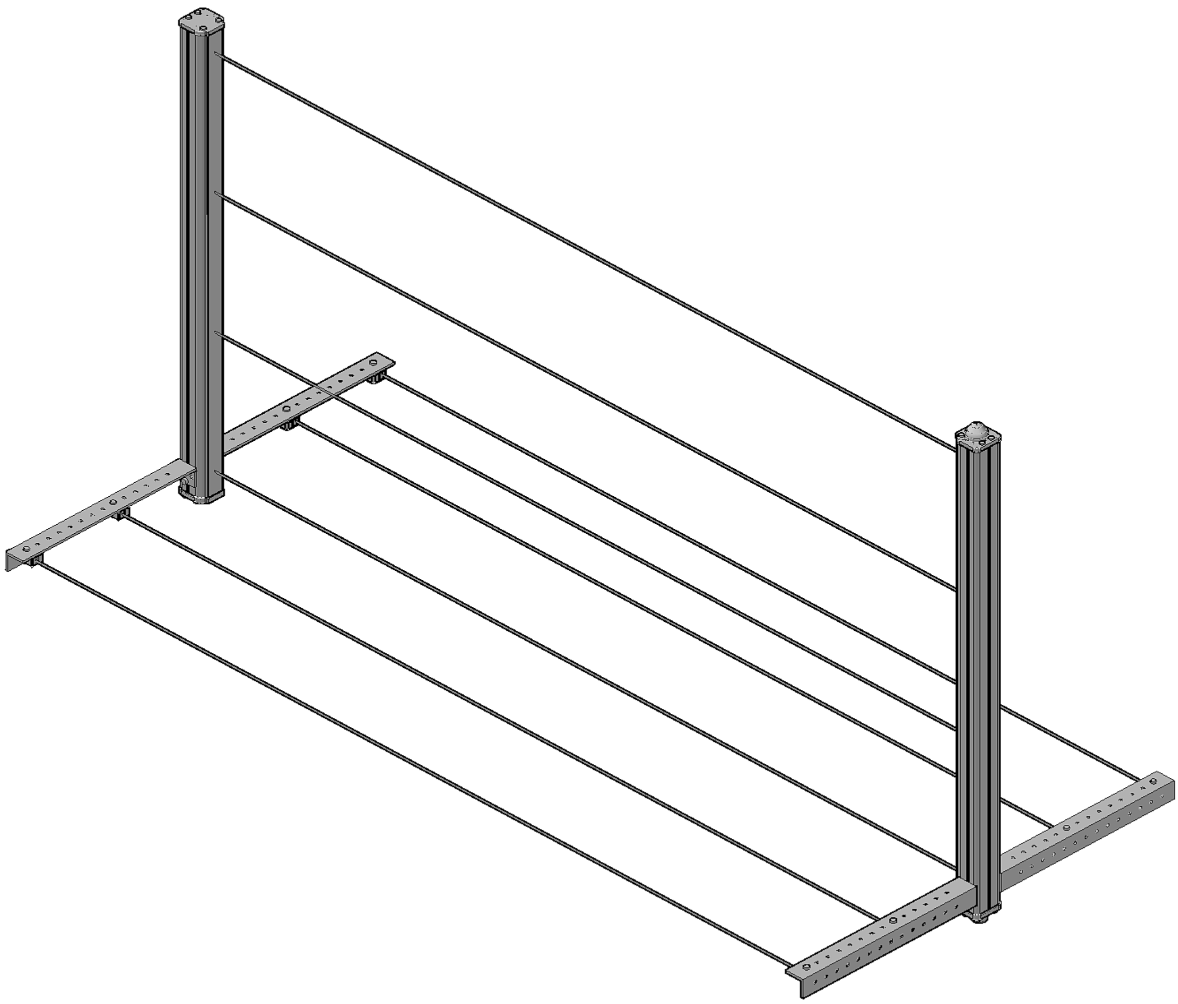
OPERATOR'S MANUAL

SBX8000 Evolution

Photoelectric safety barrier



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Contents

1 General Information

This document is intended to provide all information required for the installation and correct use of the model SBX8000 Evolution photo-sensitive barrier.
The SBX8000 Evolution barrier is classified as type 4 electro-sensitive protection equipment (ESPE) under EN ISO 13849-1, constructed in accordance with the EN IEC 61496-1 and EN IEC 61496-2 standards.

1.1 Abbreviations and terminology

A1÷2	Input logic (software) signals for muting sensor pair A
ADO	Configurable application diagnostic output, for indication of the barrier's state
B1÷2	Input logic (software) signals for muting sensor pair B
BS	Input logic (software) signals for belt stop function
C1	Input logic (software) signal for optional muting sensor
Clear	Barrier normal state with OSSD outputs activated (system powered up)
Main device	Structure containing the controller, the photo-transmitters and the system connection
Secondary device	Structure containing the photo-receivers. Connected directly to the main device
EMD	Input for monitoring correct operation of the static safety outputs
ESPE	Electro-sensitive protection equipment
IN1÷3	Physical (hardware) input signals for the auxiliary functions
Lock-out	Lock-out error state with the OSSDs deactivated (system not powered up)
M1÷4	Physical (hardware) input signals for the muting sensors
MTR1÷4	Receiver elements of muting photocells 1÷4
MTX1÷4	Transmitter elements of muting photocells 1÷4
Muting	Function which temporarily suspends operation of the ESPE to allow material to pass
OSSD	Output signal switching device, static switching output for safety function
Override	Function which bypasses the OSSD outputs to allow an anomaly to be reset
OVR	Input logic (software) signal for activation of the override function
RES	Input for resetting the barrier in Clear state
ARES	Input for automatic resetting the barrier in Clear state
RRO	Static output for signalling a request for reset in the Clear state
SBX8000-Tool	PC software application for system configuration and analysis

1.2 Symbols used

Note	Specific remark concerning a function or characteristic.
Recommendation	Advice on the action to be performed or the choice between several options.

Warning!

This symbol indicates the presence or possibility of a hazard. Therefore, the information provided must be considered with the maximum attention.

1.3 Safety notes

For reasons of safety, the SBX8000 Evolution barrier must only be installed by skilled staff. Failure to comply with all installation instructions and all warnings provided in this manual may involve a very high risk for exposed persons. Users are therefore urged to:

- Read the entire contents of this manual.
- Make an in-depth assessment of the risks relating to application of the safety device to the specific system.
- Check that the device's mechanical installation is stable and safe.
- Check that connections are made in accordance with the instructions in this manual, using the cables supplied.
- Check that all parameters required by the program are correct in the system configuration using the PC software.
- Use a security PIN to protect access to the barrier by the PC configuration software, choosing a PIN it is not easy to identify, with a different PIN on each system if possible.
- Perform thorough tests to ensure that the system is operating correctly, covering all the functions selected and options enabled.

WARNING

Restrictions on the use of the device!

- Any use of SBX8000 Evolution barrier other than those indicated in this manual is not authorized.

1.4 Main characteristics of the safety barrier

The SBX8000 Evolution safety barrier consists of two separate units, one referred to below as the **main device** and the other as the **secondary device**. The two units contain all safety parts, such as the electronic control board and the set of four photocells which control the safety barrier (**ESPE**).
Up to four optional sensors for **muting** functions can be remotely connected to these units.
The device's main characteristics are:

- ESPE safety barrier with 4 beams at 300 mm intervals and range 5m
- 4-beam muting system, which can be set up with 3 main layouts
- Override function for dealing with muting errors
- Muting and override monitoring functions for the maximum safety
- 3-colour indicator light unit incorporated in main device
- 2 protected and controlled static safety outputs
- 2 protected static signalling outputs, one of them configurable
- 4 inputs for reset, override and auxiliary functions
- Automatic test for the 4 barrier beams and optionally for muting beams
- Diagnostics by means of 7-segment display and 4 integral LEDs.
- Serial connector with Modbus protocol for complete control
- Complete configurability and analysis by means of PC software

1.4.1 Totally redundant system

The SBX8000 Evolution barrier is controlled by a total of **5 different microprocessors,** two of which perform all logic and safety control functions in total independence, giving complete redundancy. Each of the two main microprocessors controls its own section using separate supply and input and OSSD interfacing circuits. Any failure of either of the two sections does not affect the normal operation of the other and moreover each section compares the performance of its functions with those of the other, identifying any **differences in behaviour**. None of the relative OSSDs is activated unless both microprocessors are in Clear state.
A further three microprocessors perform auxiliary and support functions for the two main ones, together with additional checks on their correct operation.

1.4.2 Total I/O configurability

Using the PC software, the user can set the hardware connections between the device's **physical** (hardware) inputs and its **logic** (software) functions in a completely arbitrary way. For example, logic signal A1, corresponding to program's first muting photocell, can be associated to any of the four signals M1-4 relating to the photocells' physical connectors. Or the logic signal for activation of the override function can be connected to one of the 4 physical auxiliary inputs or one of the 4 input signals normally used for the muting photocells.

1.4.3 PC software tool

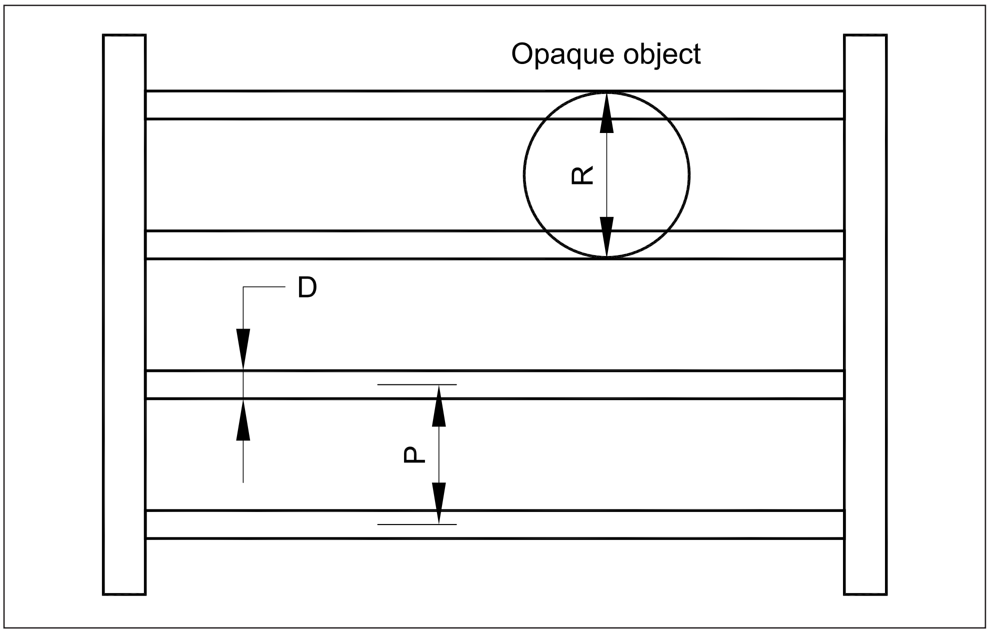
The SBX8000-Tool software for PC includes all program and signal use **configuration procedures.** The software is able to read and write the SBX8000's configuration and save it in and load it from a specific file.
The software also includes an **analyser for the logic states** of the signals of the selected program, capable of acquiring values with resolution 100ms over a time window of up to 10000 seconds. The analyser is also able to save the entire trace of the states in CSV format, with the exact absolute time data in hours, minutes, seconds and tenths of a second.

2 Description and use of the device

2.1 Operating principle

The SBX8000 Evolution barrier is a **logic block for the safety function** of machinery and plants. It has **4 photo-sensitive beams** provided by high-frequency modulated infrared light transmitters arranged along the main device and the same number of receiver elements along the secondary device. The combination of these beams forms the **ESPE** (electro-sensitive protection equipment), a photo-sensitive barrier capable of detecting any opaque body passing through at least one of the beams.
The ESPE is installed close to **hazard zones on machinery** to cut out their operation if a person accesses the controlled area. The machine is stopped by means of two static output signal switching devices **(OSSDs)** which immediately cut off the power supply if the barrier is breached.
The beams are able to detect even very small objects, since their diameter D, for the SBX8000 Evolution barrier, is **10mm**. The beams are located along the aluminium profiles, at a regular pitch which depends on the type of protection provided. In the case of the SBX8000 Evolution barrier, the pitch P between the beams is **300mm** since it is intended to provide **"body protection"**. The barrier's **resolution R** is therefore defined as the minimum size of an opaque body which will be reliably detected:

Fig. 1: Defining the optic beam resolution



Resolution R is therefore equal to:

R = P + D

where:

P = pitch between two consecutive beams
D = detection diameter of a single beam

Any opaque body with dimensions less than R will not be detected if it passes through the barrier in the zone midway between two beams.
Therefore, for the SBX8000 Evolution barrier, the resolution is **310mm**.

2.2 Application of the device

Before installing the SBX8000 Evolution barrier to protect a hazard zone of a machine, a series of essential checks and verifications must be performed to ensure the safety of the application.

WARNING

Check all the conditions necessary for use of the barrier!

