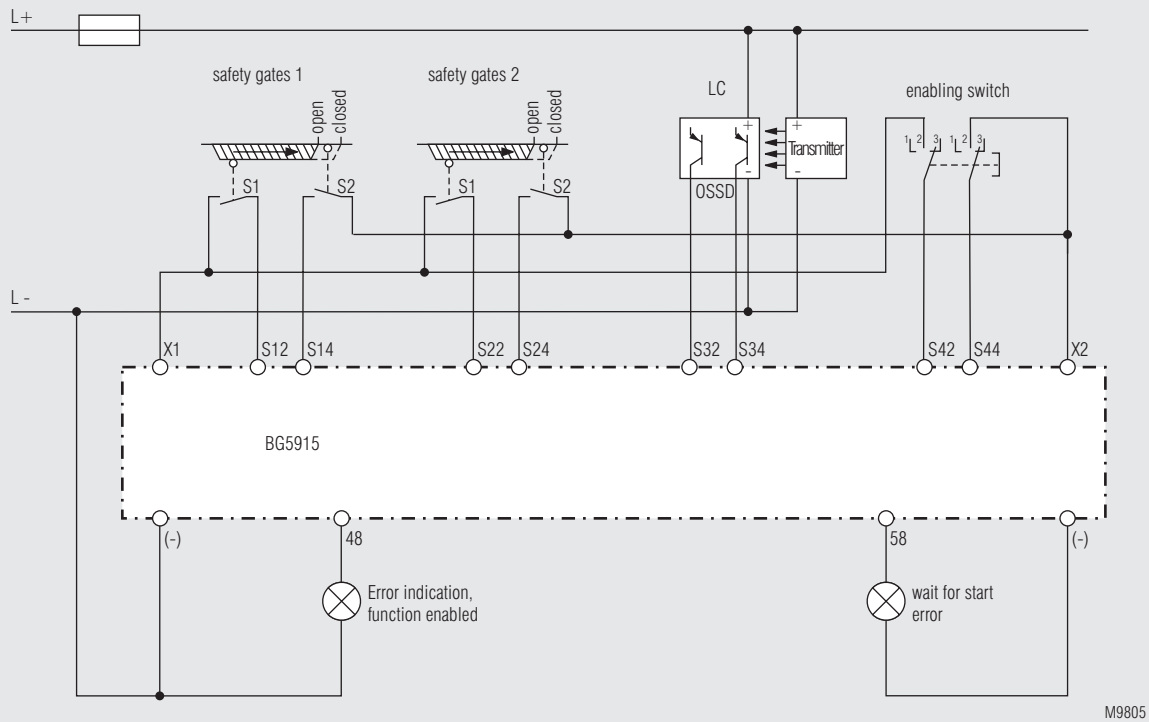


BH 5915.08/01MF0, Connection at sensors with semiconductor outputs

Potentiometer = 2

Function 1	S11-S14: door 250 ms monitoring time			
Function 2		S21-S24: door 250 ms monitoring time	S31-S34: door 250 ms monitoring time	
Function 3		S21-24: door 250 ms monitoring time		S41-S44: door 250 ms monitoring time

## Application Examples



M9805

### Potentiometer = 3

Function 1	S12, S14: safety gate 1	S22, S24: safety gate 2	S32, S34: (LC) Manual start	
Function 2				S42, S44: enabling switch

## Technical Data

### Voltage Supply

<b>Nominal voltage <math>U_N</math>:</b>	DC 24 V (comes from basic module BH 5911)
<b>Voltage range:</b> with max. 5% residual ripple:	0.85 ... 1.15 $U_N$
<b>Nominal consumption:</b>	max. 60 mA (no load on semiconductor outputs)
<b>Short-circuit protection of the modules:</b>	internally with PTC

### Inputs

<b>Control voltage over</b> X1, X2:	DC 23 V at $U_N$
<b>Control current over</b> S11-S12, S13-S14, S21-S22, S23-S24, S31-S32, S33-S34, S41-S42, S43-S44: max. wire length to sensors with contacts:	4.5 mA each at $U_N$ 100 m
<b>Minimum voltage at</b> S12, S14, S22, S24, S32, S34 S42, S44:	DC 16 V

