SAFEMASTER
Light curtain controller with selectable operating modes BH 5902/01MF2

Translation of the original instructions

DOLD

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0262834

Contents

Before installing, operating or maintaining this device, these instructions must be carefully read and understood.

Keep instructions for future reference

The installation must only be done by a qualified electrican!

Do not dispose of household garbage!
The device must be disposed of in compliance with nationally applicable rules and requirements.

To help you understand and find specific text passages and notes in the operating instructions, we have important information and information marked with symbols.

Symbol and Notes Statement

DANGER:
Indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING:
Indicates that death or severe personal injury can result if proper precautions are not taken.

CAUTION:
Indicates that a minor personal injury can result if proper precautions are not taken.

INFO:
Referred information to help you make best use of the product.

ATTENTION:
Warns against actions that can cause damage or malfunction of the device, the device environment or the hardware / software result.

General Notes

The product hereby described was developed to perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors, evaluation units, signals and logical modules for safe disconnections. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. DOLD cannot guarantee all the specifications of an installation or machine that was not designed by DOLD. The total concept of the control system into which the device is integrated must be validated by the user. DOLD also takes over no liability for recommendations which are given or implied in the following description. The following description implies no modification of the general DOLD terms of delivery, warranty or liability claims.

Designated Use

The BH 5902/01MF2 interrupts a safety circuit in a safe way. In applications with light curtains it can be operated in protection, muting and stepping mode to protect people and machinery.
When used in accordance with its intended purpose and following these operating instructions, this device presents no known residual risks. Nonobservance may lead to personal injuries and damages to property.

Safety Notes

Risk of electrocution!
Danger to life or risk of serious injuries.

- Disconnect the system and device from the power supply and ensure they remain disconnected during electrical installation.
- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed.
- The contact protection of the elements connected and the insulation of the supply cables must be designed in accordance with the requirements in the operating instructions / data sheet.
- Note the VDE and local regulations, particularly those related to protective measures.

Risk of fire or other thermal hazards!
Danger to life, risk of serious injuries or property damage.

- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed. In particular, the current limit curve must be heeded.
- The device may only be installed and put into operation by experts who are familiar with this technical documentation and the applicable health and safety and accident prevention regulations.

Functional error!
Danger to life, risk of serious injuries or property damage.

- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed.
- The device may only be installed and put into operation by experts who are familiar with this technical documentation and the applicable health and safety and accident prevention regulations.
- The unit should be panel mounted in an enclosure rated at IP 54 or superior. Dust and dampness may lead to malfunction.

Installation fault!
Danger to life, risk of serious injuries or property damage.

- Make sure of sufficient protection circuitry at all output contacts for capacitive and inductive loads.

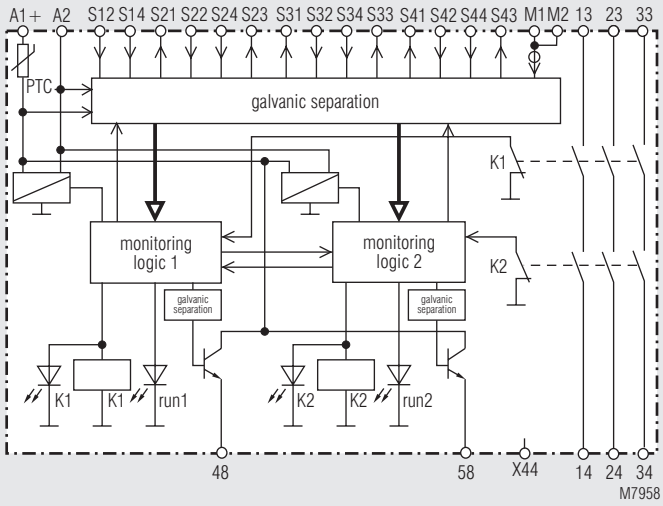
Attention!

- The safety function must be triggered during commissioning.
- On BH 5902.22 the NC contact 31-32 must only be used as monito ring contact
- Not suitable for machines where the area behind the light curtain is accessable
- Settings have to be carried out by educated personnel with disconnected power supply
- Before removing the front plate the person must be discharged to ground.
- The muting lamp must be conform to IEC/EN 61 496-1 section A7.4
- If an input is not used, 2 wire links have to be made according to picture 8 on the terminals S-1/S-2 and S-4/S-3.
- Opening the device or implementing unauthorized changes voids any warranty

SAFEMASTER
Light Curtain Controller With Selectable Operating Modes
BH 5902/01MF2

0237093

Block Diagram



- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- To connect max.:
  - 3 light curtains 2-channel or
  - 2 light curtains 2-channel and 2 muting sensors 1-channel or
  - 1 light curtain 2-channel and 4 muting sensors 1-channel or
  - 2 light curtains 2-channel and key switch for stepping operation
  - Additionally: Start button and machine contact with line fault detection
- Broken wire detection on light curtain input
- Outputs:
  - 3 NO or 2 NO and 1 NC
  - 2 Semiconductor outputs, protected against short circuit and overload
- Multifunction device, different functions selectable by rotational switches:
  - Protective operation e.g. light curtains
  - Protective operation with muting, e.g. conveyors
    - * Signal sequence of muting sensors can be selected
    - * Override function via start button
  - Stepping operation e.g. on presses
    - * Optionally with key switch
    - * 1, 2 or 3 steps possible
    - * Setting of number of step possible via selector switch
- Suitable to connect light curtains of type 4 or selftesting light curtains type 2 according to IEC/EN 61 496-1, crossfault monitoring in the light curtain
- With under- and overvoltage detection and indication
- Reaction time: max. 30 ms
- LED indication for RUN and Channel 1,2
- Width 45 mm

Approvals and Markings

CE · TÜVRheinland CERTIFIED Product Safety Functional Safety www.tuv.com ID 0600000000 · c UL us LISTED Canada / USA · UKCA

Applications

- Protection of men and machines e.g. presses and conveyors

Indicators

Lower green LEDs
K1, K2: - On, when K1 and K2 are energized

Upper yellow LED
run 1: - Permanent on, when relay K1 and K2 are energized
- Flashes with 1 Hz when the unit waits for the start signal after fault free operation (power up of the unit)
- Flashes fast with approx. 3 Hz when the start button is pressed and all conditions for an override are fulfilled during muting
- Flashes fast with approx. 3 Hz when at stepping operation the unit waits for interruption of the light curtain
- Flashes with failure code to indicate normal indication states that disable the energisation of the output relays (e.g. after not allowed interruption of the light curtain) until the start button is pressed
- Flashes with failure code to indicate special failures (e.g. undervoltage)

Semiconductor output 48: - Off, when unit is on special failure mode
- Normally off when relays K1 and K2 are energized
- Continuously on, when unit in muting mode
- Shows the same failure codes as LED run 1 (except on special failures)

All technical data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.

Indicators

Upper yellow LED run 2:
- Permanent on, when unit operates correctly
- Flashes with failure code to indicate special operation failures (e.g. undervoltage)

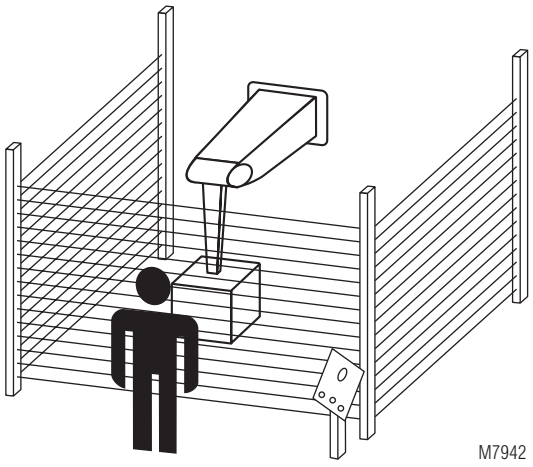
Semiconductor output 58:
- Off, when unit is on special failure mode
- Off, when relays K1 and K2 are energized
- Symmetric flashing, when a normal functional state is active that disables the energisation of the output relays (e.g. not allowed interruption of a light curtain)
- Permanent on, when waiting for start

Operation Mode 0, 1: Protective Operation

Application e.g. for light curtains to secure dangerous areas
(without feedback input see picture 1 or with feedback input see picture 2)
- Connection up to 3 light curtains
- Manual or automatic start possible for each light curtain
- With or without feedback input for external contactors

Possible settings:

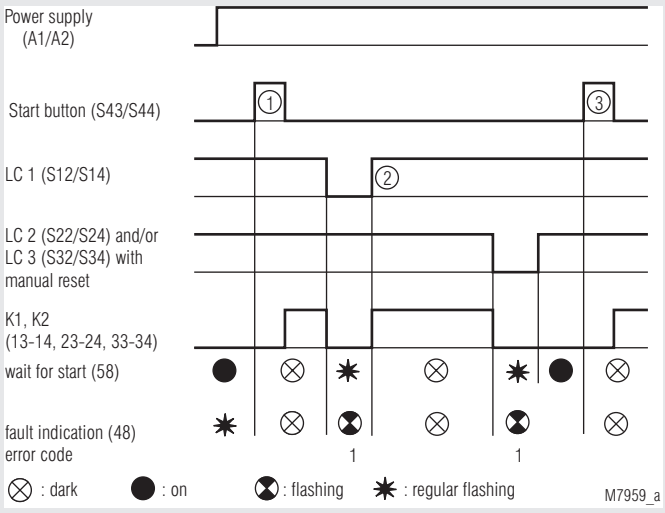
			Switch 10: Start mode and feedback input									
			0	1	2	3	4	5	6	7	8	9
			without feedback input					with feedback input				
Switch 1	0	LC 1 LC 2 LC 3	Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)		Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)	
	1	LC 1 LC 2 LC 3	Manu Manu Manu	Manu Auto Manu	Manu Auto Auto			Manu Manu Manu	Manu Auto Manu	Manu Auto Auto		