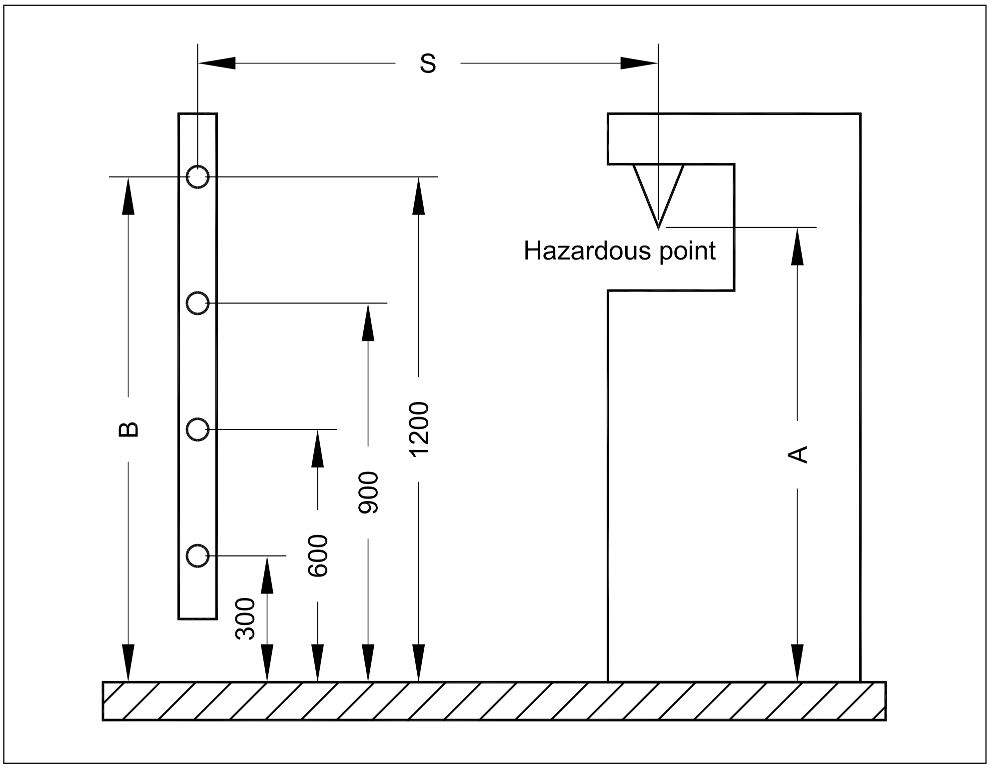
- The level of protection provided, specified in the characteristics, must be suitable for the application. In addition, the SBX8000 Evolution barrier is only suitable for use for **body protection**.
- The machinery must be complete with all **mechanical auxiliary protection devices** such as fixed guards around the accessible zone controlled by the barrier.
- The machine's system must include **devices capable of immediately stopping** dangerous moving parts by means of electrical commands, such as disconnection of the power supply.
- The machine's **overall stopping time** from the moment when the barrier's OSSDs are deactivated must be known.

The sections which follow provide greater detail of some factors, necessary to ensure the machine's safety, relating to the barrier's mechanical positioning.

2.2.1 Minimum installation distance

The barrier must be installed in such a way that the dangerous movement of the machine is halted sufficiently in advance in relation to the time taken by the person to approach the danger point.
It is therefore fundamental to define the **safety distance S** between the barrier's sensitive area and the danger point identified, also considering any specific moving parts of the machine.

Fig. 2: Defining the safety distance



With reference to European standard EN13885, the safety distance is established by means of the following calculation:

S = K x (T1 + T2) + C

where:

K = approach speed of the body (taken as 1600mm/s)
T1 = barrier maximum response time (16ms for SBX8000 Evolution)
T2 = time required to stop the movement after the command is given
C = additional distance (depends on the application)

There are two possible scenarios for the **additional distance C**:

- **It is not possible to access the hazard zone with parts of the body by reaching over the ESPE**. In this case a fixed additional distance of 850mm is considered.
- **It is possible to access the hazard zone with parts of the body by reaching over the ESPE detection area**. In this case the additional distance will depend on the specific application.

The latter case refers to the possibility that a person could lean over the ESPE detection area towards the hazard zone. The additional distance considered will therefore depend on the height of the photo-sensitive barrier and the height A of the hazard zone, using the following table provided in European standard EN 13885:

Tab. 1: Additional distance in case of unauthorised penetration above the top edge of the ESPE

Height A of hazard zone	Height B of upper edge of the ESPE detection zone											
	900	1000	1100	1200	1300	1400	1600	1800	2000	2200	2400	2600
	Alternative distance C											
2600	0	0	0	0	0	0	0	0	0	0	0	0
2500	400	400	350	300	300	300	300	300	250	150	100	-
2400	550	550	550	500	450	450	400	400	300	250	100	-
2200	800	750	750	700	650	650	600	550	400	250	-	-
2000	950	950	850	850	800	750	700	550	400	-	-	-
1800	1100	1100	950	950	850	800	750	550	-	-	-	-
1600	1150	1150	1100	1000	900	850	750	450	-	-	-	-
1400	1200	1200	1100	1000	900	850	650	-	-	-	-	-
1200	1200	1200	1100	1000	850	800	-	-	-	-	-	-
1000	1200	1150	1050	950	750	700	-	-	-	-	-	-
800	1150	1050	950	800	500	450	-	-	-	-	-	-
600	1050	950	750	550	-	-	-	-	-	-	-	-
400	900	700	-	-	-	-	-	-	-	-	-	-
200	600	-	-	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-	-	-	-

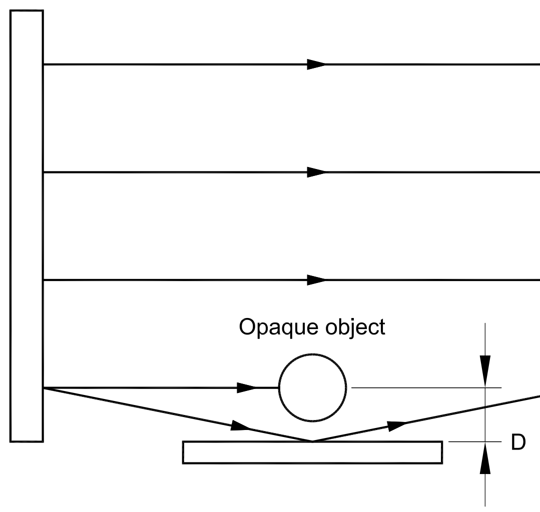
In the case of a 4-beam barrier, like the SBX8000 Evolution, if the lowest beam is 300 mm above the floor, the height B of the ESPE detection area will be 1200mm. In the case of a hazard zone at a height A of 1400 mm, an additional distance of 1000 mm must be considered.
Therefore, if the machine's response time T2 is 200 ms, the safety distance is:

S = 1600 x (0.016 + 0.2) + 1000 = 1346mm

2.2.2 Distance from reflective surfaces

When positioning the barrier devices, consideration must be given to a phenomenon relating to the **conical divergence of the beams of light** from the infrared transmitters. Although the emission angle of the sender devices is very small, at a distance of metres even a few degrees of divergence may lead to the emission of a significant amount of light at a given **distance D** from the axis of the transmitter/receiver pair:

Fig. 3: Defining the distance from reflective surfaces



Therefore, if there are reflective surfaces such as the shiny metal of a conveyor roller way or a glossy flooring in the vicinity of the beams, the light emitted may be reflected onto the receiver device.
In this case, the presence of an opaque body obstructing the direct beam might not be detected because of **reception of the light reflected by the surface**.

This phenomenon increases in direct proportion to the distance between the transmitters and receivers. The graph below illustrates this proportion:

Fig. 4: Minimum distance from reflective surfaces in relation to operating distance

It is therefore important not to place reflective surfaces in the vicinity of the barrier beams. If this cannot be avoided, the minimum distance for the specific operating distance must still be complied with.

2.2.3 Installation of several devices side by side

It may be necessary to install **several barriers side by side,** for example where several machines are installed parallel on a production line. In this case, the trasmitter beams of one barrier may reach the receivers of the next-door barrier.
In these applications, if the distance between the barriers is less than the maximum specified range, the transmitter and receiver devices must be installed in opposite directions, as shown below:

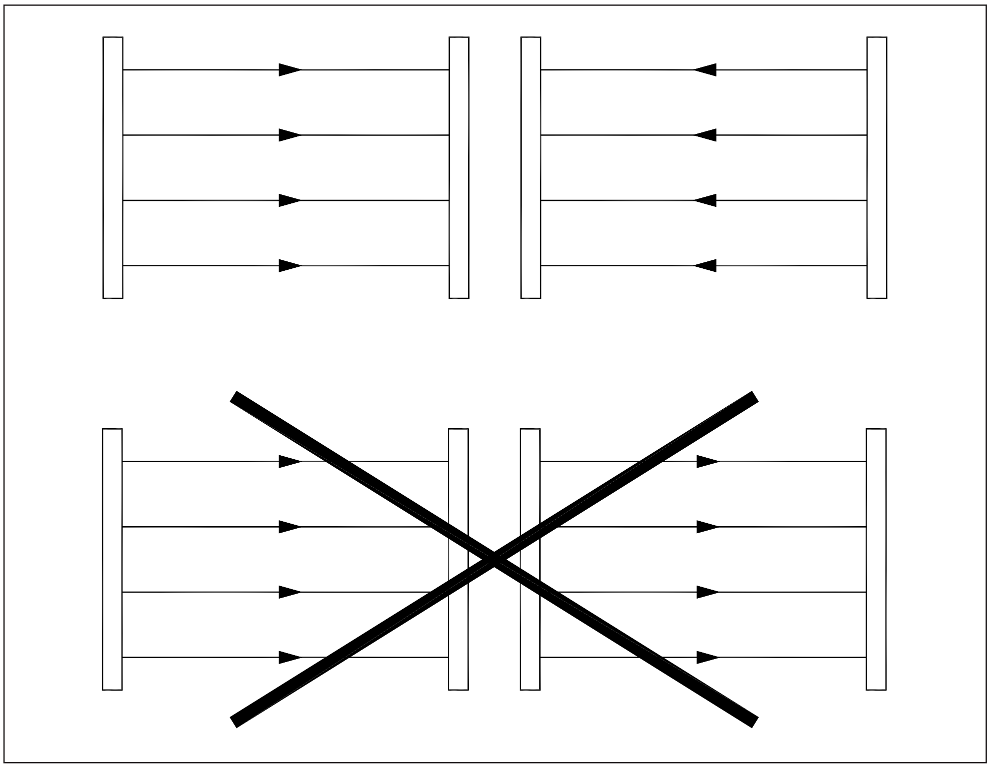


Fig. 5: Positioning several devices in case of optic interference

Note In the case of the SBX8000 Evolution barrier, incorrect positioning which causes optical interference between two separate units **is automatically indicated** by the photocell error codes of the barrier which is receiving interference from the other one.

3 Muting configurations

The SBX8000 Evolution barrier has **muting function** to temporarily suspend its safety control functions to allow material to cross the ESPE during normal operation. This function is a major part of the operating logic, and so the various programs which can be activated on the barrier are identified by their specific muting system configurations.

WARNING

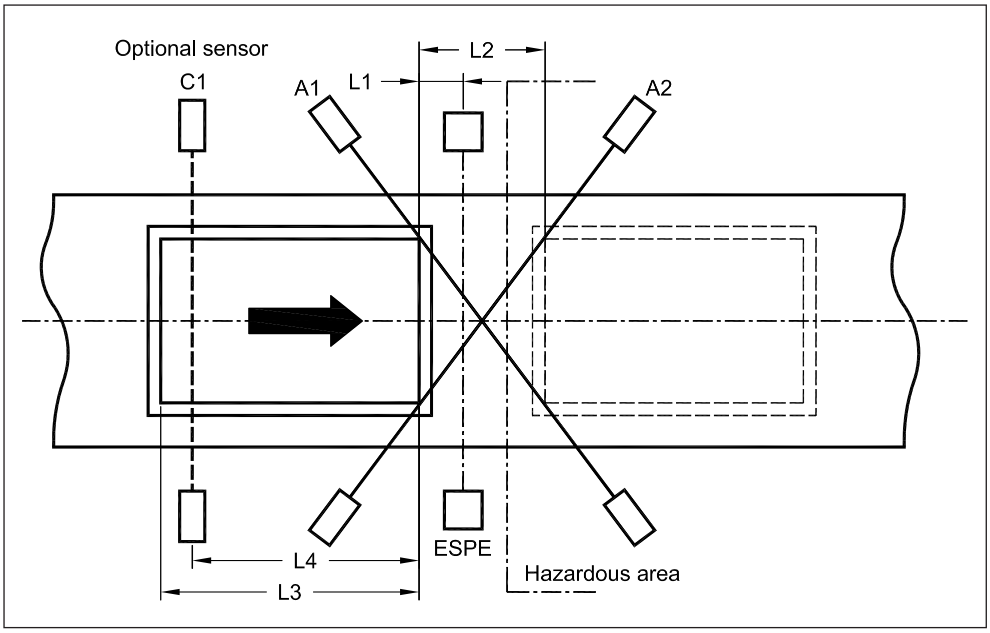
Read the documentation concerning the muting function carefully!

- **Disabling of the ESPE** using the muting function must only be possible during the transportation of material through the hazard zone.
- The muting state must be activated by at least **two independent signals** and must end as soon as the conveyed material leaves the hazard zone access area.
- Install the muting photocells as **close as possible** to the barrier ESPE.
- The barrier restart command must be **outside the hazard zone** and in a position which gives an unobstructed view of this zone.
- Activate all possible **optional functions to ensure increased safety** in the muting state, described in this and following sections.

3.1 Program 1 - Muting with 2 crossed beams

This program only uses the A1/A2 pair of muting photocells. The two photo-sensitive beams are positioned to form a cross, in the same point as the ESPE beams or closer to the hazard one.

Fig. 6: System layout for muting with 2 crossed beams



As the material passes, it **trips sensors A1 and A2** to switch the system to muting state. This allows the material to travel through the ESPE, which is temporarily deactivated. The muting state continues until the material leaves at least one of the two beams, on the opposite side from the entry side.
This program offers variants and options which can be set using the SBX8000-Tool software to increase safety during muting; they are described in the following points.

3.1.1 Signal A1/A2 concurrence time

The muting state is only activated if both beams A1 and A2 are obscured within a time window set by the **"Muting conc. time"** parameter.
The permitted range of values is **from 0.1" to 3.0"**.

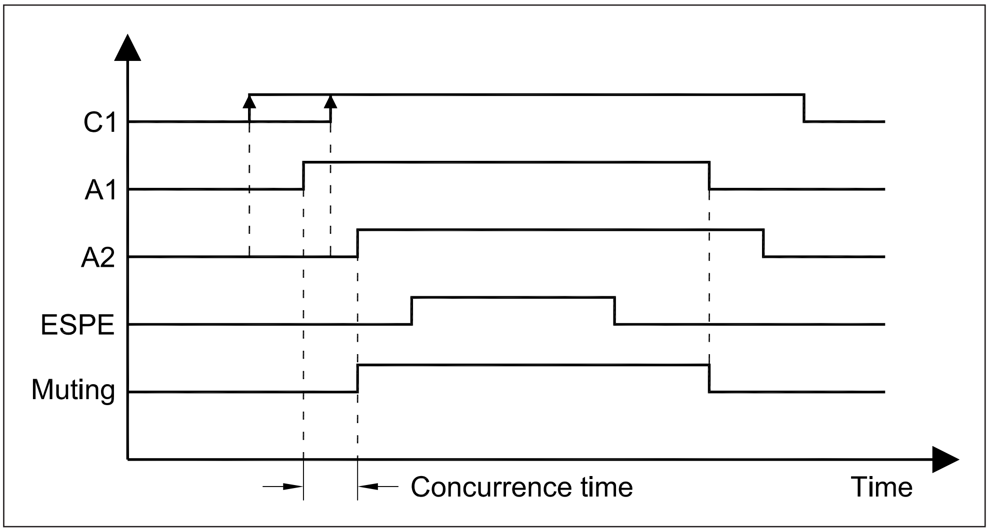
3.1.2 Muting ended by ESPE

The muting state ends when the material, having passed in front of the ESPE, exits it, causing a falling edge in the relative signal. This means that the safety function is restored **before** the moment when either beam A1 or A2 is cleared.
This option is enabled by **"End by ESPE"** parameter SBX8000-Tool software.
The **"End by ESPE hold time"**, programmable **from 0.01" to 1.00"**, allows the filtering of momentaneous clearing of ESPE photocells.