### Outputs

Output on terminal 48 and 58:	Transistor outputs, plus-connected internal short circuit, overtemperature and overload protection
Output nominal voltage:	DC 23 V at $U_N$
Output current:	max. 100 mA continuous current max. 400 mA for 0.5 s

### Safety outputs (at control unit or output modules)

#### Reaction times (time till reaction of the assigned output)

##### Typ. operating time with $U_N$

Manual-Start:	max. 110 ms
First start at automatic start:	max. 1 s
Restart at automatic start:	max. 115 ms
<b>Break time</b> (reaction time):	max. 33 ms

### General Data

<b>Operating mode:</b>	Continuous operation
Temperature range:	$\pm 0 \dots + 50 \text{ }^\circ\text{C}$ At an operating temperature of $50 \text{ }^\circ\text{C}$ the modules must be mounted with a distance of 3 - 5 mm.

### Clearance and creepage distances

rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1
<b>EMC:</b>	IEC/EN 61 326-3-1, IEC/EN 62 061

Radio interference suppression:	Limit value class A EN 55011
------------------------------------	------------------------------

**Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.**

### Degree of protection

Housing:	IP 20 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529

<b>Housing:</b>	Thermoplast with V0 behavior according to UL Subject 94
<b>Vibration resistance:</b>	Amplitude 0.35 mm

<b>Shock resistance:</b>	
Acceleration:	10 g
Pulse duration:	16 ms
Number of shocks:	1000 per axis on three axes
<b>Climate resistance:</b>	0 / 050 / 04 IEC/EN 60 068-1
<b>Terminal designation:</b>	EN 50 005

## Technical Data

<b>Wire connection:</b>	1 x 2.5 mm <sup>2</sup> stranded wire with sleeve, or 1 x 4 mm <sup>2</sup> massive or 2 x 1.5 mm <sup>2</sup> litz with sleeve DIN 46 228-1/-2/-3/-4
<b>Wire fixing:</b>	Box terminal with wire protection, remov- able terminal strips
<b>Mounting:</b>	DIN rail IEC/EN 60715
<b>Weight</b>	
BG 5915:	165 g
BH 5915:	255 g

### Dimensions

<b>Width x height x depth:</b>	
BG 5915:	22.5 x 84 x 121 mm
BH 5915:	45 x 84 x 121 mm

### Safety Related Data for E-STOP

#### Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF <sup>d</sup> :	812.8	a
DC <sup>avg</sup> :	96.0	%
d <sub>op</sub> :	365	d/a (days/year)
h <sub>op</sub> :	24	h/d (hours/day)
t <sub>Zyklus</sub> :	3600	s/Zyklus
	≅ 1	/h (hour)

#### Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT <sup>1)</sup> :	1	
DC <sup>avg</sup> :	96.0	%
SFF	99.2	%
PFH <sub>D</sub> :	2.34E-10	h <sup>-1</sup>

### Safety Related Data for LC, Safety Gate or Two-Hand

#### Values according EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF <sup>d</sup> :	2697.1	a
DC <sup>avg</sup> :	96.0	%
d <sub>op</sub> :	220	d/a (days/year)
h <sub>op</sub> :	12	h/d (hours/day)
t <sub>Zyklus</sub> :	138	s/Zyklus

#### Values according IEC/EN 62061 / IEC/EN 61508:

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT <sup>1)</sup> :	1	
DC <sup>avg</sup> :	96.0	%
SFF	99.2	%
PFH <sub>D</sub> :	2.34E-10	h <sup>-1</sup>

<sup>1)</sup> HFT = Hardware-Failure Tolerance



The values stated above are valid for the standard type.  
Safety data for other variants are available on request.

The safety relevant data of the complete system has to be  
determined by the manufacturer of the system.

### Standard Type

BG 5915.08/01MF0	
Article Number:	0058869
• 8 inputs	
• Width:	22.5 mm
BH 5915.08/01MF0	
Article Number:	0058874
• 8 inputs	
• Width:	45 mm