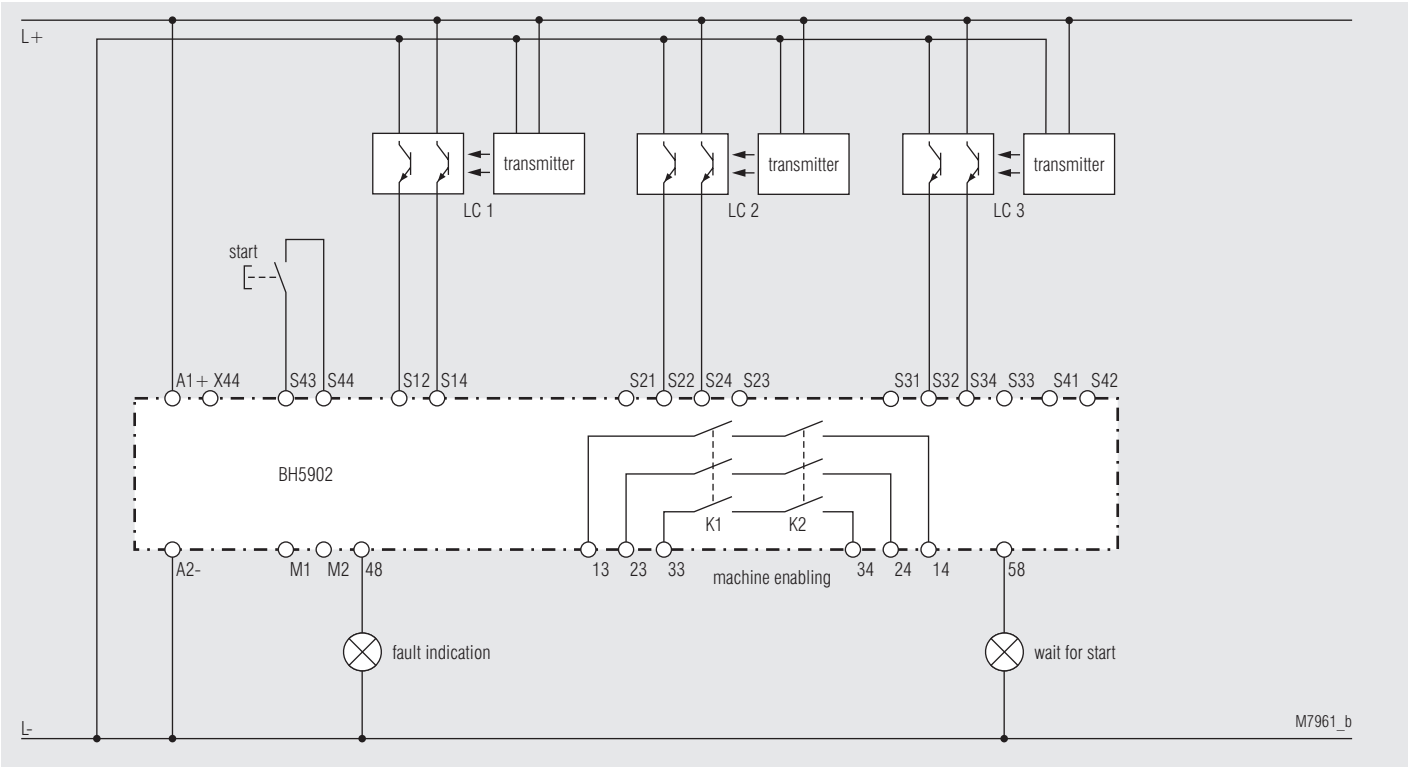


- **Automatic start**
  On automatic start the contacts K1 and K2 are energized when the light curtain that is set for auto start is free after interruption. It is necessary that the other light curtains with manual start are not interruped.
- **Manual start**
  On manual start the contacts K1 and K2 are energized when the light barrier that is set for manual start is free after interruption and the start button is pressed ③

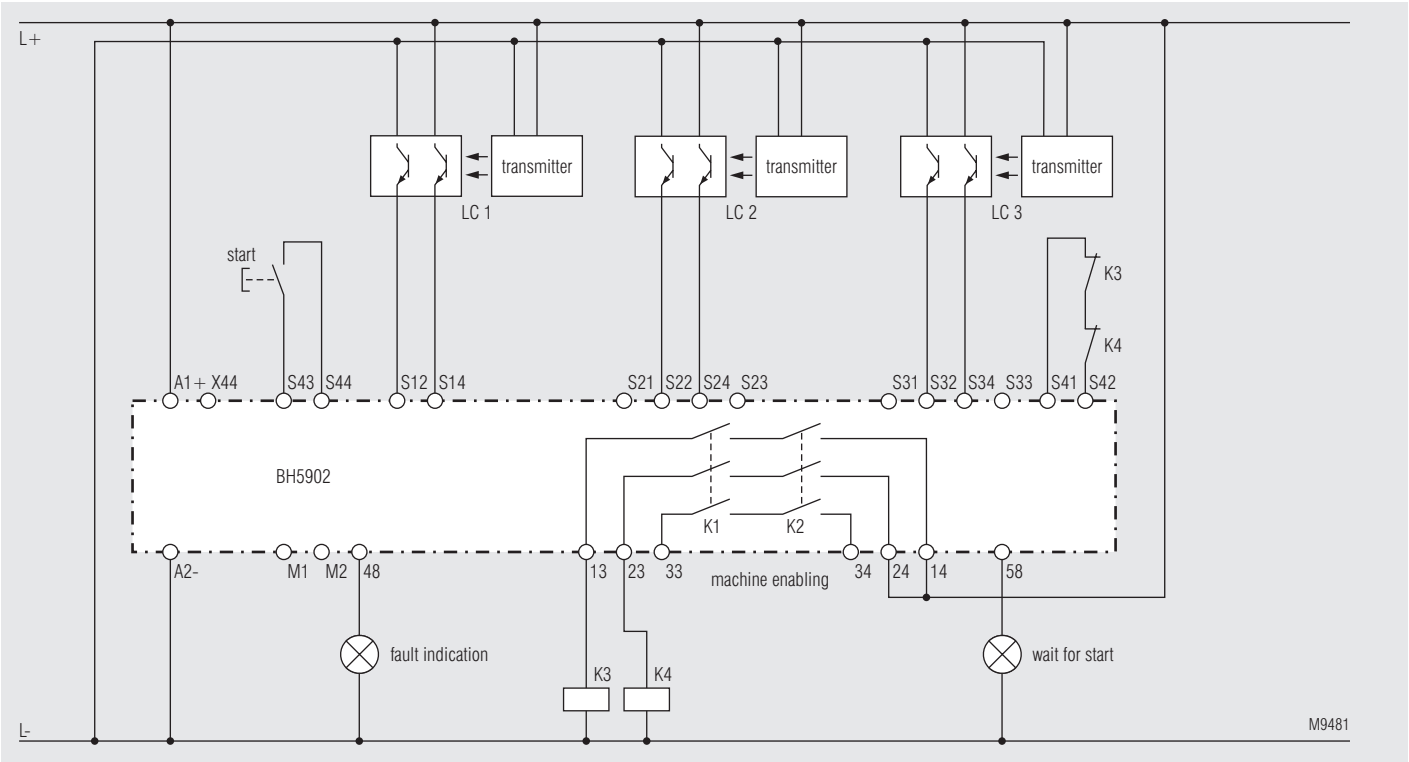
The start button must be activated in 2 conditions:
- after return of the supply voltage ①
  (when minimum 1 light curtain is programmed for manual start)
- when 1 light curtain with manual start was interrupted ③

Function Diagram





Picture 1: Protective operation with 3 LCs, manual or auto start, setting without feedback input



Picture 2: Protective operation with 3 LCs, manual or autostart, setting with feedback input

Operation Mode 2, 3, 4, 5: Protective Operation With Muting

Application e.g. for conveyors
- 1 or 2 light curtains
- Muting of light curtain 1
- 2 or 4 muting sensors with different input sequences
- LC1 with auto or manual start
- LC2 always with manual start
- Override via start button
- Manual start is always necessary after supply voltage ist connected

Muting
Muting means to disable temporarily the protective function of a light curtain. This function is used to transport material through a light curtain without stopping the machine. The differentiation between material and persons is done by additional muting sensors which have to create a certain switching sequence together with the light curtain when material passes the light curtain. The muting control starts then the muting cycle for the time the material is passing the light curtain. It must not be possible that a person activates the muting sensors in the same switching sequence as the material. To realise this function 2 different switching sequences can be chosen on BH 5902 either with 2 or 4 muting sensors. This makes sure that if a person passes the light curtain the dangerous movement of the machine is stopped immediately. The muting cycle is indicated by a muting lamp that is controlled and monitored by the BH 5902. The maximum muting time can be set in 10 steps between 10 s and infinite.
If the light curtain is still interrupted after the max. permitted muting time e.g. by blocked material the contacts K1, K2 open and the muting lamp as well as the LED run 1 show failure code 4.