3.1.3 Optional muting sensor C1

A third signal, known as signal C1, can be enabled as an option, to make activation of the muting state, with no material passing through, more unlikely.
This signal must be **dynamically** controlled, in the sense that there must be a rising edge (switch from inactive to active state) of C1 before both signals A1 and A2 are activated. This may occur either before activation of the first of the two signals, A1 or A2, or after the first of these photocells has been obscured but the second has not (during the concurrence time).

Fig. 7: Signal sequence of program 1 with control of optional sensor C1



Once the muting function has been activated, signal C1 must be returned to non-active state before the next muting cycle starts, so that a new rising edge can occur.
Sensor C1 is enabled by associating logic signal C1 to one of the barrier's possible physical signals (e.g. photocell M3).

3.1.4 Notes on sensor positioning

When using the muting program with 2 crossed beams, the sensors must be installed in accordance with the following recommendations, which allow for functional constraints. See Fig. 6 for layout and the relevant dimensions:

$L_1 \geq V \times Tr$

$V \times T > L_2 + L_3$

$L_4 < L_3$

where:

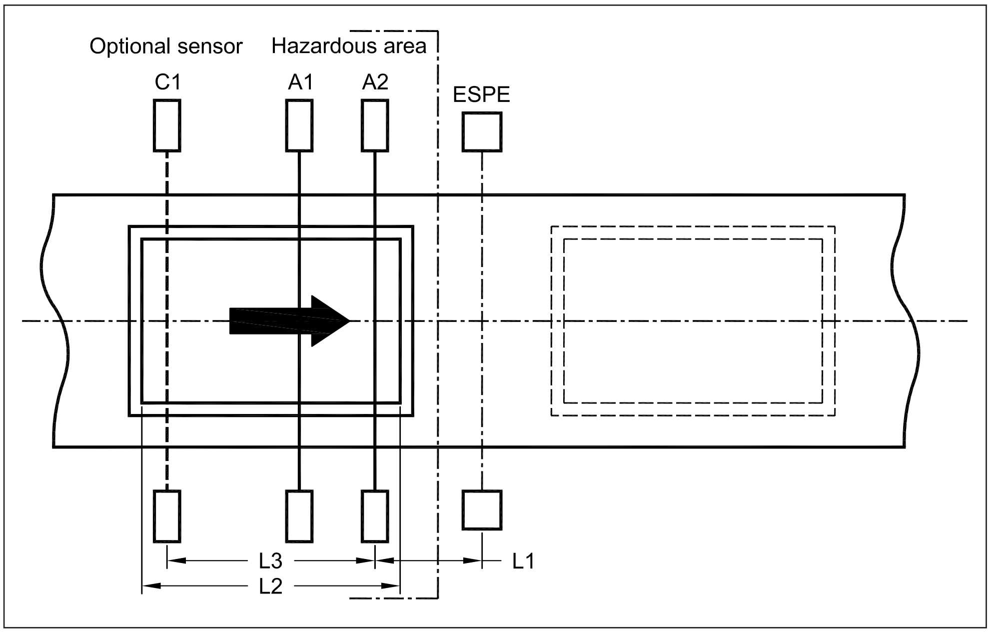
L_1 = minimum distance between ESPE and muting sensor detection position (m)
L_2 = distance between the detection lines of the muting sensors (m)
L_3 = length of the transported material (m)
L_4 = distance between sensor C1 and muting sensor detection position (m)
Tr = barrier maximum response time (s), equal to 0.016s
V = material transport velocity (m/s)
T = muting state hold time (s)

Recommendation For conveyor systems operating in just one direction, place the point where beams A1 and A2 cross on the hazard zone side.

3.2 Program 2 - Muting with 2 parallel beams

In this program, the two beams of the muting photocells A1 and A2 are installed parallel, in the material entry zone.

Fig. 8: System layout for muting with 2 parallel beams



Muting state is activated by the **covering, in sequence, of photocells A1 and A2,** and temporarily suspends the ESPE's control function.

Note To comply with the muting sequence, photocell A1 must be installed before photocell A2. In order to swap the order of the photocells, the association between logic signals A1 and A2 and the physical photocells M1÷4 must be reversed.

Muting state continues until the material quits the ESPE, or ends at the end of the count of a timer set in **“Muting hold time”** in the **range from 0.5” to 5.0”**, which starts to count at the moment when at least one of photocells A1 or A2 is cleared.
In normal conditions, muting state ends when the material leaves the ESPE, while the timer ensures that the barrier's safety function is restored in all cases.

This program offers variants and options which can be set using the SBX8000-Tool software to increase safety during muting; they are described in the following points.

3.2.1 Signal A1/A2 concurrence time

The muting state is only activated if both beams A1 and A2 are obscured within a time window set by the **"Muting conc. time"** parameter.
The permitted range of values is **from 0.1" to 5.0"**. To disable this functions, set the parameter value to 0.

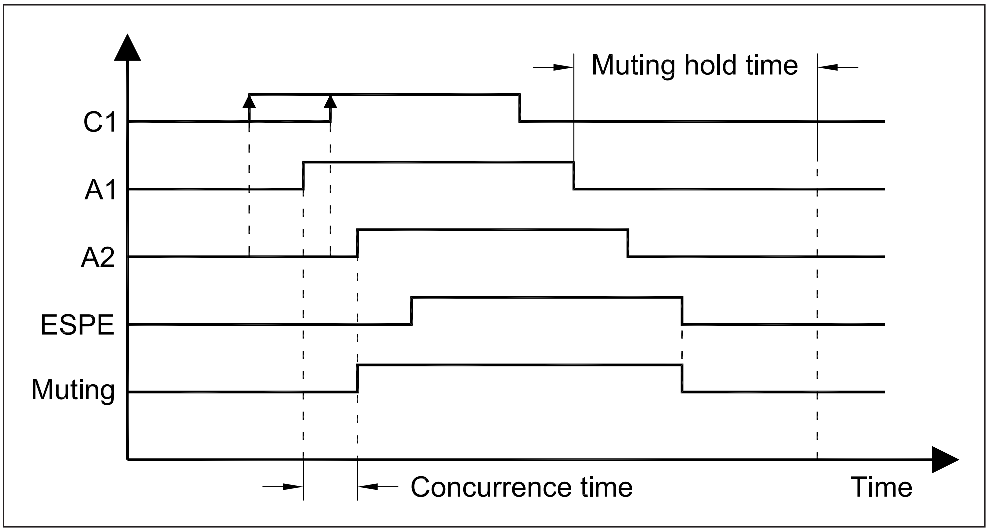
3.2.2 Muting ended by ESPE

The muting state ends when the material, having passed in front of the ESPE, exits it, causing a falling edge in the relative signal. This means that the safety function is restored **before** the moment when either beam A1 or A2 is cleared.
This option is enabled by **"End by ESPE"** parameter SBX8000-Tool software.
The **"End by ESPE hold time"**, programmable **from 0.01" to 1.00"**, allows the filtering of momentaneous clearing of ESPE photocells.

3.2.3 Optional muting sensor C1

A third signal, known as signal C1, can be enabled as an option, to make activation of the muting state, with no material passing through, more unlikely.
This signal must be **dynamically** controlled, in the sense that there must be a rising edge (switch from inactive to active state) of C1 before both signals A1 and A2 are activated. This may occur either before activation of the signal A1 or after A1 is obscured but not A2 (during the concurrence time).

Fig. 9: Signal sequence of program 2 with control of optional sensor C1



Once the muting function has been activated, signal C1 must be returned to non-active state before the next muting cycle starts, so that a new rising edge can occur.
Sensor C1 is enabled by associating logic signal C1 to one of the barrier's possible physical signals (e.g. photocell M3).

3.2.4 Notes on sensor positioning

When using the muting program with 2 parallel beams, the sensors must be installed in accordance with the following recommendations, which allow for functional constraints. See Fig. 8 for layout and the relevant dimensions:

$L_1 \geq V \times Tr$

$V \times T > L_1 + L_2$

$L_3 < L_2$

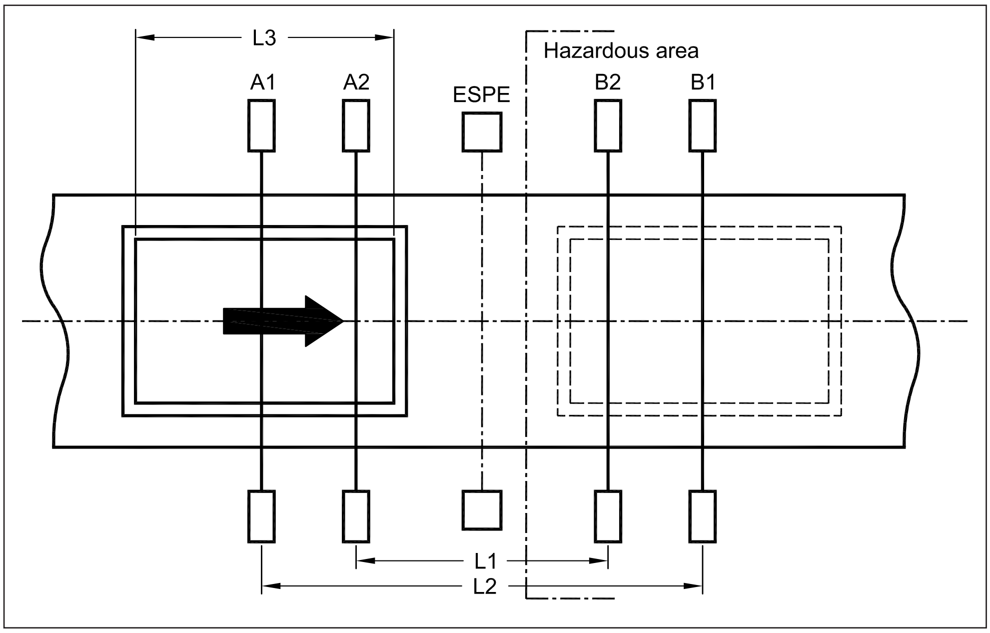
where:

L_1 = minimum distance between ESPE and the position of muting sensor A2 (m)
L_2 = length of the transported material (m)
L_3 = distance between sensor C1 and the position of muting sensor A2 (m)
Tr = barrier maximum response time (s), equal to 0.016s
V = material transport velocity (m/s)
T = muting state hold time (s)

3.3 Program 3 - Muting with 2 pairs of parallel beams

These program uses both pairs of photocells, A1/A2 and B1/B2, with the beams of both pairs set parallel, at opposite ends of the ESPE. This layout allows material to be transported in both directions, since the muting function can be activated symmetrically using pair A1/A2 or pair B1/B2.

Fig. 10: System layout for muting with 2 pairs of parallel beams



Muting state is activated by the covering, in sequence, of photocells A1 and A2 (or B1 and B2 in the opposite direction), and temporarily suspends the ESPE's control function.

Note To comply with the muting sequence, photocell A1 (or B1) must be installed before photocell A2 (or B2). In order to swap the order of the photocells, the association between logic signals A1 and A2 (or B1 and B2) and the physical photocells M1÷4 must be reversed.

The muting state continues until the material exits the beam of photocell B2 (or the beam of photocell A2 in the opposite direction).
This program offers variants and options which can be set using the SBX8000-Tool software to increase safety during muting; they are described in the following points.

3.3.1 Signal A1/A2 (B1/B2) concurrence time

The muting state is only activated if both beams A1 and A2 (or B1 and B2) are obscured within a time window set by the **"Muting conc. time"** parameter.
The permitted range of values is **from 0.1" to 5.0"**. To disable this functions, set the parameter value to 0.

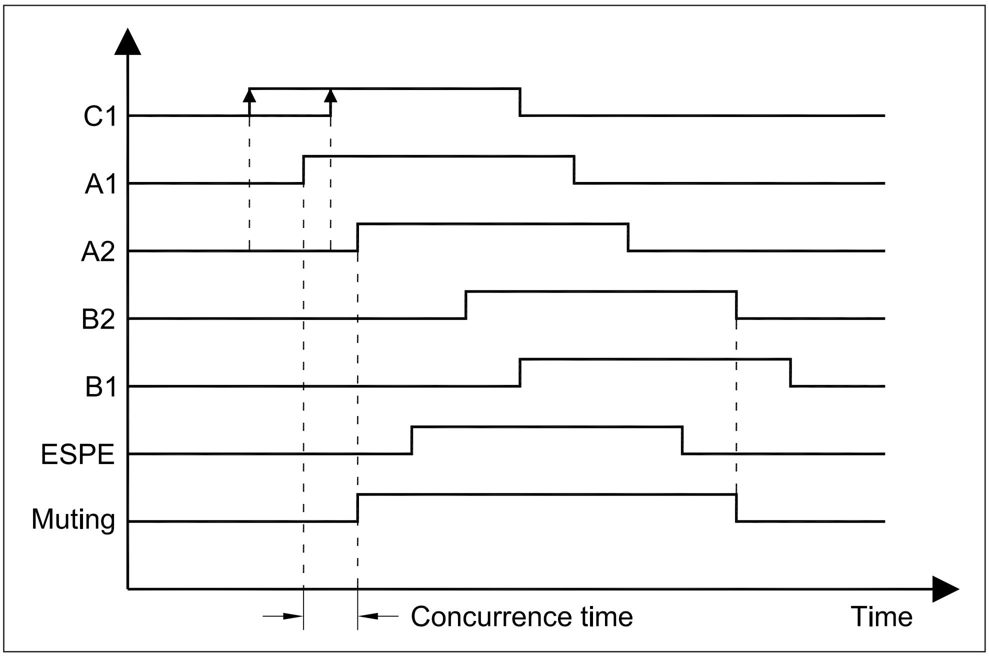
3.3.2 Muting ended by ESPE

The muting state ends when the material, having passed in front of the ESPE, exits it, causing a falling edge in the relative signal. This means that the safety function is restored **before** the moment when beam B2 (or A2) is cleared.
This option is enabled by **"End by ESPE"** parameter SBX8000-Tool software.
The **"End by ESPE hold time"**, programmable **from 0.01" to 1.00"**, allows the filtering of momentaneous clearing of ESPE photocells.

3.3.3 Optional muting sensor C1

A third signal, known as signal C1, can be enabled as an option, to make activation of the muting state, with no material passing through, more unlikely.
This signal must be **dynamically** controlled, in the sense that there must be a rising edge (switch from inactive to active state) of C1 before both signals A1 and A2 (or B1 and B2) are activated. This may occur either before activation of the signal A1/B1 or after A1/B1 is obscured but not A2/B2 (during the concurrence time).

Fig. 11: Signal sequence of program 3 with control of optional sensor C1



Once the muting function has been activated, signal C1 must be returned to non-active state before the next muting cycle starts, so that a new rising edge can occur.
Sensor C1 is enabled by associating logic signal C1 to one of the barrier's possible physical signals (e.g. auxiliary input IN1).

3.3.4 Direction enabling

Program 3 offers an additional control function, relating to the entry direction of the material. Both possible directions are associated to the start of the muting sequence by means of photocell pair A1/A2 or pair B1/B2:
Using the SBX8000-Tool software, one of the following alternatives can be selected:

- **Direction A -> B** Sequence: A1-A2-ESPE-B2-B1
- **Direction B -> A** Sequence: B1-B2-ESPE-A2-A1
- **Both** Direction A -> B or Direction B -> A

If just one direction is enabled, the muting sequence can only be begun from the chosen direction. If any material enters from the opposite direction, this is considered to be a muting sequence error.
This option is selected by **“Direction”** parameter of SBX8000-Tool software.

3.3.5 Notes on sensor positioning

When using the muting program with 2 pairs of parallel beams, the sensors must be installed in accordance with the following recommendations, which allow for functional constraints. See Fig. 10 for layout and the relevant dimensions:

$L_1 \geq 2 \times V \times Tr$

$V \times T > L_1 + L_3$

$L_2 < L_3$

where:

L_1 = distance between the positions of internal muting sensors A2 and B2 (m)
L_2 = distance between the positions of external muting sensors A1 and B1 (m)
L_3 = length of the transported material (m)
Tr = barrier maximum response time (s), equal to 0.016s
V = material transport velocity (m/s)
T = muting state hold time (s)

3.4 Program 4 - ESPE without muting function

It is possible to use the SBX8000 barrier as a permanent protection of an area without the muting function. At each crossing of the area protected by ESPE, the OSSD outputs are turned off immediately until the next restart.
The restart can occur according to two distinct modes:

- **Auto-restart** The reactivation is automatic by exiting from ESPE
- **Manual** The reactivation requires the RES restart command

The automatic restart involves the use of the logic (software) **ARES** signal as enabling controlled by an external safety logic.
Once the ESPE has been crossed and the OSSD outputs have became inactive, to reactivate the barrier, the auto-restart must be confirmed by ARES signal. From the instant of ESPE clearing, a timer set to **“Auto-restart time”** in the **range from 0.1” to 25.0”** starts counting. At the end of the time, the barrier is automatically reactivated only if the ARES signal is active or if a rising edge of ARES signal take palce between the obstruction of ESPE and the end of the timing:

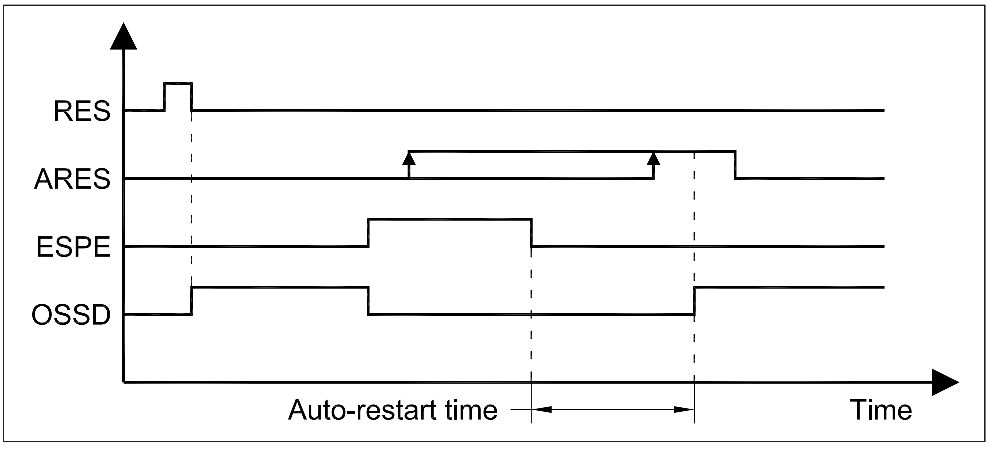


Fig. 12: Signal sequence of program 4 with auto-restart function

The acivation mode (level or rising edge) of ARES signal is configurable by the **"ARES mode"** parameter:
The selection of the restart type is defined by the configuration parameter for ARES signal. The "Not used" value of parameter disables the auto-restart function so the reactivation can only be performed manually by RES signal. The association of the logic (software) input to a physical (hardware) signal enables the automatic reactivation function.

4 Auxiliary functions

4.1 Muting sensor hold time

As an optional, a **software filter** can be applied to the muting photocell detection status to compensate for any beam reception failures during transit of material. This may be due to uneven areas of material or gaps, through which the photocell beam is able to pass.
The filter operates asymmetrically, only in the switch of state from **photocell obscured to clear**. Therefore, the system's reaction to obstruction of the beam is immediate (equal to the response time), while in the opposite case, when the material is already present in front of the photocells, the presence of the obstacle is extended by the **"Sensor hold time"** parameter set using the SBX8000-Tool software in the **range from 0.01" to 1.00"**.

WARNING

Set the sensor hold time with the lowest possible value!

- The **"Sensor hold time"** parameter must be set at the lowest possible value compatible with the filtering requirements.
- For the **parallel muting** configurations, the holding time must be verified in relation to the distance between the photocells so as not to interfer with the correct handling of the muting sequence.

4.2 Muting function timeout

The SBX8000 Evolution barrier muting function includes a **safety timer** so that the ESPE disabled condition is always terminated after a maximum time.
The timer starts counting as soon as the correct sequence for activation of the muting state has occurred. The value of **"Muting timeout"** parameter can be set using the SBX8000-Tool software in the **range from 10" to 300"**.
At the end of the muting timeout, the barrier is forced to Restart Request or Override Request state (if the latter function is enabled) with the OSSDs not active.

WARNING

Set the muting function control times with the lowest possible values!

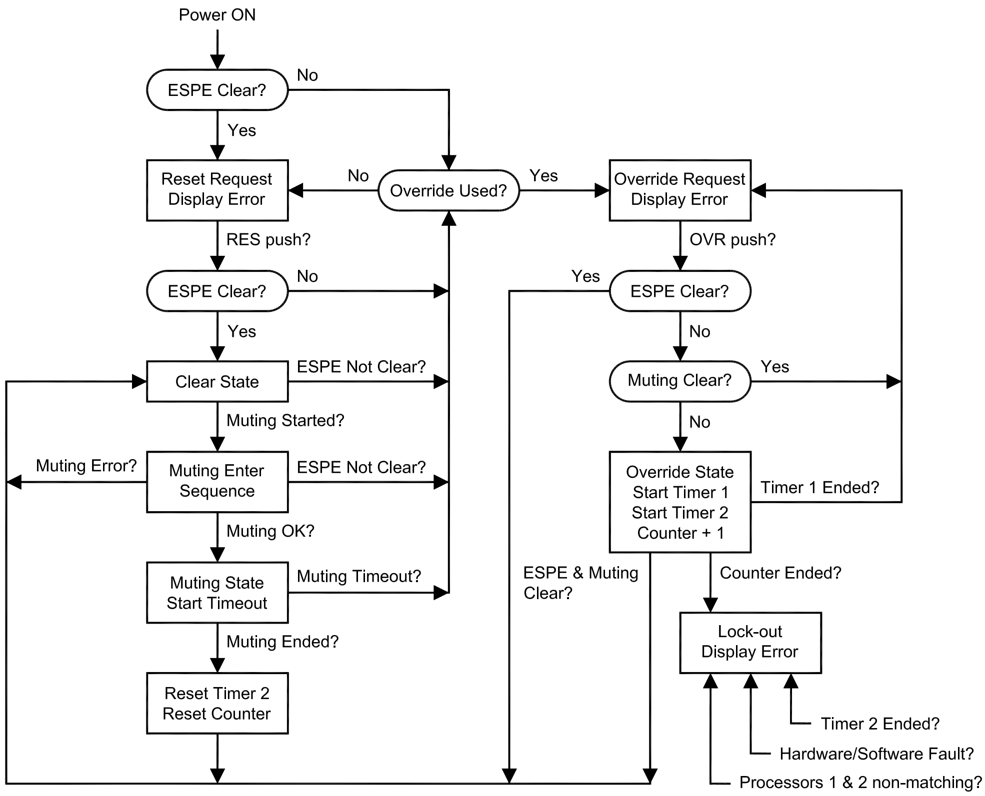
- The **"Muting hold time"** parameter, only available with program 2, must be set at the lowest possible value compatible with the time the material takes to exit the ESPE position.
- The **"Muting timeout"** parameter valid for all the programs in general must be set at the lowest possible value compatible with the muting hold time value T, which will depend, for each program, on the photocell position, the size of the material and its transit velocity.

4.3 The override function

The SBX80000 Evolution barrier includes an **override function** for restoration of operation of the ESPE/system in the event of a stoppage triggered by **muting sequence errors**.
For example, if an unplanned stoppage occurs as the material transits in front of the photocells, the muting conditions cannot be satisfied and the barrier switches to Restart Request state, which cannot be exited because the barrier is disabling

operation of the system and thus also the conveyor drives.
This situation can be overcome using the **OVR** logic signal, which can be associated to any programmable physical input; this then functions as a **manual command** for activation of override state, during which the OSSD outputs are temporarily activated to allow removal of the standing material in front of the photocells.
Control logic of all the muting programs, which includes the override function, can be more clearly understood with the aid of the following **state graph**:

Fig. 13: State graph of general management of the muting programs and override function



In order for the system to be switched from **Restart Request state** to **Clear state** all photocell beams of ESPE must be unobstructed. If the ESPE photocells are unobstructed, pressing the restart command (**RES** input) switches the system to Clear state with the OSSD outputs activated. In this state, **obstruction of the ESPE** will return the barrier to the Restart Request state, deactivating the OSSD outputs.
When the material passes in front of the barrier, the **muting sequence** begins; this should switch the barrier to muting state, with the OSSD outputs still activated but with the ESPE's control function temporarily disabled. At the end of the muting state, the system returns to Clear state and the ESPE's control function is restored.
Once the muting sequence has begun, in the event of a **functional anomaly** in the photocell signals or auxiliary input C1, the sequence is aborted and system remains in the Cleat state. All the muting photocells must be cleared before a new muting cycle can begin.
It is difficult to resolve a situation of this kind without using the override function, since the material cannot be moved in order to free the photocell beams with the OSSD output not active.

Note It is important not to confuse functional anomalies due to an incorrect muting signal sequence with all the other anomalies which may occur such as a **hardware failure** or a negative outcome from a **cross-check on the two redundant parts.**
Anomalies of this last kind cannot be resolved using the override function, since the system has detected a **serious error** not caused by a specific operating situation which

may occur during normal use of the system.
An anomaly of this kind **shuts down the system** in **Lock-out** state, which cannot be reset without disconnecting the power supply and resolving the problem (perhaps even replacing the device concerned) if it is not resolved automatically.

The override function allows resolution of muting sequence anomalies, since the OSSDs are temporarily activated but in specific conditions with special safety checks.
After an anomaly, the **Override Request** state displays the code of the error which occurred during the muting sequence or the obstructed photocells. This code is very important for establishing the cause of the problem.
However, **Override state** is effectively activated by pressing the override command.
Once override state has been activated, with the OSSD outputs powered, the material can be removed by clearing all the photocells, after which the system will automatically return to the Clear state.

4.3.1 Override control functions

Override is a hazardous state because the outputs are activated and the ESPE's control function is deactivated, as in muting state. The following control functions are therefore built into the system:

- **Timer 1** - Override state duration timeout
- **Timer 2** - Timeout on the waiting time before a new and correct muting cycle
- **Counter** - Counter of max override cycles without a new and correct muting cycle

Timer 1 is always set with the value of **30'** and no other values can be programmed. At the end of this time, the OSSD outputs are deactivated and the system suggests a new override cycle by returning to Override Request state.

Timer 2 is always set with the value of **60'** and no other values can be programmed. If a complete and correct muting cycle is not performed after an override cycle, the system switches to error (lock-out) state and is shut down.

The **Counter** is set with a value calculated automatically using the following formula:

Maximum number of override cycles = 1500 / Muting Timeout

When the maximum number of cycles is reached, the system switches to error (lock-out) state and is shut down.

WARNING

Pay attention to the following notes when using the override function!

- The override function activation command must be installed in a position which is **not accessible** from the hazard zone and has an unrestricted view of it.
- Before activating the override function, check the cause of the lock-out, using the barrier's warning lights and the **display error code**.
- As far as possible, resolve the problem without activating the override state.

4.4 Belt stop input

The belt stop function allows the conveyor belt to be stopped temporarily in muting state without causing timeout errors. Using the SBX8000-Tool software, use of the **BS input** can be enabled by associating it to a physical input (e.g. IN1÷4), in order to freeze the following timers while the belt is stopped:

- Concurrence time
- Muting hold time
- Muting timeout time

The BS logic signal is active-low, so if the belt stop function is enabled, with the presence of low signal, the counts of the muting control timers are temporarily suspended.
During the belt stop, the muting entry sequence remains frozen, while in case of active muting, a change in ESPE state causes the OSSD output to be deactivated.