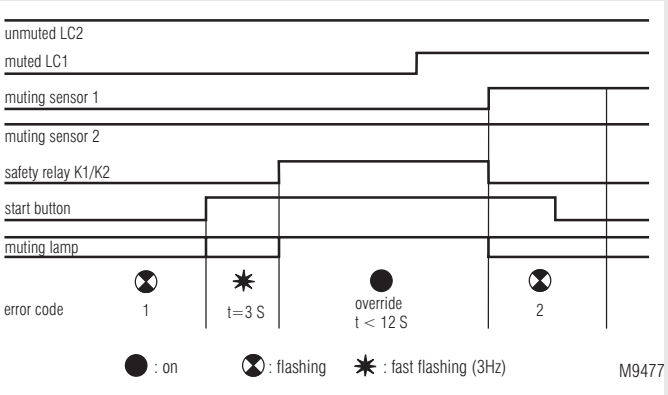
Starting by pressing the start button is only possible if the muting lamp is working and the light curtain to be muted is free of interruption. During the muting cycle a wrong switching sequence or exceeding the maximum muting time leads to failure code 4. This failure can only be reset by pressing the start button. The muting sensors have to be installed in a way, that the correct sequence cannot be achieved manually or by passing the light curtain (see IEC/EN 61 491-1)

Possible settings:

			Switch 10: a = maximum muting time b = maximum synchronising time									
			0	1	2	3	4	5	6	7	8	9
Switch 1	2	LC S1 Auto, muting 2 sensors	a: 10 s / b: 3 s	a: 20 s / b: 3 s	a: 30 s / b: 3 s	a: 1 min / b: 6 s	a: 5 min / b: 30 s	a: 15 min / b: 90 s	a: 30 min / b: 3 min	a: 1 h / b: 3 min	a: 8 h / b: 3 min	no muting time monitoring
	3	LC S1 Manu, muting 2 sensors										
	4	LC S1 Auto, muting 4 sensors										
	5	LC S1 Manu, Muting 4 sensors										

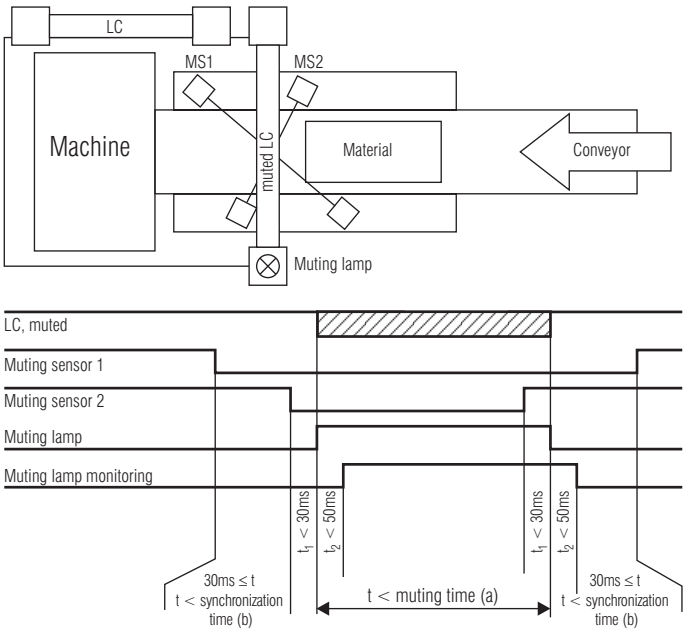
Override
If the monitored area is blocked by transported material and the outputs K1, K2 are switched off, this is indicated by fast flashing (approx. 3 Hz) of the muting lamp. The operator can activate the outputs K1, K2 by pressing the start button for more than 3 s for a maximum time of 12 s until the muting sensor are again inactive or the start button is released again.

Example for an override cycle when muting with 2 sensors



In all function diagrams the part "monitored operation" is the phase where the unit differentiates between men and material.

Using 2 muting sensors



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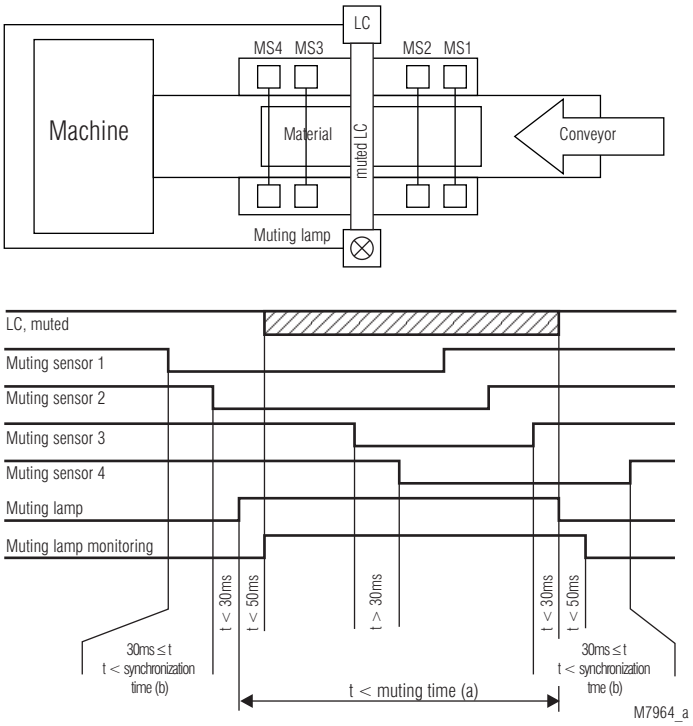
Using 4 muting sensors



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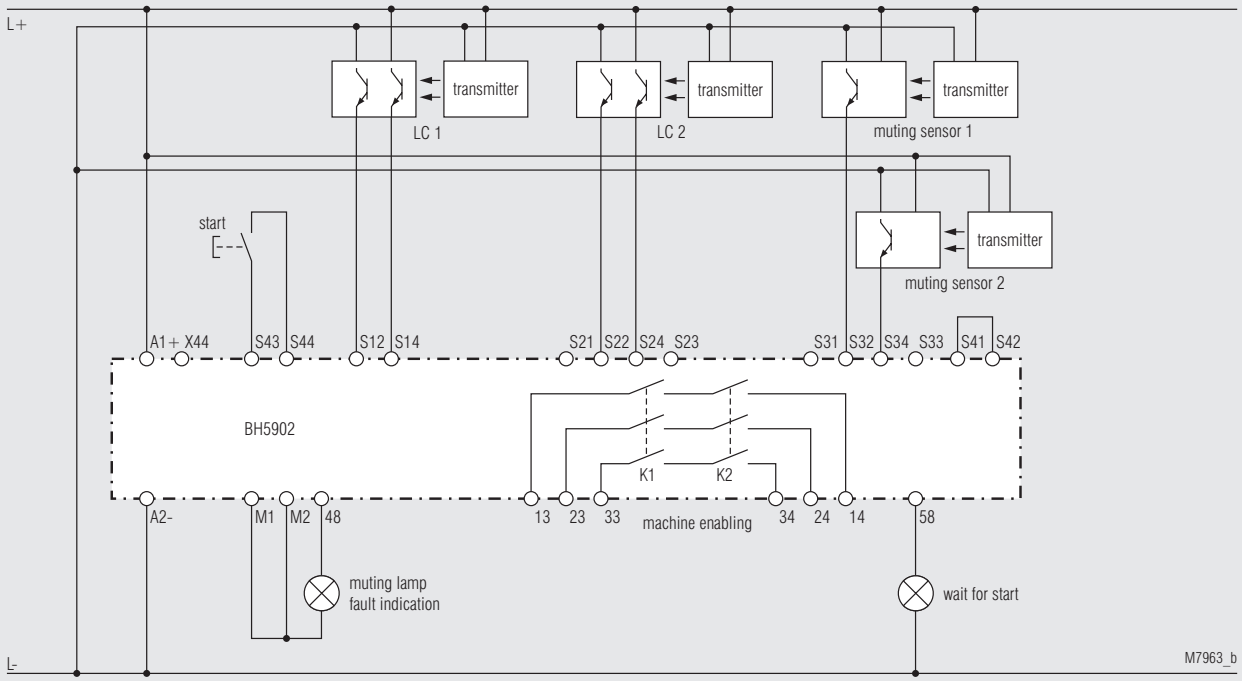
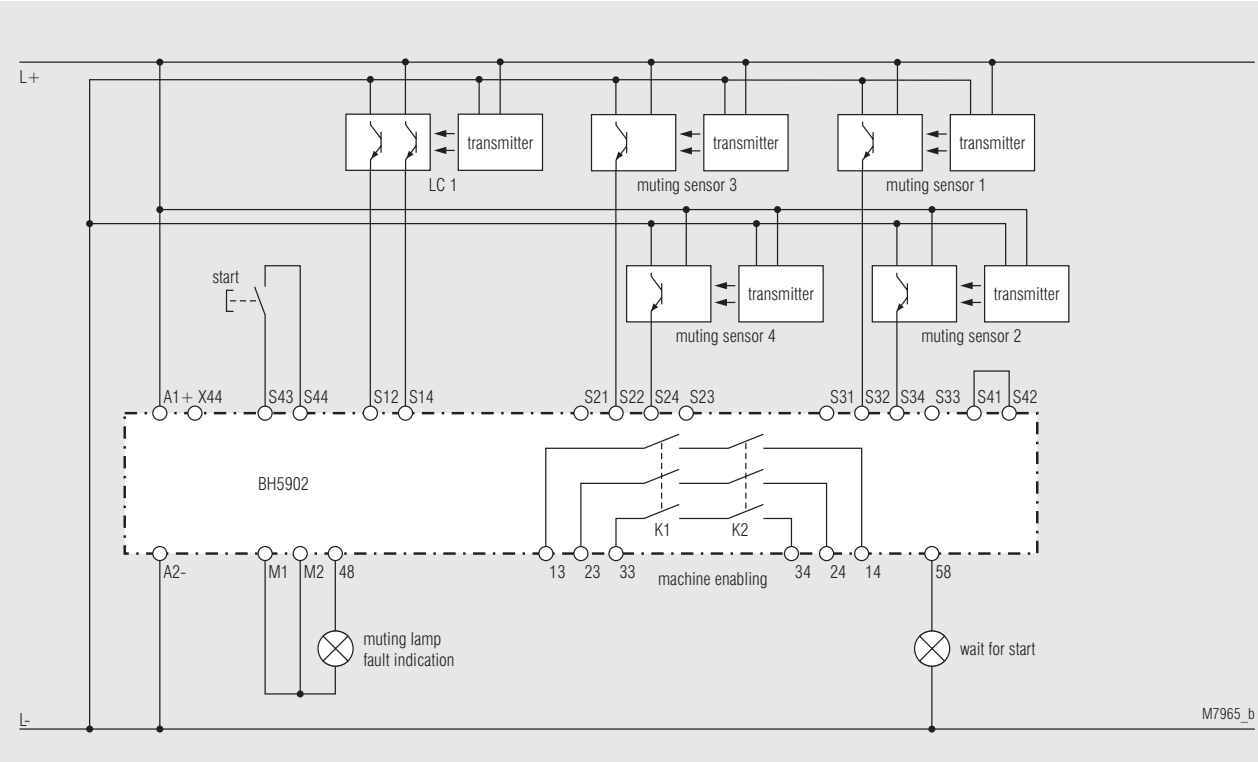
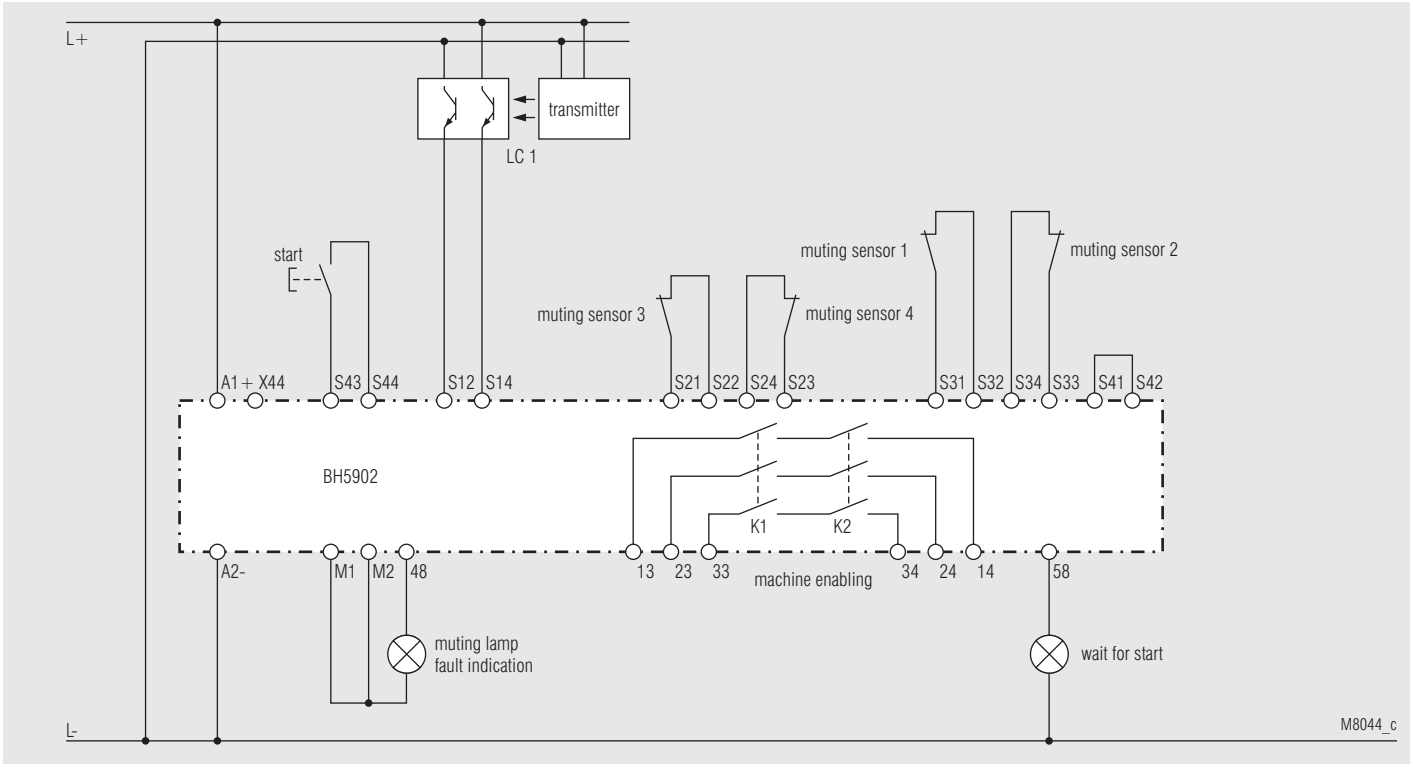