4.5 Diagnostic signalling output

The SBX8000 Evolution barrier has a **static programmable output ADO** (Application Diagnostic Output) which can perform a number of state signalling functions. This output normally informs the PLC of the barrier's current status. The possible ADO signal configurations are detailed in the table below:

Tab. 2: ADO programmable output configurations

ADO	Meaning
Not used	Output always in not active state (high impedance).
OSSDs	Output active (+24Vdc) with OSSDs activated. In high impedance with OSSDs not activated.
RRO	Output active (+24Vdc) during Restart Request state. Otherwise in high impedance.
Muting	Output active (+24Vdc) during Muting state. Otherwise in high impedance.
Override	Output active (+24Vdc) during Override state. Otherwise in high impedance.

WARNING

Do not use the ADO for safety-related purposes!

The ADO output has electrical protection but it is **not controlled** for safety purposes. It must therefore only be used to inform the PLC about the barrier's state.

4.6 Inversion of signals logic state

All logic (software) signals used in the SBX8000 Evolution barrier can be arbitrarily connected to the physical (hardware) inputs available in the connectors.
It is also possible to associate the logic signals to the same hardware signals but previously negated in their logic state.
The SBX8000-Tool software allows a simple association of logic signals to the physical signals or to their negate version.

4.7 RES/OVR signals maximum pulse

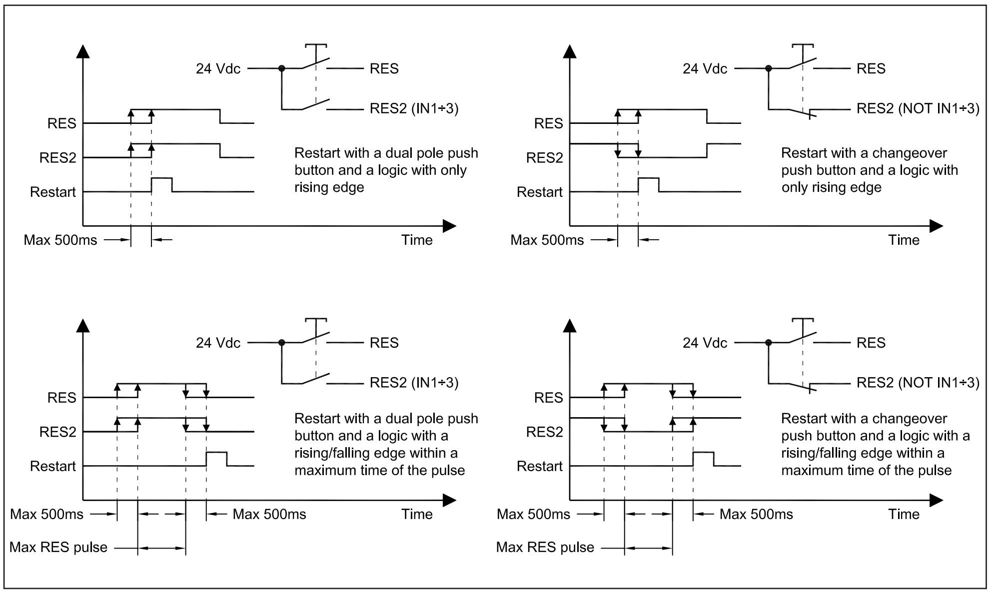
The RES signal is used for the initial start and for any subsequent restart of the barrier. The restoration of the Clear state can occur as a result of a **rising edge** or a **short pulse** of RES signal. The **RES pulse** parameter defines the modality of RES signal operation.
A value 0 of the parameter disables the pulse control and the restart occurs as a result of a rising edge of the RES signal.
A value **from 0.1” to 10.0”** enables the pulse control and the restart occurs only if a rising edge of RES signal is followed by a falling edge within the maximum set time.
A similar management is **also performed on the OVR signal** to control the override function. The “RES pulse” enabling/setting parameter is used for both command blocks.

Recommendation Use the pulse modality for RES/OVR signals to further increase the security in case of failure on the signal line.

4.8 RES and OVR signals redundance

The logic (software) signals for the restart (RES) and the Override (OVR) function are also equipped with a redundant system that analyzes the simultaneous switching of two separate physical (hardware) inputs. For this purpose **RES2** and **OVR2** signals can be activated as “shadow” of respectively RES and OVR main signals. The signals of each pair RES/RES2 and OVR/OVR2 must assume the same logical state within a maximum time window of **500ms** so that the overall signal is evaluated accordingly. The management of the redundant signals requires the use of actuators with double contact. In addition, using the feature for the association of the logic (software) input to the negated version of physical (hardware) signals, it is also possible to use actuators with changeover contacts. Below are some example of configurations for the RES restart signal:

Fig. 14: RES/OVR command configurations using redundant signals



Recommendation Use the redundant modality to further increase the security in case of failure of the actuators.

4.9 Momentary action of OVR signal

In Override state, the OSSD outputs are activated to allow the removal of the material in order to recover the barrier in the Clear state.
Using the **“OVR momentary“** parameter, it is possible to activate the OSSD outputs, in the Override state, only through the momentary action of the push button connected to OVR signal.
In the case of activation of the Override function by means of a **short pulse**, at the end of the pulse, the momentary action of the button must be carried out within a maximum time of 3“.

ATTENZIONE

Use the momentary action of the OVR signal

With the “OVR momentary” parameter not enabled, the OSSD outputs remain activated continuously and independently of a manual action for the duration of the Override status.

4.10 Photocell test

The eight photocells in the SBX8000 Evolution barrier have an internal test function which checks periodically that the beam detection system is functioning correctly. The test ensures that every photocell is receiving the beam from its transmitter correctly.
In the photocell unobstructed state, only one transmitter at a time is periodically shut down for 2 ms while the system checks that the relative receiver is not detecting a signal.
The periodic **test can be disabled** for the four muting photocells only, if commercial photocells without a test circuit are used. The SBX8000-Tool software is required to disable the photocell test.
This option is enabled by **“Muting test”** parameter of SBX8000-Tool software.

Recommendation

Do not disable the photocell test unless this is necessary due to the specific muting photocells used. Users are, however, advised to use the photocells supplied with the SBX8000 Evolution barrier and leave the test enabled.

4.11 EDM check disabling

The two OSSD outputs of the SBX8000 Evolution barrier are suitable for direct control of external contactors used to cut off the power supply to the system for safety purposes. The outputs are equipped with automatic check of open circuit failures, short-circuit on power supply (+24V and GND), overload and incorrect switching of external contactors. The EDM signal, obtained by the auxiliary contacts of the external contactors, is used for the latter function.
However the two OSSD outputs can also be connected directly to a safety PLC inputs. For this purpose it is provided the **”EDM check”** parameter for disabling the control of EDM signal. This disabling also excludes the open circuit check to allow direct connection of the OSSD outputs to the low current inputs of PLC.

WARNING

Do not disable the EDM check parameter if a safety PLC is not used!

The setting of EDM check is only allowed to personnel qualified for the safety purpose. Use **access PIN** to protect the parameter programming.

4.12 Factory default settings

The SBX8000 Evolution barrier is supplied with the following default parameters set in its internal memory:

Tab. 3: Configuration parameter default settings

Parameter	Default
Muting program	3 (muting with 2 pairs of parallel beams)
A1 signal selection	M1
A2 signal selection	M2
B1 signal selection	M4
B2 signal selection	M3
C1 signal selection	IN1
OVR signal selection	Combined with RES
BS signal selection	Not used
ADO signal selection	OSSDs
RES2 selection	Not used
OVR2 selection	Not used
OVR momentary action	Disabled
RES/OVR maximum pulse	Enabled with 3 s
ARES signal selector	Not used
Auto-restart time	0.5 s (not used in program 3)
Muting sensor hold time	1 s
Muting concurrence time	0 (disabled)
Muting hold time	3 s (not used in program 3)
Muting timeout	60 s
Muting ended by ESPE	Enabled
ESPE hold time	0.5”
Muting directions	Both
Muting test	Enabled
OSSD/EDM test	Enabled
Access PIN	Disabled

5 Electrical installation

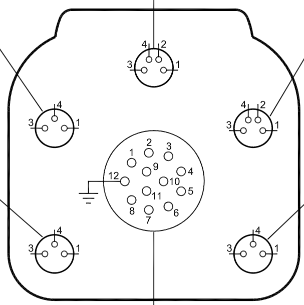
5.1 Connections to the main device

Fig. 15: Main device connector pin allocation

Bus connection between units M8 x 4			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
2	White	RA	Bus signal A
3	Blue	GND	Power 0V
4	Black	RB	Bus signal B

Programming serial port M8 x 3			
Pin	Wire	Name	Description
1	Brown	RXD	Rx signal
3	Blue	GND	0V reference
4	Black	TXD	Tx signal

Auxiliary Input / Output M8 x 4			
Pin	Wire	Name	Description
1	Brown	+24Vdc	Power supply
2	White	RRO	Reset required
3	Blue	GND	Power 0V
4	Black	RES	Reset / Restart



Muting senders M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Tx commom
3	Blue	MTX1	Muting TX - 1
4	Black	MTX2	Muting TX - 2

Muting senders M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Tx commom
3	Blue	MTX3	Muting TX - 3
4	Black	MTX4	Muting TX - 4

System connection M26 x 11 + PE			
	Wire color	Name	Description
1	Brown	+24Vdc	Power supply input 24Vdc
2	Blue	GND	Power supply reference 0V
3	Grey	OSSD1	Switching device 1 output - 24Vdc PNP
4	Pink	OSSD2	Switching device 2 output - 24Vdc PNP
5	Red	RES	Reset / Restart input - 24Vdc PNP
6	Yellow	EDM	External device monitoring input - 24Vdc PNP
7	White	ADO	Application diagnostic output - 24Vdc PNP
8	Red / Blue	RRO	Reset required output - 24Vdc PNP
9	Black	IN3	Configurable input 3 - 24 Vdc PNP
10	Purple	IN2	Configurable input 2 - 24 Vdc PNP
11	Gray / Pink	IN1	Configurable input 1 - 24 Vdc PNP
12	Green	PE	Protection earth

WARNING

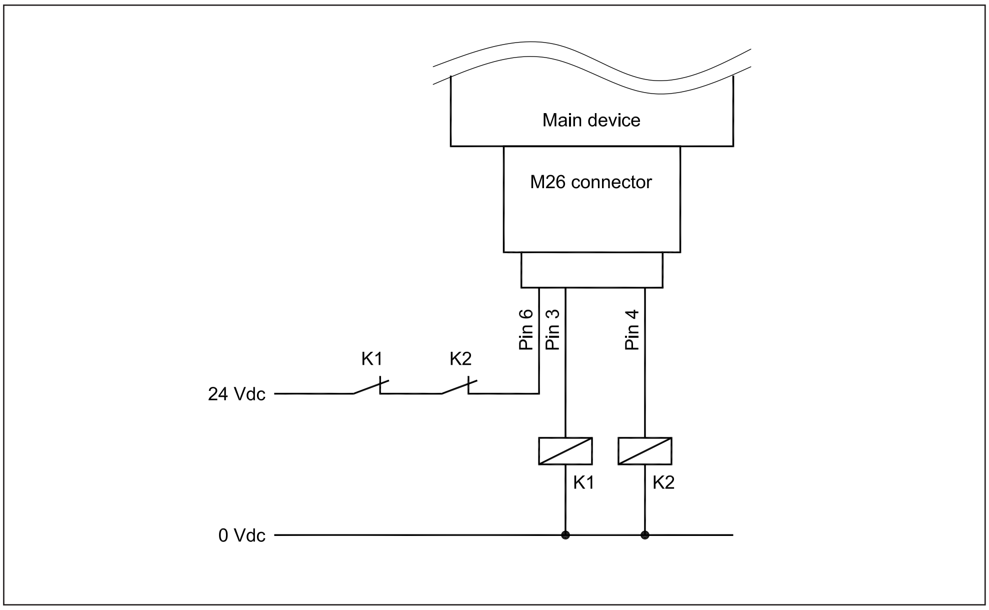
Do not make connections with the system powered up!

Anomalies, even as serious as activation of the system, may occur if the connections are made with the barrier receiving 24V power.

5.1.1 Safety outputs (OSSD1/2) and control input (EDM)

Outputs OSSD1 and OSSD2 are used to cut off the power supply to the system for safety purposes. Each output is controlled by one of the two redundant sections of the barrier and they have protection against connection errors or anomalies. In addition, the EDM (External Device Monitoring) input signal monitors correct switching of the external contactors operated by these static outputs:

Fig. 16: OSSD static output and EDM input connection



In protection conditions, the static outputs are deactivated and the relative normally closed contacts supply 24 Vdc power to the EDM input signal. After 300ms from the deactivation of the outputs, if the EDM is not activated (high) due to a contactor failure, the barrier switches to lock-out state and does not allow any further activation of the system.

WARNING

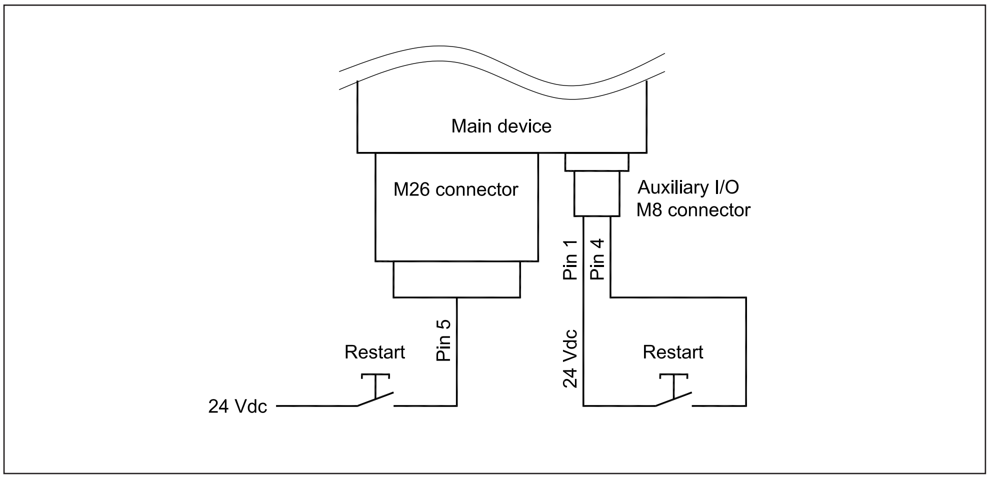
Wire OSSD1 and OSSD2 separately!