Picture 3: Protective operation with muting a light curtain via 2 muting sensors, 2 light curtains



Picture 4: Protective operation with muting, 1 light curtain, 4 muting sensors

Application Example Operation Mode 2, 3, 4, 5: Protective Operation With Muting



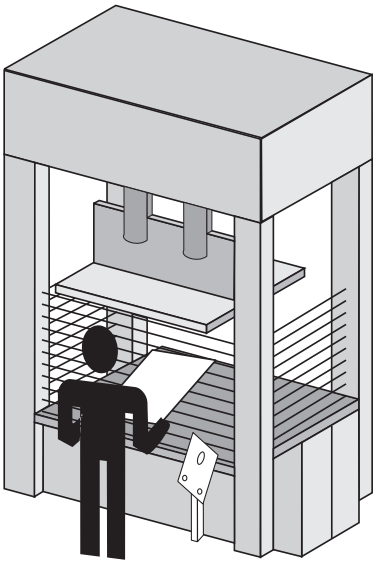
Picture 5: Protective operation with muting via 4 muting sensor contacts

Contact reinforcement
If external relays or contactors are used to reinforce or mulitply the contacts of the safety relays these must be monitored by feeding back one NC contact of each relay/contactor into the start circuit (see application example picture 7).

Operation Mode 6, 7, 8, 9: Stepping Operation

Application e.g. for presses with manual operation and automatic start
- Max. 3 light curtains
- LC2 and LC3 always with manual start

Setting functions:
- 1, 2 or 3 steps
- 2 different start sequences
- 2 ways of monitoring the machine contact
- Number of steps fixed or settable with key switch



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Stepping operation enables automatic restart of a machine (Press) after a certain number of accesses into the protected area of the first LC. This Operation consists of start sequence and normal sequence.

Possible settings

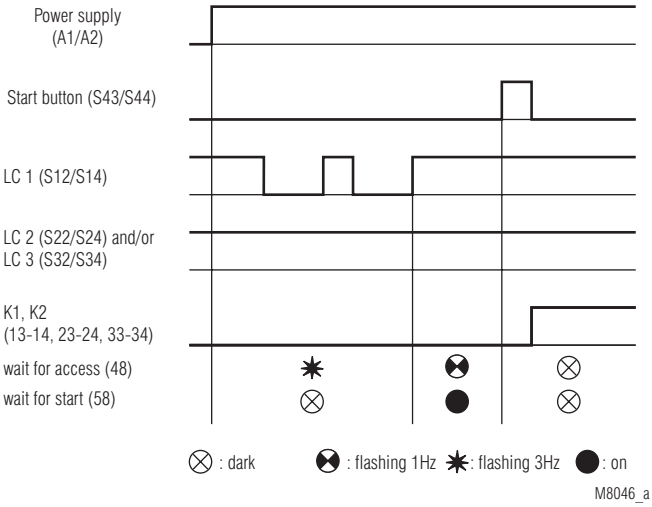
Stepping operation			Switch 10: Number of steps				
			0	1	2	3	4 - 9
Switch 1	6	Stepping operation, contact type 1, Start-sequence: stepping and start	selectable by key switch	1 step	2 step	3 step	not allowed (fault 5)
	7	Stepping operation, contact type 2, Start-sequence: stepping and start					
	8	Stepping operation, contact type 1, Start-sequence: start and stepping					
	9	Stepping operation, contact type 2, Start-sequence: start and stepping					

Start sequence

To enable the machine at start-up on stepping operation 2 different start sequences can be chosen:

1.) The required number of interruptions of the LC must be completed and then the start button must be pressed.
2.) The start button is pressed first, and after that the required number of interruptions must be completed.

The request to start the operation (e.g. 2 steps according to the diagrams below) is signalled by a flashing lamp (terminal 48). The request to press the start button is signalled by continuous light on a lamp (terminal 58). After finishing the starting sequence correctly the lamps go off and the contact K1 and K2 close.



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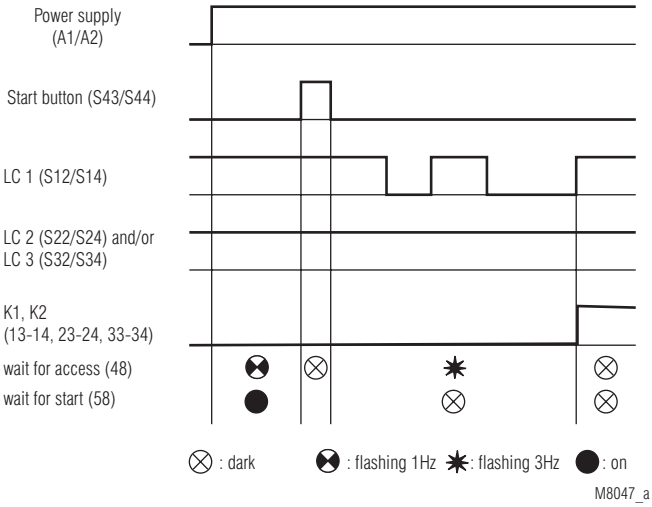
Start sequence: 2 steps and start button



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Start sequence: start button and 2 steps

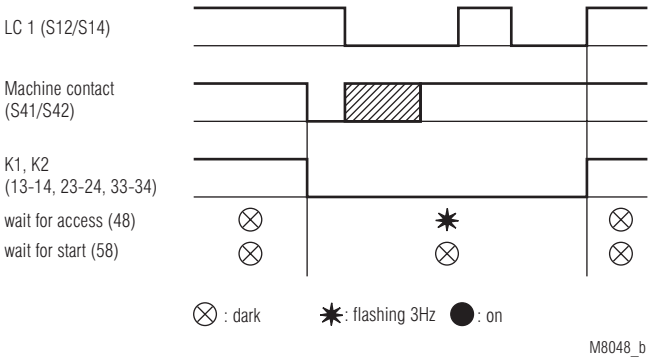
Normal sequence
A correct starting sequence is necessary to run the normal operating sequence. In the normal operating sequence the machine movement is signalled to the light curtain by opening and closing of the machine contact. The output contacts of the BH 5902 are opened when the machine contact opens. After that the operator must interrupt the LC for the required number of times to start again the machine operation. All necessary steps must be completed within 30 s. The demand to access is indicated on fast flashing (3 Hz) output 48. When the required number of interruptions on the LC is completed the lamp goes off and the contacts K1 and K2 close.

Machine contact
To the terminals S41 and S42 of the BH 5902 a machine contact must be connected. It opens and closes depending on the machine movement.

Monitoring of the machine contact
2 ways of monitoring are selectable:

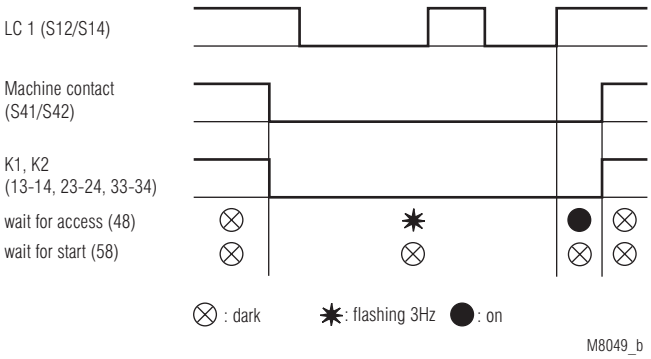
Mode 1
In this mode the access to the LC must only be done when the machine contact has been openend and closed again. An exception is when the access is done while the contact is open and still is going on while the contact closes.

Mode 2
In this mode the accesses are accepted already when the machine contact is open. The machine is only enabled when all the accesses are completed and the machine contact is closed again.



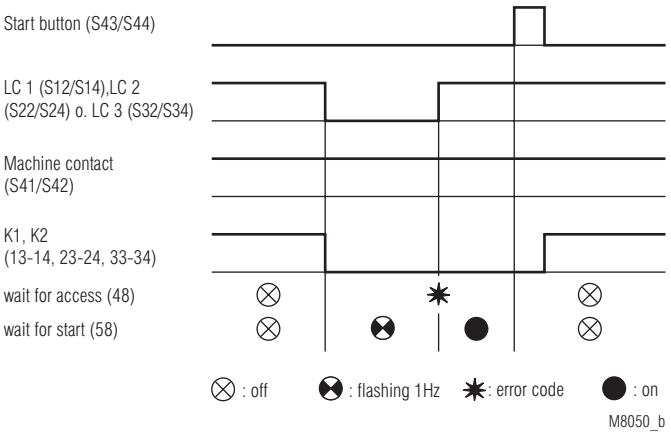
Applictaion: Presses with normal to fast movement

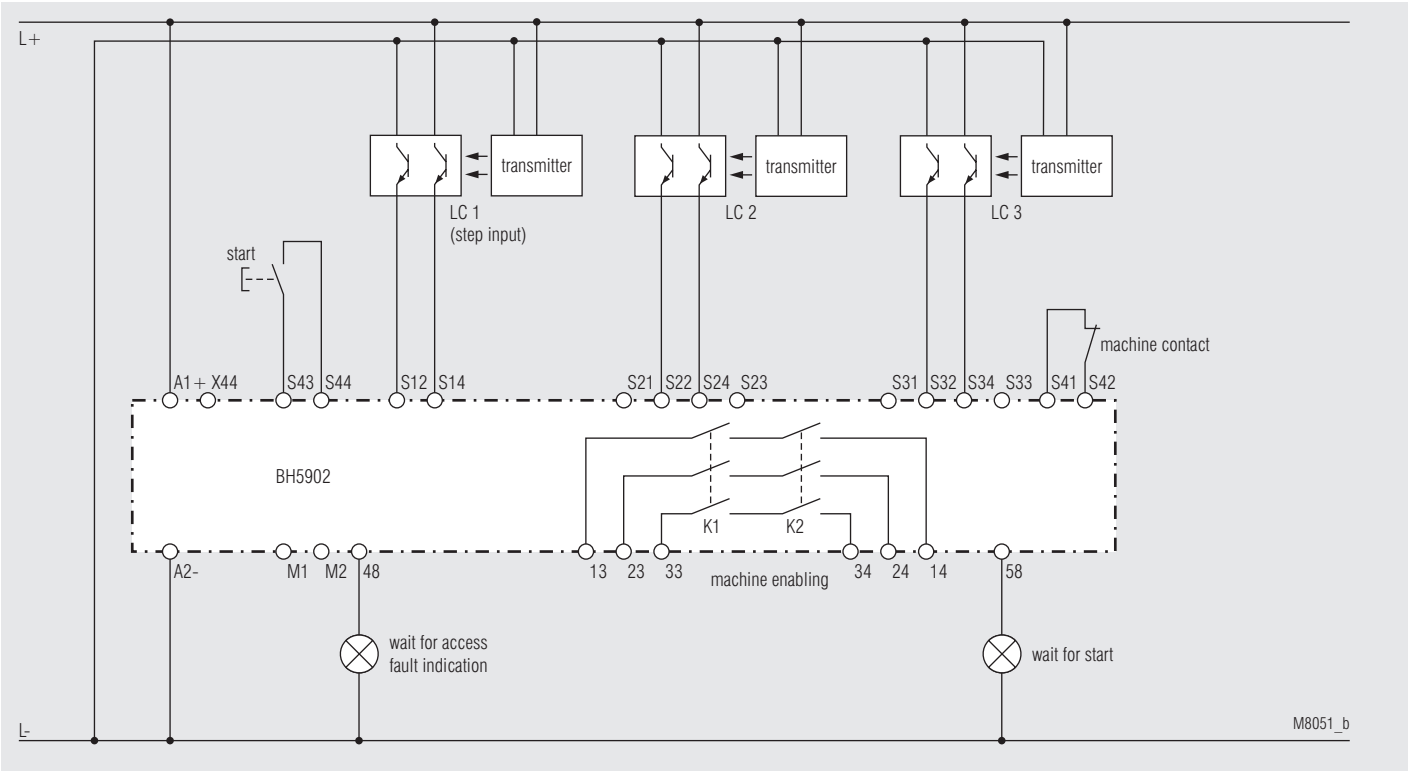
Forbidden access into the light curtain
On forbidden access the lamp (on terminal 58) shows symmetric flashing.



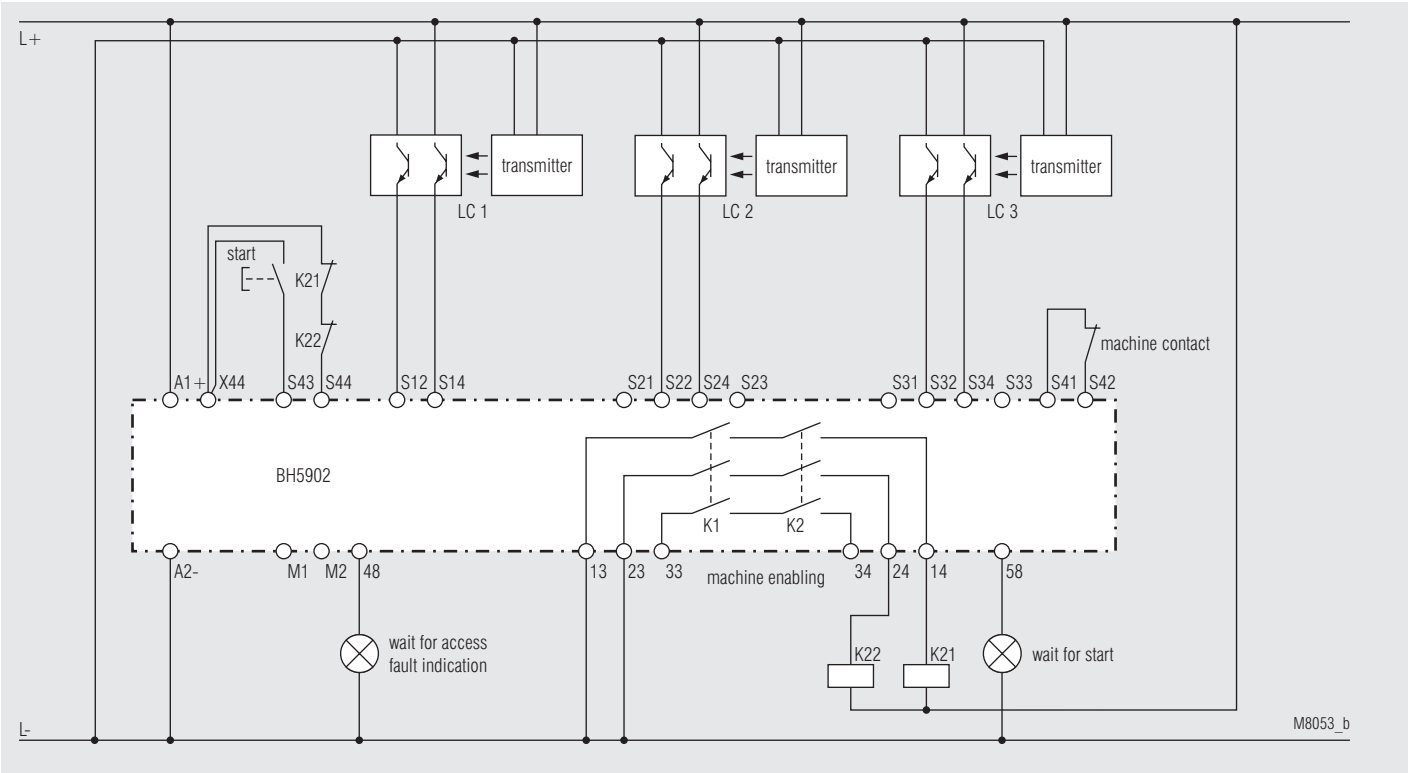
Application: Presses with slow movement

The lamp on terminal 48 flashes with code 1. After finishing the access the lamp on terminal 58 returns to permanent light and signalises, that the machine can be started with the start button.