- Use separate cables to connect pins 3 and 4 of the OSSDs to their respective external contactors.
- Check that the EMD signal is only powered by the off position of both contactors.

5.1.2 Restart button (RES)

The barrier restart input RES is available both in the main M26 connector and in the auxiliary I/O M8 connector. The restart button can be connected to either of the two connectors.
The RES input is PNP at 24V and is active-high. The barrier power supply voltage of 24Vdc is available on Pin 1 of M8 connector, for direct connection of the button:

Fig. 17: Restart input connection



WARNING

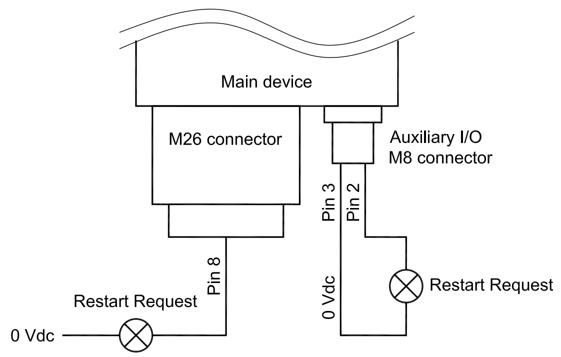
Position the restart button correctly!

The restart button must be located outside the hazard zone and in a position with an unrestricted view of it.

5.1.3 Restart request signal (RRO)

Output RRO (for signalling that a barrier restart is required) is available both in the main M26 connector and in the auxiliary I/O M8 connector. A warning light can be connected to either of the two connectors.
The RRO output is PNP at 24V with maximum current 0.5A and is active-high. The M8 connector includes Pin 3, internally connected to the barrier's 0Vdc power supply reference, for direct connection of the lamp:

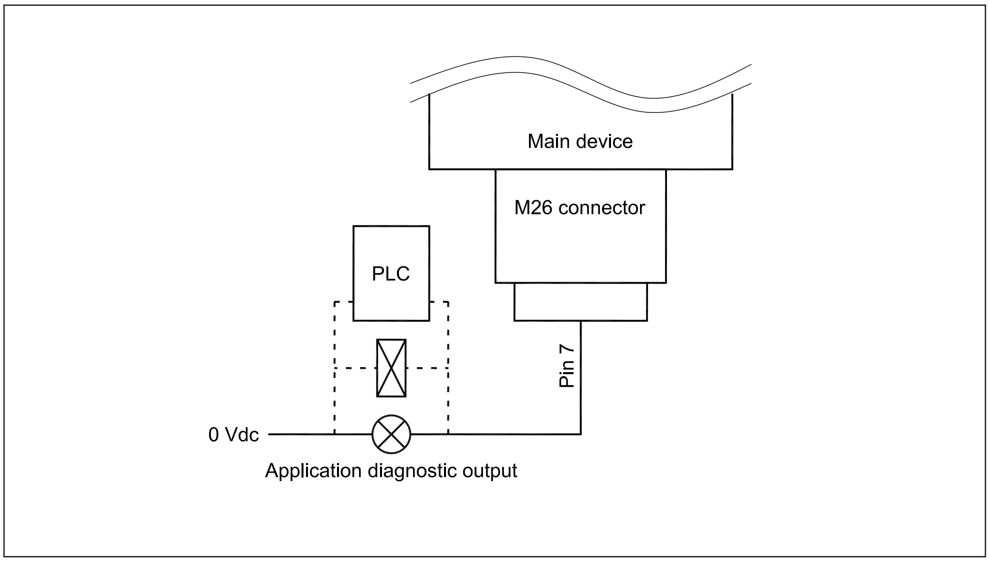
Fig. 18: Restart request output connection



5.1.4 Application diagnostics output (ADO)

The main M26 connector includes an ADO output for indication of the barrier's state. This output's function can be programmed as explained in section 4.
The RRO output is PNP at 24V with maximum current 0.5A and is active-high. It can be connected directly to a load or to a low current input of the PLC which controls the system.

Fig. 19: Application diagnostic output connection



WARNING

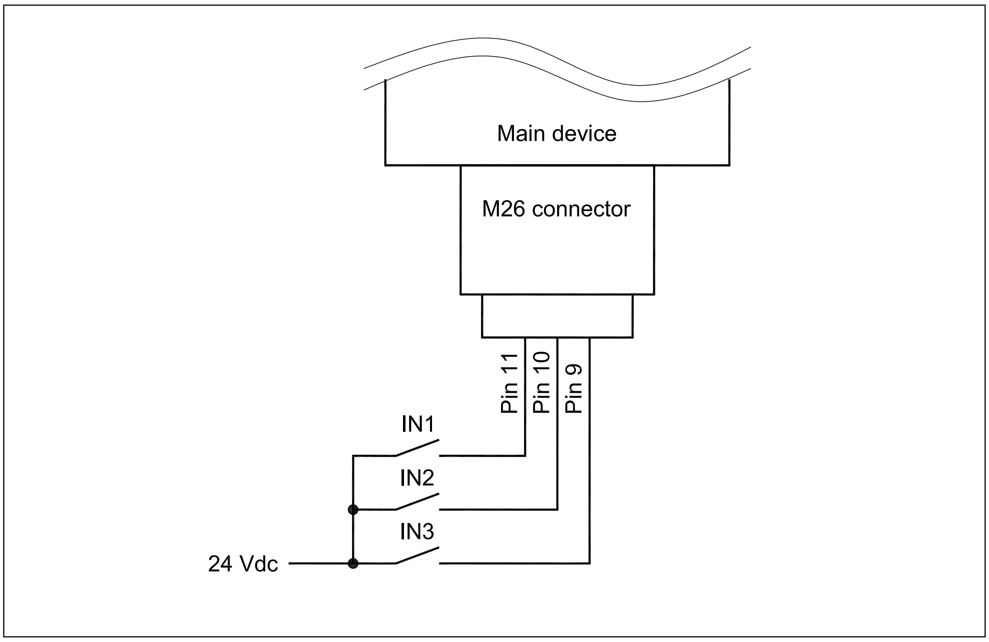
Do not use the ADO for safety-related purposes!

The ADO output has electrical protection but it is **not controlled** for safety purposes. It must therefore only be used to inform the PLC about the barrier's state.

5.1.5 Auxiliary inputs (IN1÷3)

The M26 main connector includes 3 additional inputs, identified as IN1÷3, which can be associated to barrier functions using the SBX8000-Tool software.
Inputs IN1÷3 are PNP at 24V and their functions and logic states depend on the specific programming selected:

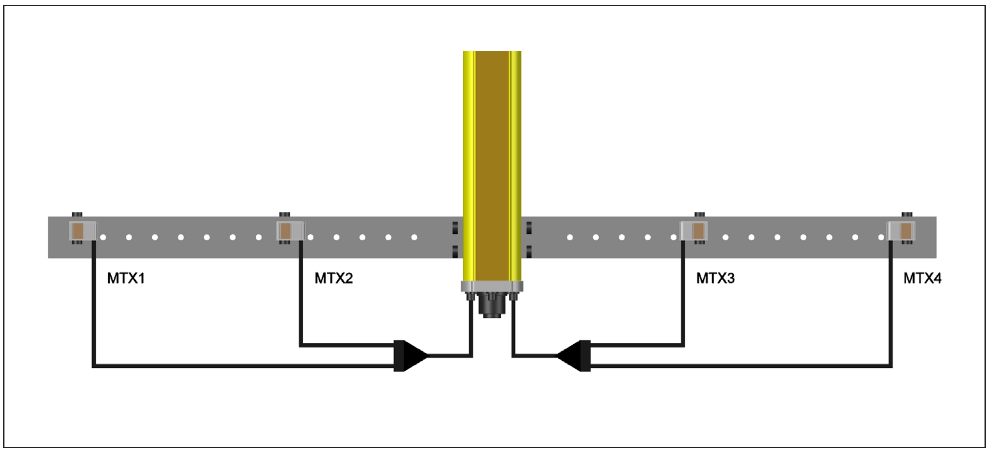
Fig. 20: Auxiliary input connection



5.1.6 Muting photocell senders

The SBX8000 Evolution barrier is able to control up to four muting beams, each created using a transmitter-receiver pair. The transmitters are located in the main device and the receivers in the secondary device.
The main device includes two M8 connectors, each of them connected to two transmitters by means of a Y cable supplied with the system. The four transmitters are identified as MTX1÷4 and they must always be connected as shown below:

Fig. 21: Muting photocell transmitters connection



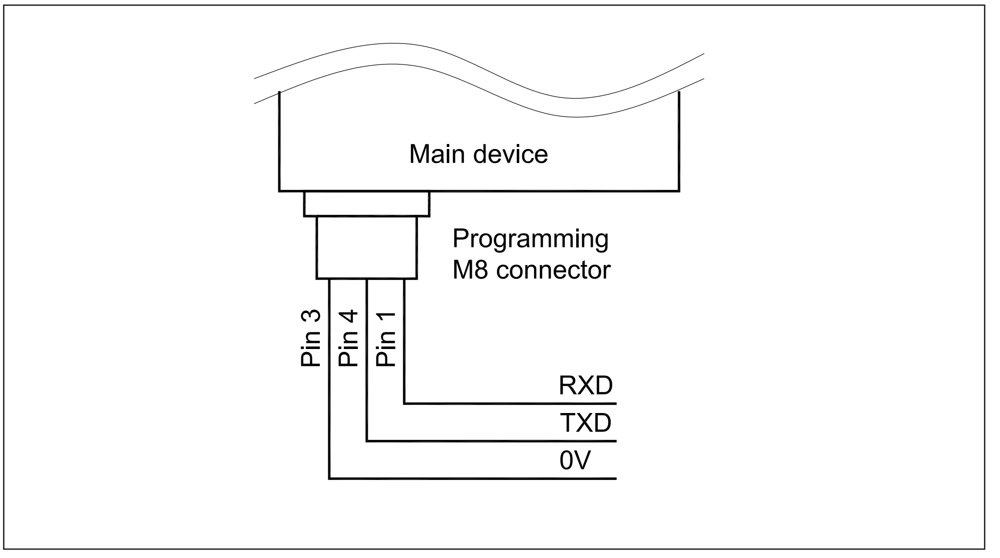
The connector on the left of the main device is for connection to transmitters MTX1÷2 and the one on the right for transmitters MTX3÷4.
While the wiring layout must be as shown, the physical positions of the transmitters may vary depending on the specific muting configuration. Remember that the hardware signals of the four photocells M1÷4 can be associated to any muting logic/functional signal (A1, A2, B1, B2) using the software tool.

Note The beams of the four transmitters MTX1÷4 must be aligned with the respective receivers MRX1÷4, complying with the numbering 1÷4 and the position of connection to the respective connectors.

5.1.7 Connecting the serial communication line

The barrier is configured and put into operation using the SBX8000-Tool software, which requires the PC to be connected to the barrier's programming port. To allow this, the main device has an M8 connector with the RS232 standard port signals:

Fig. 22: Programming port connection

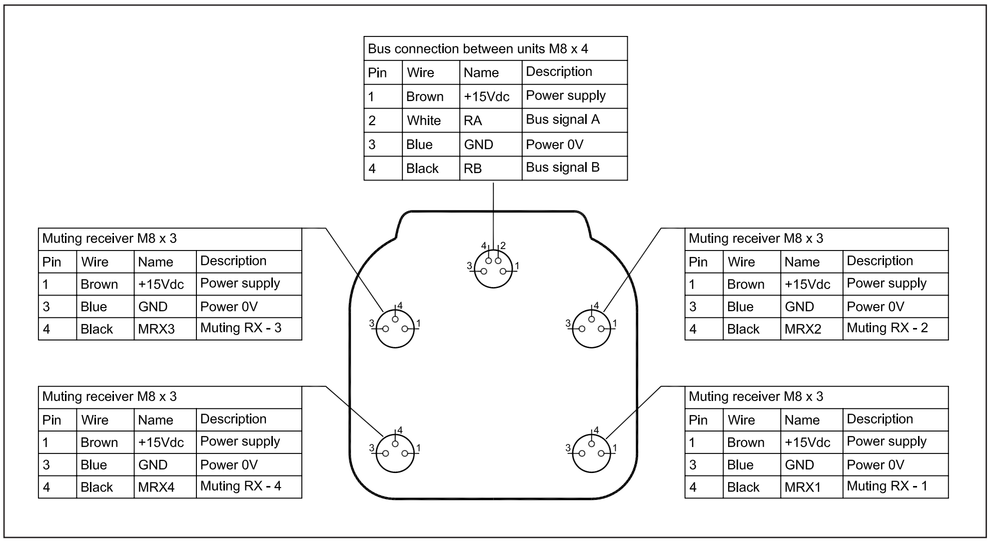


A specific adapter cable from M8 to a DB9 connector (9 pin female D connector) is available.

Note Connect the programming cable to one of the PC's USB port using USB-RS232 converter, which can be purchased on the market or is available together with the adapter cable.