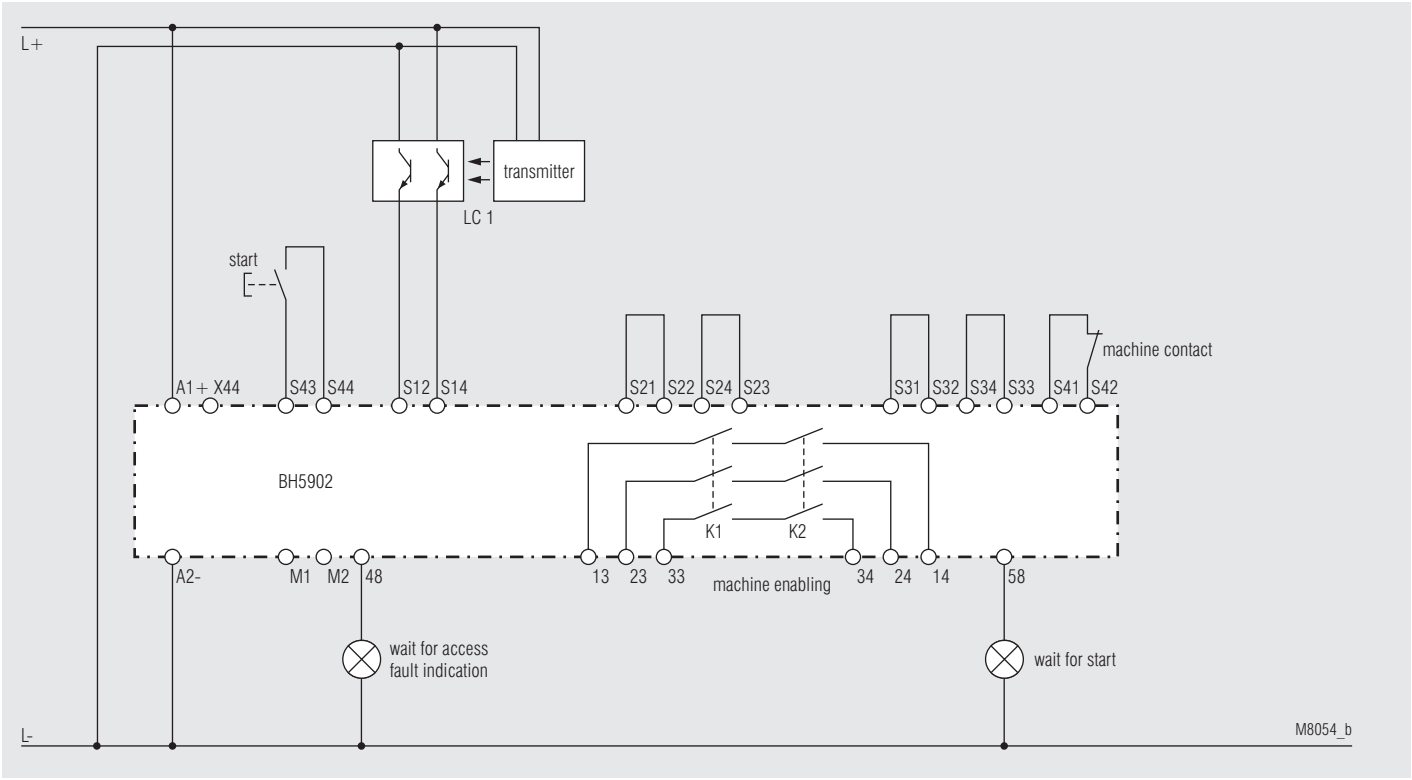
Picture 6: Stepping operation with 3 light curtains



Picture 7: Stepping operation with 3 light curtains and contact reinforcement by external contactors, 2-channel operation (switching of feedback input can also be used at protective operation with muting)

The feed back circuit of the external relays is only tested when the module is started by pressing the push button. When using this circuit the safe function has to be tested in regular intervalls. This can be done by interrupting a light curtain so that a reset requires activation of the start button. activating the module is only possible when all external relays are de-energized.

Application Example Operation Mode 6, 7 ,8 ,9: Stepping Operation



Picture 8: Stepping operation with one light curtain (with all different operating modes unused inputs must be linked).

Operation Mode 6, 7, 8, 9: Stepping Operation With Key Switch

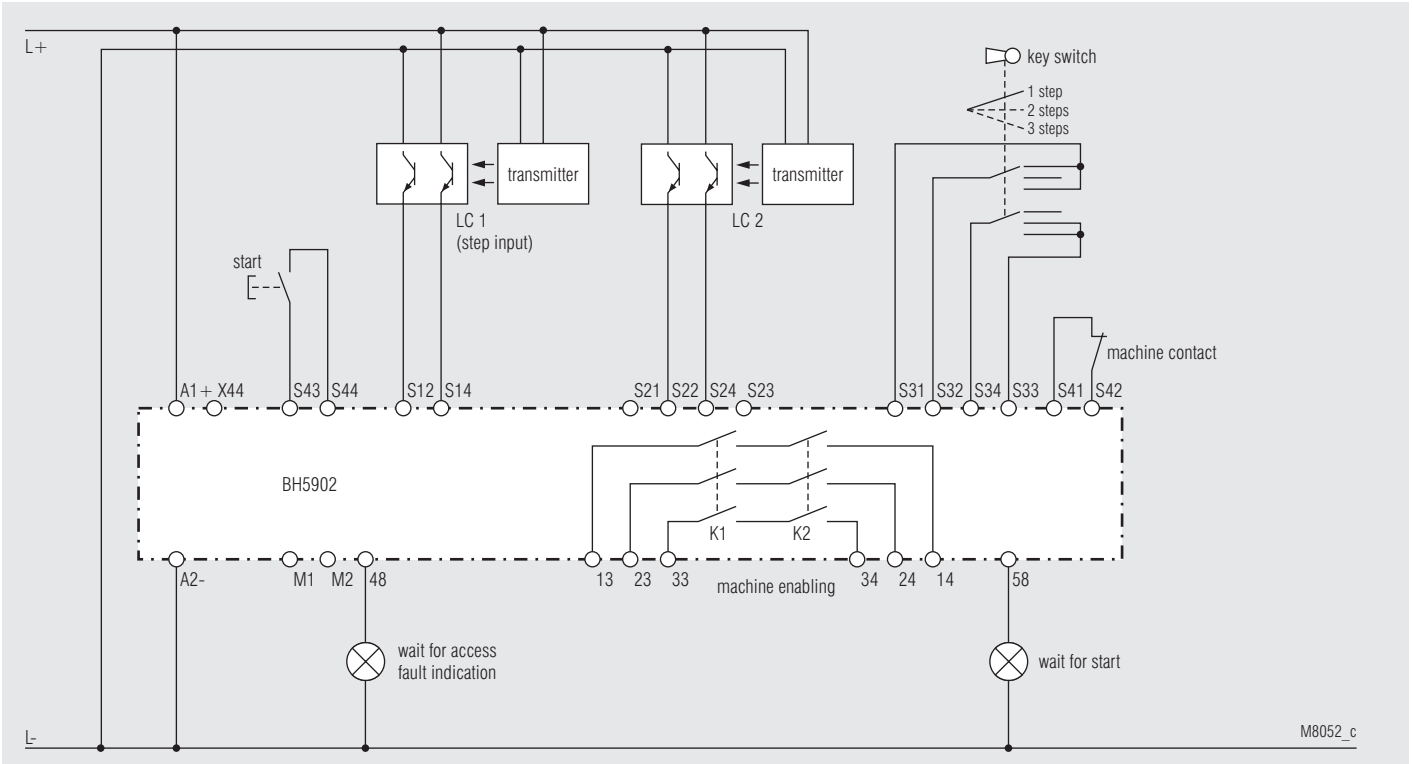
Application e.g. for presses witch changing number of accesses

- selection iwth key switch: 1, 2 or 3 steps

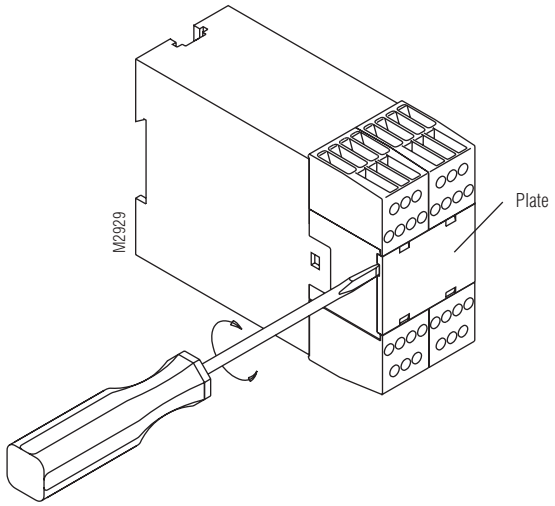
Enable new setting

A changed number of steps is only recognised at standstill (K1 and K2 open).

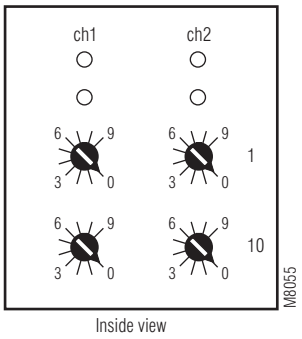
A new number of steps is signalised by failure indication 3 on the lamp (terminal 48). Pressing the start button will restart the unit. After that the normal start sequence complete swith start button and number of accesses must be completed to enable the machine with the new number of steps.