5.2 Connections to the secondary device

Fig. 23: Secondary device connector pin allocation



Bus connection between units M8 x 4			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
2	White	RA	Bus signal A
3	Blue	GND	Power 0V
4	Black	RB	Bus signal B

Muting receiver M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
3	Blue	GND	Power 0V
4	Black	MRX3	Muting RX - 3

Muting receiver M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
3	Blue	GND	Power 0V
4	Black	MRX2	Muting RX - 2

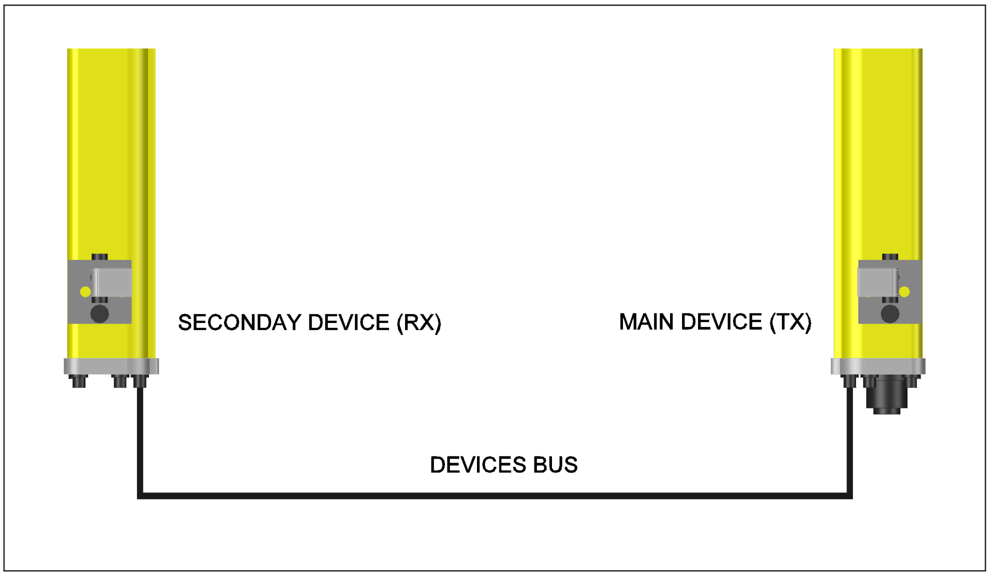
Muting receiver M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
3	Blue	GND	Power 0V
4	Black	MRX4	Muting RX - 4

Muting receiver M8 x 3			
Pin	Wire	Name	Description
1	Brown	+15Vdc	Power supply
3	Blue	GND	Power 0V
4	Black	MRX1	Muting RX - 1

5.2.1 Connection to the main device

The main device must be connected to the secondary device using the 5m cable supplied. The M8 connectors on the front of both units are used:

Fig. 24: Connection between main and secondary devices

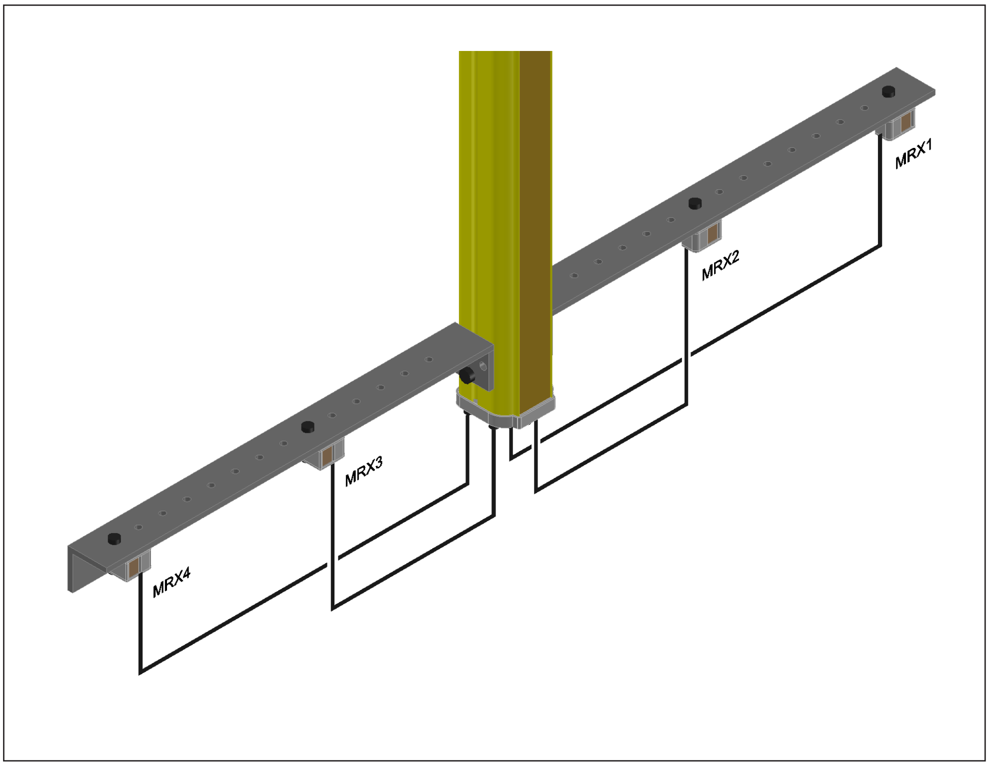


Recommendation Position the cable connecting the two devices as far as possible from sources of electromagnetic interference such as motors, inductive drives and power supply wiring.

5.2.2 Muting photocell receivers

The SBX8000 Evolution barrier is able to control up to four muting beams, each created using a transmitter-receiver pair. The transmitters are located in the main device and the receivers in the secondary device.
The secondary device has four M8 connectors, to each of which a receiver is connected using the cable supplied. The four receivers are identified as MRX1÷4 and they must always be connected as shown below:

Fig. 25: Muting photocell receivers connection



While the wiring layout must be as shown, the physical positions of the receivers may vary depending on the specific muting configuration. Remember that the hardware signals of the four photocells M1÷4 can be associated to any muting logic/functional signal (A1, A2, B1, B2) using the software tool.

Note The beams of the four receivers MRX1÷4 must be aligned with the respective transmitterss MTX1÷4, complying with the numbering 1÷4 and the position of connection to the respective connectors.

6 PC software

6.1 The SBX8000-Tool application

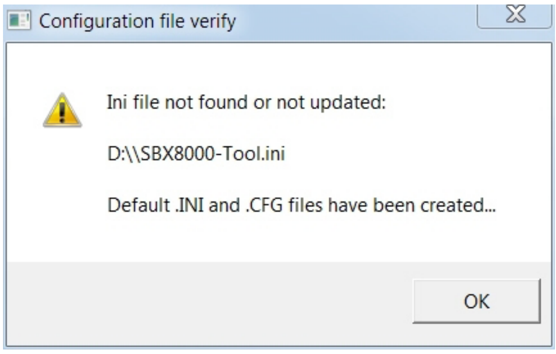
The SBX8000-Tool software must be used for all barrier configuration and control functions. This software allows the user to select one of the muting programs available and configure the relative operating parameters. The tool also has a logic state analyser to analyse the main signals for diagnostic purposes and to identify the optimal values for the parameters.

6.2 Installing the software on the PC

6.2.1 Executing the installation program

To install the software on the PC, run the **SBX8000-Tool_Vxxx_Setup.exe** setup file supplied with the barrier. Follow the instructions in the setup program until the installation operation is complete.
After installation, the first time software is run an alert message relating to automatic creation of the **configuration file** will appear:

Fig. 26: Automatic creation of the configuration file after installation

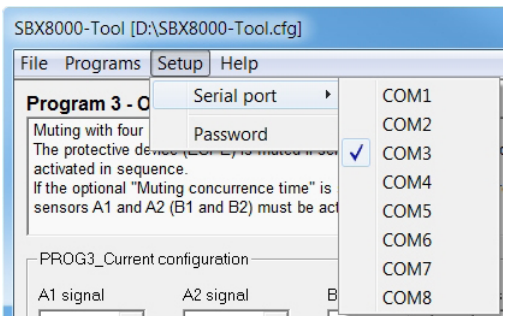


Confirm creation of the initial configuration file and restart the program. The points which follow will explain how to create new and specific configuration files.

6.2.2 Software tool setup

Before the tool is used, the PC serial port used for communication with the SBX8000 Evolution barrier must be set. To do this, open the **“Setup”** menu and select the port:

Fig. 27: Serial communication port setting menu



Note The SBX8000 Evolution barrier uses the **Modbus** standard protocol for serial communication functions. The two main microprocessors respond as slaves on protocol addresses 1 and 2 and use the same **shared RS232** serial port. The tool manages communication between the two microprocessors independently, comparing the relative replies to identify any problems of congruency between the two separate parts.

6.3 Programs setup

The SBX8000 Evolution barrier is able to operate with different muting programs. The muting programs are all stored in the **read-only memory** inside the barrier, so to select the program the user simply sets the number of the program chosen. Each of the two microprocessors receives the selected program number from the software tool and independently activates execution of the copy of the program stored in its memory. Each microprocessor also has its own **programmable memory** used for setting the operating parameters of the chosen program.
The Programs menu is used to select and configure the program:

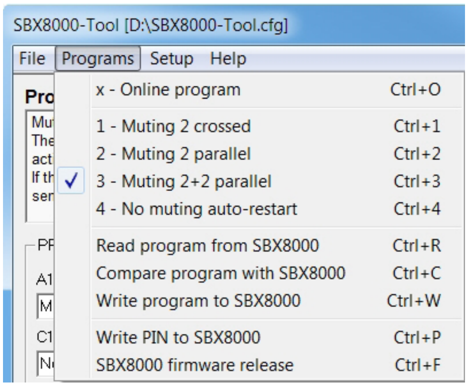


Fig. 28: Muting program selection menu

Once the program has been selected using the **“Programs”** menu, the tool's entire layout is immediately updated in response to its characteristics. For example, for program 3 the layout is as follows:

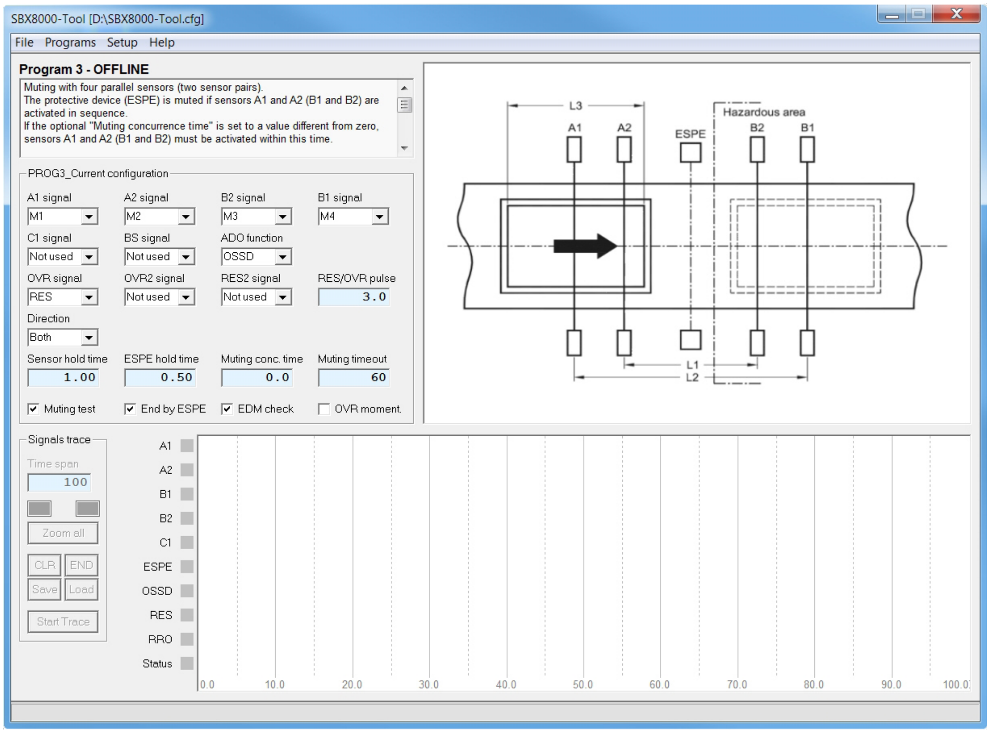


Fig. 29: Tool layout for program 3

The left-hand side of the screen contains all the configurable parameters of the specific program.
The software tool provides two distinct operating modes:

- **Offline mode** - View/edit values of configuration file
- **Online mode** - View/edit values currently present into the barrier

6.4 Offline mode

The Offline mode allows the visualization and modification of the programs values memorized inside a specific configuration file. In this way a particular program can be prepared without necessarily being connected to the barrier. Using different configuration files, various programs can be archived to be recalled and programmed inside another barriers.

6.4.1 Muting program configuration

Once the software has been installed, the values in the tool window are those saved in the default configuration file created automatically.
These values can be changed by clicking in the box of the parameters. Every change in the values automatically updates the current configuration file. See Section 3, which describes the muting programs, for description of the specific parameters.

6.4.2 Transferring the program to the device

The parameter values set in the PC screen have to be transferred to the SBX8000 Evolution barrier to enable the device to actually use them. This is done using the serial connection between the PC and the barrier, by means of the **“Write program to SBX8000”** function in the “Programs” menu. This function sends the number of the selected program and all the configuration values currently set in the PC to both microprocessors. After this operation, the new program is automatically put into execution on the barrier.

6.4.3 Recovering the program from the device

Normally, the configuration procedure is performed as described above, with the values preset in the configuration file with the aid of the tool screen copied into the barrier memory. However, the reverse is also possible, with the barrier's current setup copied onto the tool window and thus into the current configuration file.
This can be done using the **"Read program from SBX8000"** function, which transfers the values from the barrier's memory to the PC.

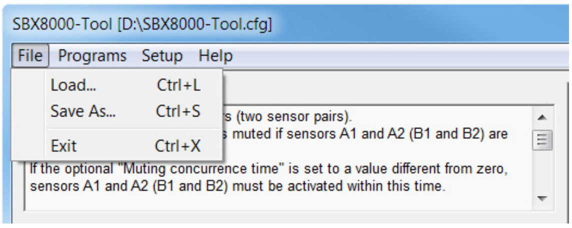
6.4.4 Verifing the program on the device

The **"Compare program with SBX8000"** function allows the comparation of all the values of the program set on the barrier with those of the currently selected page of configuration file.
This command does not modify the values in the barrier or those in the configuration file but it is limited only to verifying equality.

6.4.5 Saving the configuration on file

It is very important to use different configuration files when working with different program settings, in order to keep a copy of the specific settings on the PC. Therefore, the File menu allows the user to select the current configuration file associated to the tool screen:

Fig. 30: Tool configuration save menu



The **"Save As"** command creates a new configuration file starting from the current one, while the **"Load"** command selects a different current configuration file.

6.5 Online mode

The Online mode allows the direct visualization and modification of the parameters inside the barrier currently connected without interacting with the configuration file as it happens in the Offline mode.
As soon as Online mode is activated, the parameters currently stored in the barrier are automatically read through the serial connection and displayed in the PC layout on a temporary page.
At this point, the parameters can be changed but consider that the new values will actually be updated in the barrier only after the "Write program to SBX8000" command is executed.

6.6 Auxiliary functions

6.6.1 PIN protection

The Programs menu includes the **"Write PIN to SBX8000"** command, allowing a numerical safety code to be saved in the barrier to block all writing operations of the tool on the barrier. The PIN is disabled by default, meaning that writing operations are always possible. When a PIN value is set, it will be requested before the first writing operation.