Picture 9: Stepping operation with key switch



Example:
Required function: Protective operation with manual start, with muting, 4 muting sensors, max. 30 s muting time.
Setting:
Upper switches set to "5" for both µprocessors
Lower switches set to "2" for both µprocessors



The function setting of BH 5902 is made by 4 rotational switches behind the frontplate (see picture). The switches on the left make the setting for µprocessor 1 (LED run 1) and the switches on the right for µprocessor (LED run 2). For both processors the same functions must be set. On the upper switches (1) the main function is adjusted. On the lower switches (10) the setting of the muting time (Protective operation) or the number of steps (stepping operation) is adjustable.
On muting or stepping function the light curtains LC 2 and LC 3 are always in protective operation with manual start.

Protective operation without muting

			Switch 10: Start mode and feedback input									
			0	1	2	3	4	5	6	7	8	9
			without feedback input					with feedback input				
Switch 1	0	LC 1 LC 2 LC 3	Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)		Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)	
	1	LC 1 LC 2 LC 3	Manu Manu Manu	Manu Auto Manu	Manu Auto Auto			Manu Manu Manu	Manu Auto Manu	Manu Auto Auto		

Protective operation with muting

			Switch 10: a = maximum muting time b = maximum synchronising time									
			0	1	2	3	4	5	6	7	8	9
Switch 1	2	LC S1 Auto, muting 2 sensors	a: 10 s / b: 3 s	a: 20 s / b: 3 s	a: 30 s / b: 3 s	a: 1 min / b: 6 s	a: 5 min / b: 30 s	a: 15 min / b: 90 s	a: 30 min / b: 3 min	a: 1 h / b: 3 min	a: 8 h / b: 3 min	no muting time monitoring
	3	LC S1 Manu, muting 2 sensors										
	4	LC S1 Auto, muting 4 sensors										
	5	LC S1 Manu, muting 4 sensors										

Stepping operation

			Switch 10: Number of steps				
			0	1	2	3	4 - 9
Switch 1	6	Stepping operation, contact type 1, Start-sequence: stepping and start	selectable by key switch	1 step	2 step	3 step	not allowed (fault 5)
	7	Stepping operation, contact type 2, Start-sequence: stepping and start					
	8	Stepping operation, contact type 1, Start-sequence: start and stepping					
	9	Stepping operation, contact type 2, Start-sequence: start and stepping					

Flashing Codes For Status And Failure Indication

When a failure is detected the relays K1, K2 are de-energized.
The different failures are indicated by different flashing codes on the LEDs run 1 and run 2. The failures are split into 2 groups.

Failure group 1:
System failure
On occurrence of such a failure the unit locks out and shows the failure code, the module can only be reset by switching the unit off and on again. These failures are only indicated on LEDs run 1 and/or run 2. At the same time 2 different codes can be indicated on the 2 LEDs. The outputs (48 and 58) are always off in this state.

Failure group 2:
Function failure
These failure codes are only displayed on LED run 1 and output 48 while LED run 2 remains on permanently.
The relays K1, K2 are de-energized in this state, the module is still active and the relays can be activated by pressing the start button after the failure has been removed.

System failure: (indicated only on LEDs run 1 and/or run 2)

No.*)	Description	Measures and notes
0	internal failure (LEDs off)	If both LEDs are off the relay is defective and has to be sent back for examination.
5	Faulty setting	1) The switches on both channels are not identically 2) The selected setting is not allowed.
6	Undervoltage detection	Left LED is flashing when the voltage drops under the allowed level (< approx. 0.85 UN). After returned to normal a reset is made (similar to power up of the unit).
6	Overvoltage detection	The right LED is flashing when the voltage rises over the allowed level of > approx. 1,15 UN + 5 % residual ripple.
7	Input failure	1) A short circuit occurred on the start button or machine contact input.2) 2) Both signals of one LC are not identically (short circuit, broken wire of defective LC)
8	Failure on output contacts K1, K2	Please check the output K1, K2 circuit and contact current, relay has to be repaired.
9 10 11	Internal failure	Please try to evaluate the circumstances that led to this fault and check with the supplier or manufacturer.
12 13	Internal failure	The relay has to be repaired.

*) No.: number of flash pulses in a series

Function failure: indication on LED run 1 and output 48

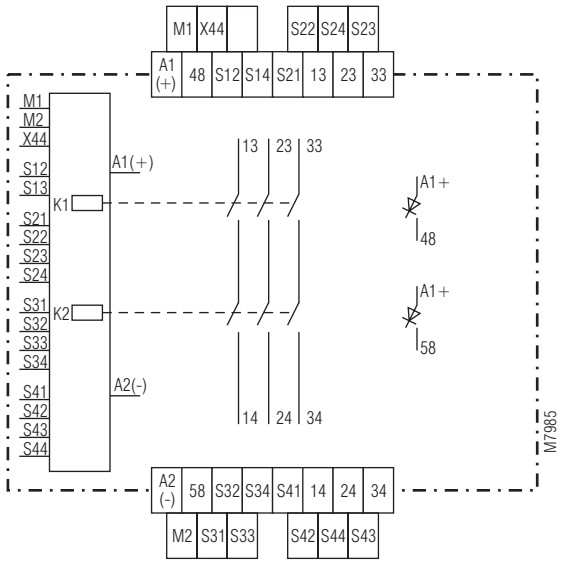
No.*)	Description	Measures and notes
1	LC failure	1) One LC has been interrupted. 2) All LC inputs that are not used must be bridged: LC 2: S21-S22, S23-S24 LC 3: S31-S32, S33-S34
2	Failure on start button	1) During start up of the unit and initialising the start button must not be pressed 2) The start button must not be pressed longer than 3 s.
3	Protective operation failure in feed back circuit	1) An operating mode with feed back circuit ist selected and and the circuit connected to S41-S42 is not closed before activation of K1, K2.
3	Stepping operation contact failure	1) The machine contact is not closed in initial position (waiting for start) 2) With contact type 1 the machine contact was not closed at the end of the required first interruption of the light curtain.
4	Muting failure (blocked LC)	1) The selected max. muting time had been exceeded (muting lamp on).
4	Muting failure (lamp)	2) The muting lamp is not connected between terminals 48 and M1 and M2. 3) The necessary bridge is not connected between terminal S41-S42.. 4) The muting lamp is defective. 5) The measuring circuit for the muting lamp is defective, the unit has to be repaired.
5	Stepping operation (key failure)	1) Both contacts of the key switch to select the number of steps are open

*) No.: number of flash pulses in a series

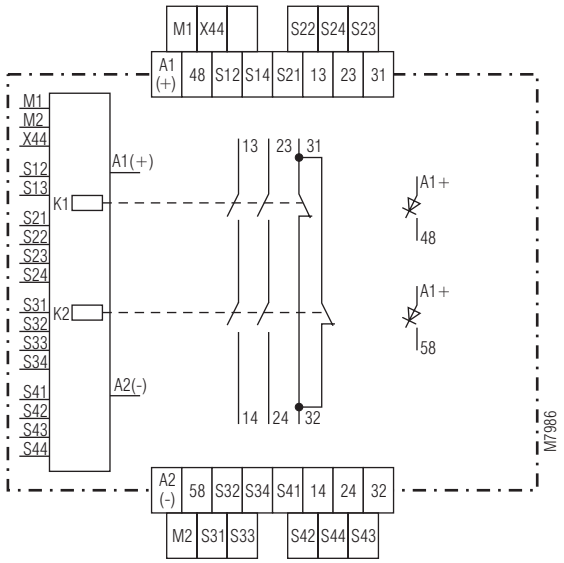
Status indication

LED run 1 and output 48 are flashing fast with 3 Hz	
Muting operation: Override possible	Minimum one muting sensor is active, LC 1 is interrupted and the start button is pressed. After 3 s with activated start button the override is started for max. 12 s.
Stepping operation: Wait for access	The unit is waiting for the required number of interruptions of the LC so that the safety relays can be activated.

Circuit Diagrams



BH 5902.03



BH 5902.22

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S14, S22, S24, S32, S34, S42, S44, M1, M2	Inputs
S21, S23, S31, S33, S33, S41, S43	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
31,32	Forcibly guided NC contacts for release circuit
48, 58	Semiconductor monitoring output
X44	Free junction terminal, volt free

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range:	
at max. 5 % residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	Max. 170 mA (no load on semiconductor outputs)
Control voltage on S21, S23, S31, S33, S41, S43, S48, S58:	DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, S44:	Each 4.5 mA at U_N
Min. voltage on terminals S12, S14, S22, S24, S32, S34 S42, S44:	DC 16 V
Short circuit protection:	Internal with PTC
Min. current on M1, M2:	25 mA with active lamp

Output

Contacts		
BH 5902.03:	3 NO contacts	
BH 5902.22:	2 NO, 1 NC contacts The NC contact must only be used as monitoring contact !	
Contact type:	Relay, forcibly guided	
Operate delay typ. at U_N:		
Manual start:	Max. 50 ms	
Automatic start:	Max. 1.5 s	
Automatic restart:	Max. 55 ms	
Release delay (reaction time):	Max. 30 ms (max. 50 ms when failure on LC and only one input channel de-energises)	
Output voltage:	AC 250 V DC: see arc limit curve	
Switching of low loads:	≥ 100 mV	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60947-5-1
NC contact	2 A / AC 230 V	IEC/EN 60947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V	IEC/EN 60947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60947-5-1
Permissible switching frequency:	Max. 1200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

Semiconductor Outputs

Output (terminal 48 and 58):	Transistors, plus-switching
Output voltage:	DC 24 V, max. 100 mA continuous current, max. 400 mA for 0,5 s internal short circuit, overtemperature and overload protection

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	± 0 ... + 50 °C	
Storage:	- 25 ... + 85 °C	
Altitude:	≤ 2000 m	
Clearance and creepage distances		
Rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC/EN 60664-1
EMC		
Electrostatic discharge:	8 kV (air) (according to test degree 3)	IEC/EN 61000-4-2
HF irradiation:		
80 MHz ... 2.7 GHz:	10 V / m	IEC/EN 61000-4-3
Fast transients		
on wires for power supply A1-A2:	2 kV	IEC/EN 61000-4-4
on wires for signals and control:	2 kV	IEC/EN 61000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61000-4-5
between wire and ground:	2 kV	IEC/EN 61000-4-5
HF wire guided:	10 V	IEC/EN 61000-4-6
Interference suppression:	Limit value class A*)	EN 55011

*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated.
To avoid this, appropriate measures have to be taken.

Degree of protection:	According to IEC/EN 61496-1 the unit has to be installed in a housing with protection degree 54.	
Housing:	IP 40	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	According to IEC/EN 61496-1 Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Shock resistance:		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per axis on 3 axis	
Climate resistance:	0 / 050 / 04	IEC/EN 60068-1
Terminal designation:	EN 50005	
Wire fixing:	Terminal screws M 3.5 Box terminal with wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	320 g	

Dimensions

Width x height x depth:	45 x 84 x 121 mm

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL 508, "general use applications"

Nominal voltage U_N:	DC 24 V
Ambient temperature:	0 … + 50 °C
Switching capacity:	
Ambient temperature 50 °C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Semiconductor outputs:	24Vdc, 100 mA
Wire connection:	60 °C / 75 °C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Standard Type

BH 5902.03/01MF2/61 DC 24 V

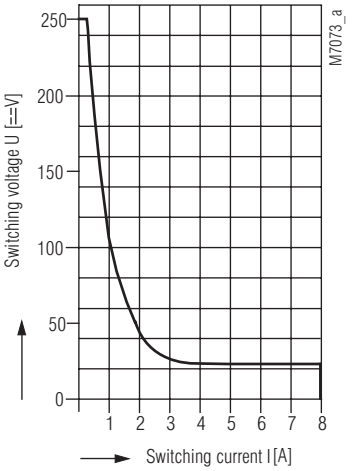
Article number:	0053847
• Output:	3 NO contacts
• All functions settable via rotational switches	
• Nominal voltage U_N:	DC 24 V
• Width:	45 mm

Ordering Example

BH 5902 ._ _ /01MF2/61 DC 24 V

- DC 24 V: Nominal voltage
- ._ _: Contacts
  - .03: 3 NO contacts
  - .22: 2 NO, 1 NC contacts
- BH 5902: Type

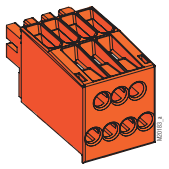
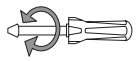
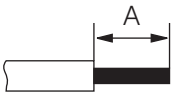
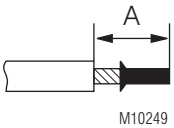
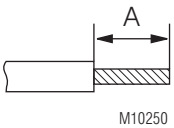
Characteristic



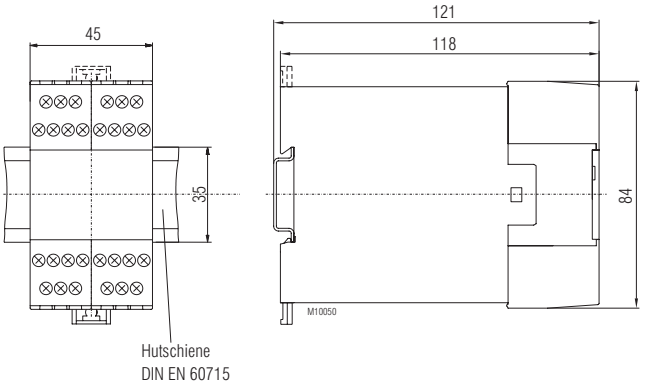
Safe breaking, no continuous arcing under the curve, max. 1 switching cycle/s

Arc limit curve

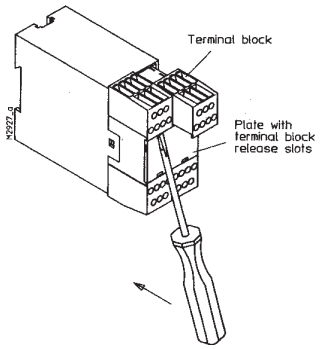
DE	**Anschlusstechnik**
EN	**Connection Technology**
FR	**Technologie de connexion**

	Schraubklemmen, abnehmbar Screw terminals, pluggable Bornes à vis, amovibles
	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**



DE	**Sicherheitstechnische Kenndaten (nur Sofortkontakte)**
EN	**Safety related data (only instantaneous contacts)**
FR	**Données techniques sécuritaires (contact instantané)**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	30	a (year)
DC_{avg}:	99	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{cycle}:	140	s/cycle

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	99	%
PFH_D:	8,2E-09	h^{-1}
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
Nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	Einmal pro Monat Once per month Mensuel
	PL d with Cat. 3	Einmal pro Jahr Once per year Annuel
Nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	Einmal pro Monat Once per month Mensuel
	SIL CL 2, SIL 2 with HFT = 1	Einmal pro Jahr Once per year Annuel

DE	**EG-Konformitätserklärung**
EN	**CE-Declaration of Conformity**
FR	**Déclaration de conformité européenne**

EG - Konformitätserklärung
Declaration of Conformity
Déclaration de conformité européenne

Hersteller:
Manufacturer: / Fabricant:
E. Dold & Söhne GmbH & Co. KG

Anschrift:
Address: / Adresse:
Bregstraße 18
78120 Furtwangen
Germany

Produktbezeichnung:	Lichtgittermodul mit umschaltbaren Funktionen	**BH5902.kk/01MF2/ccc**	mit:	kk = 03, 22 optional ccc = /60 ... / 69
Product description:	*Light curtain module with selectable operating modes*		*with:*	
Désignation du produit:	*Module de barrières immatèrielles, fonctions ajustables*		*avec:*	

Das bezeichnete Produkt stimmt mit den Vorschriften folgender europäischer Richtlinien überein:
The indicated product is in conformance with the regulations of the following european directives:
Le produit désigné est conforme aux instructions des directives européennes:

Maschinenrichtlinie: *Machinery directive: / Directives Machines:*	2006/42/EG	EU-Abl. L157/24, 09.06.2006
EMV - Richtlinie: *EMC - Directive: / Directives- CEM::*	2014/30/EU	EU-Abl. L96/79, 29.03.2014
RoHS - Richtlinie *RoHS -Directive: / Directives - RoHS:*	2011/65/EU	EU-Abl. L174/88, 01.07.2011

Prüfgrundsätze: *Basis of Testing:* *Lignes de contrôle:*	EN ISO 13849-1:2015 EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	EN 61508 Parts 1,2 :2010 EN 60664-1:2007
	EN 61000-6-2:2005 EN 55011:2016 + A1:2017	EN 61000-6-4:2007 + A1:2011

Die Übereinstimmung eines Baumusters des bezeichneten Produktes mit der oben genannten Maschinenrichtlinie wurde bescheinigt durch:
Consistency of a production sample with the marked product in accordance to the above machiney directive has been certified by:
La conformité d'un échantillon du produit désigné aux directives machines susmentionnées a été certifiée par:

Benannte Stelle: *Certification office: / l´organisme notifié:*	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln
Nummer der benannten Stelle: *Number of certification office:/ Numéro de l´organisme notifié:*	0035
Nummer der Bescheinigung: *Certification number: / Numéro de certificat:*	01/205/0760.03/22
Ausstelldatum : *Date of issue: / Date de délivrance:*	22.02.2022

Für die Zusammenstellung der technischen Unterlagen ist bevollmächtigt:
For the compilation of technical documents is authorized:
Pour la composition des documents techniques est autorisé:

Gamal Hagar, Entwicklungsleiter / R&D Manager

Rechtsverbindliche Unterschrift:
Signature of authorized person:
Signature autorisée :

ppa. A. Dold

Christian Dold, Produktmanagement / Productmanagement

Ort, Datum :
Place, Date: / Lieu, date:
Furtwangen, 24.08.2022

Diese Original - Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der Produktdokumentation sind zu beachten.
This original declaration confirms the conformity of the mentioned directives but does not comprise any guarantee of the product characteristics. The safety directives of the product documentation are to be considered.
Cette déclaration originale certifie la conformité des directives nommées mais ne comprend aucune garantie des caractéristiques du produit. Les directives de sécurité de la documentation du produit sont à considérer.

DE	**UKCA-Konformitätserklärung**
EN	**UKCA-Declaration of Conformity**
FR	**Déclaration de conformité UKCA**

UK Declaration of Conformity

Manufacturer:	**E. Dold & Söhne GmbH & Co. KG**			
Address:	Bregstraße 18 78120 Furtwangen Germany			
Product description:	Light curtain module with selectable operating modes	**BH5902.kk/01MF2/ccc**	mit:	kk = 03, 22 optional ccc = /60 .. /69

The indicated product is in conformance with the regulations of the following British regulations:

Supply of Machinery (Safety) Regulations:	S.I. 2008 No. 1597
Electromagnetic Compatibility Regulations:	S.I. 2016 No. 1091
RoHS Regulations:	S.I. 2012 No. 3032

Designated standards:

EN ISO 13849-1:2015
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015

EN 61000-6-2:2005
EN 55011:2016 + A1:2017

EN 60664-1:2007
EN 61508 Parts 1-7:2010

EN 61000-6-4:2007 + A1:2011

Consistency of a production sample with the marked product in accordance to the above machiney directive has been certified by:

Certification office:	TÜV Rheinland UK Ltd., Friars Gate(Third Floor), 1011 Stratford Road, Shirley, Solihull B90 4BN, United Kingdom
Number of certification office:	2571
Certification number:	01/205U/0760.00/22
Date of issue:	2022-07-29

For the compilation of technical documents is authorized:

Dold Industries Ltd

11 Hamberts Rd. Blackall Ind. Estate
South Woodham Ferrers
GB - Essex, CM3 5UW

Signature of authorized person:

ppa. M. Dold

Christian Dold - Productmanagement

Place, Date : Furtwangen, 2022-08-24

This original declaration confirms the conformity of the mentioned directives but does not comprise any guarantee of the product characteristics. The safety directives of the product documentation are to be considered.