Recommendation After enabling the PIN, take care not to lose the code since it will no longer be possible to communicate with the barrier. In this case, the system can only be unlocked with the support of the manufacturer.

6.6.2 Verify of firmware release

Using the **"SBX8000 firmware release"** function, the firmware release installed into SBX8000 Evolution barrier can be verified. In the case of release less that supported by the PC software tool, during the program write/read functions, all the features not available will be listed.

6.6.3 Password protection

A **Password** for access to the tool can be set in the Setup menu. Once set at a value other than an empty string, the password will be requested whenever the software is started up.

Note The password is only required for access to the SBX8000-Tool software and must not be confused with the PIN programmed in the barrier to disable serial port communication functions.

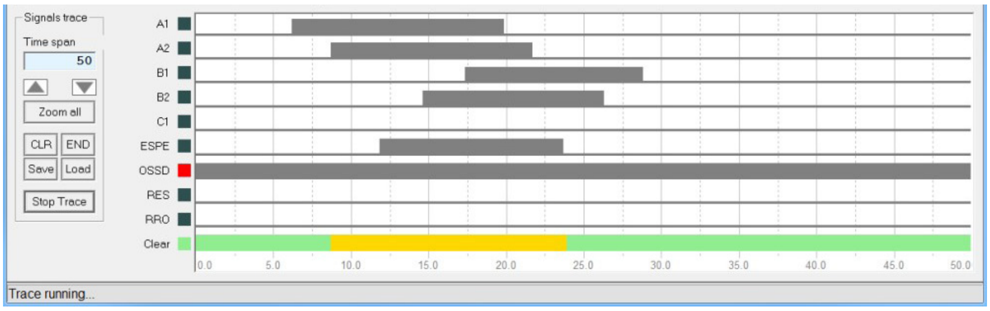
6.7 Logic state analyser

The SBX8000-Tool software has an analyser for the logic states of the main signals involved in a program. This is a useful tool, especially for checking programs' timings and the consequent choice of muting configuration times. The tool is **only available in Online mode**.

6.7.1 Trace area

The analyser, which consists of the Trace area with the commands area on the left, appears in the bottom of the tool window:

Fig. 31: Tool logic state analyser



The trace acquisition channels depend on the specific program set and they are named with the signal's standard symbol. The area is subdivided by means of a fixed grid, on which the time values are shown in seconds with resolution of **100ms**. The maximum storage capacity is **100000 samples** so the maximum plotting time is **10000"**.

6.7.2 Analyser commands

Acquisition is started and ended using the **"Start Trace"** button. All the values acquired are saved in a memory buffer which contains all the samples at 100ms intervals, regardless of the current display window setting, set by the **"Trace Span"** value. The setting of the latter value therefore only sets the current span of the zoom across the entire memory buffer. To **locate the middle of the window** on a specific time zone,

locate the cursor on the area required then click the **left button** of the mouse.
To analyse the **details of the values** of a specific point of the trace, click the **right button** of the mouse in the point required. The cursor will show the values of the individual channels and the absolute time data **hours/minutes/seconds/tenths of a second**.
There are additional commands for moving the display window onto the whole buffer (**“Zoom all“** command) or to the end of the trace (**“END“** command). All display management commands can be used both during acquisition and in stop conditions.
The **“CLR“** command definitively clears the memory buffer, so the values recorded can no longer be displayed.

6.7.3 Saving and recovering records

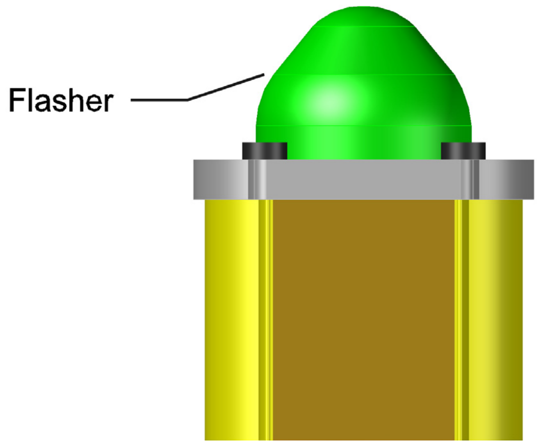
The **“Save“** and **“Load“** commands are provided for saving and recovering the buffer acquired in the form of a **CSV** file containing all the values at 100ms intervals and the relative time data.
The CSV file allows all the data relating to a trace to be restored, so all the screen zone functions can be used to analyse a trace saved previously.

7 Indicator lights

7.1 Main device flasher

The top of the main device incorporates a three-colour flasher, used for signalling the barrier's operating state:

Fig. 32: State indicator flasher



The flasher has a set of RGB LEDs, so the colours used are green, yellow and red, in accordance with the following table:

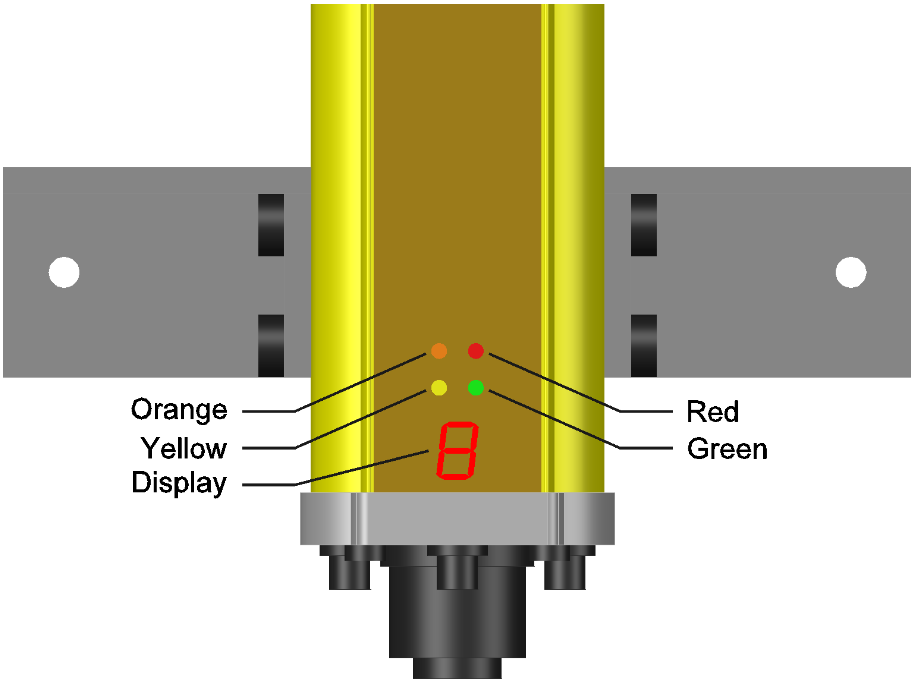
Tab. 4: Key to flasher signals

Light Mode	Meaning
Red/Yellow 1Hz	**Restart Request** state. Awaiting activation of the barrier using the RES restart command.
Green Steady	Barrier **Clear** state Normal working condition with the barrier clear of material.
Yellow Steady	**Muting** state activated. The material is passing the barrier normally with the ESPE deactivated.
Red/Yellow 2Hz	**Override Request** state. Awaiting activation of the override function using the relative command.
Yellow 2Hz	**Override** state activated. OSSDs bypassed to allow removal of material after an error.
Red 2Hz	**Lock-out** due to an error which cannot be reset using the override function, or a failure.

7.2 State and diagnostic indicator devices

The bottom of the main device has four LEDs which indicate the barrier state and a seven-segment display to provide additional state information and for error diagnostics:

Fig. 33: State and error diagnostic signalling devices.



7.3 State indicator LEDs

The four LEDs integrated in the main device indicate the barrier's current state as follows:

Tab. 5: Key to LED signals

LED	Light Mode
Green	On steady with OSSDs active and barrier functioning normally. Flashing with OSSDs active further to an override.
Red	On steady with OSSDs not active (system not powered up) and lock-out due to an error.
Yellow	Flashing 1Hz in Restart Request state. Flashing 2Hz in Override Request state.
Orange	Photocell not aligned. Correct the alignment of the photocell indicated by the display.

7.4 Diagnostic signalling display

The main device has a seven-segment display with just one character. This component is used to provide detailed diagnostics of all possible system functional anomalies or failures. The display is shared by both the main microprocessors which provide the safety functions on the redundancy principle. Generally, this sharing is governed by the following rules:

- Both microprocessors send the same code to the display:
  The display shows the code received from microprocessor 1

- The microprocessors send different codes to the display:
  The display shows the codes of the two microprocessors in alternation

The codes shown by the display are of two different types:

1. Single character codes used to indicate a state
2. Codes which alternate a number and a letter, used to indicate an error.

7.4.1 State messages

During normal operation of the barrier, the display may provide useful information of various kinds. The numbers from 1 to 8 are used to indicate the state of one of the 8 photocells (4 of the ESPE and 4 of the muting system). If more than one photocell is obscured, the photocells with the lowest numbers have priority.

Tab. 6: Display state indication codes

Code	Meaning
0	Muting state activated
1	ESPE photocell 1 obscured (photocell nearest to the display)
2	ESPE photocell 2 obscured
3	ESPE photocell 3 obscured
4	ESPE photocell 4 obscured (photocell furthest from the display)
5	Muting photocell M1 obscured
6	Muting photocell M2 obscured
7	Muting photocell M3 obscured
8	Muting photocell M4 obscured
A	Auto-restart state activated

7.4.2 Error messages

Errors and failures are indicated by a code obtained by alternating an alphanumeric letter with a number. The letter identifies the type of error and the number specifies the error within the group.
Error codes may indicate situations of two kinds:

- Error during normal operation of the programs, which can be resolved using the override function.
- Serious errors with lock out the barrier; the problem must be resolved, after which the power supply must be switched off and back on.

Errors of the first kind (no lock-out) are marked **(*)** in the table below

Tab. 7: Display error indication codes

Code	Meaning	Possible solution
A0	Microprocessor 1 system error	Switch off power for 3”. If the problem persists, replace the device
A1	Microprocessor 1 has detected an incongruity in the input signals compared to microprocessor 2	
A2	Microprocessor 1 has detected an incongruity in the output signals compared to microprocessor 2	
A3	Microprocessor 1 has detected an incongruity in the internal state compared to microprocessor 2	
A4	Microprocessor 1 has detected an incongruity in the photocell enabling test compared to microprocessor 2	
A5	Microprocessor 1 has detected a communication error on the internal bus	
A9	Microprocessor 1 has detected an invalid software licence	
b0	Microprocessor 2 system error	
b1	Microprocessor 2 has detected an incongruity in the input signals compared to microprocessor 1	
b2	Microprocessor 2 has detected an incongruity in the output signals compared to microprocessor 1	
b3	Microprocessor 2 has detected an incongruity in the internal state compared to microprocessor 1	
b4	Microprocessor 2 has detected an incongruity in the photocell enabling test compared to microprocessor 1	
b5	Microprocessor 2 has detected a communication error on the internal bus	
b9	Microprocessor 2 has detected an invalid software licence	
C1	Microprocessor 1 has detected an overload on its OSSD	
C2	Microprocessor 1 has detected a short-circuit on the +24V of its OSSD	
C3	Microprocessor 1 has detected a short-circuit on the GND of its OSSD	

C4	Microprocessor 1 has detected an open circuit on its OSSD	Switch off power for 3”. If the problem persists, replace the device
C5	Microprocessor 1 has detected an incongruity of the EDM signal in relation to the OSSD	
d1	Microprocessor 2 has detected an overload on its OSSD	
d2	Microprocessor 2 has detected a short-circuit on the +24V of its OSSD	
d3	Microprocessor 2 has detected a short-circuit on the GND of its OSSD	
d4	Microprocessor 2 has detected an open circuit on its OSSD	
d5	Microprocessor 2 has detected an incongruity of the EDM signal in relation to the OSSD	
E1 (*)	Muting sequence not correct due to ESPE signal (4 barrier photocells)	Clear the photocell beams, using the override function if necessary
E2 (*)	Maximum muting state hold time exceeded	
E3 (*)	Maximum override state hold time exceeded	Reactivate the override function to clear the photocell beams
E4	Maximum time for a correct muting cycle after activation of the override exceeded	Clear the photocell beams. Switch off power for 3”.
E5	Maximum number of override cycles reached	
P0	Serial communication error with secondary device.	Verify connection between main and secondary devices.
P1	Error detected during test on ESPE photocell 1 (photocell nearest to the display)	Switch off power for 3”. If the problem persists, replace the device
P2	Error detected during test on ESPE photocell 2	
P3	Error detected during test on ESPE photocell 3	
P4	Error detected during test on ESPE photocell 4 (photocell farthest from display)	
P5	Error detected during test on muting photocell M1	
P6	Error detected during test on muting photocell M2	
P7	Error detected during test on muting photocell M3	
P8	Error detected during test on muting photocell M4	
P9	Error detected on signalling microprocessor S	

8 Checks and maintenance

8.1 Regular functional check

For safety reasons, the regulations require the performance of specific tests to check that the barrier is functioning correctly. The check must be performed both during **initial installation** and daily before the system is used.

WARNING

The checks must be performed by skilled staff!

- All tests to ensure that the device is operating correctly must only be performed by skilled staff who hold specific safety qualifications.
- During checks, ensure that no unauthorised persons are permitted to access the system's hazard zones.
- The equipment used for this purpose must comply with the relevant standards.

The check procedure must test all the beams in the barrier individually and must verify that the barrier performs its safety function correctly.
The test operator must also **correctly compile a record form**, noting the results of the checks, which must be displayed in a clearly visible position close to the working area.

8.1.1 Checking the individual beams

To check that the beams are operating correctly, a special opaque object with the **specified diameter** (10 mm) for the ESPE's beams must be used.
To simplify checking of the individual beams, the SBX8000 Evolution barrier has a special **test program** which can be activated at power-on by holding down the restart (RES) button for 5”. The display will show a numerical code from 1 to 8 corresponding to the photocell currently obscured. Use this procedure to obscure and check all the barrier's beams, both in the centre of the protected area and close to the primary/secondary devices. At the end of the test, switch the barrier power supply off and back on or press the restart button again to quit the test program.

8.1.2 Checking the protection function

With the barrier activated in Clear state, place an opaque object equal in size to the **specified resolution** (310 mm) in various positions in the protected area. Check that the object is always detected in all positions and that the barrier switches to the system lock-out state within the specified times. For each test, reactivate the barrier in clear state once the opaque object has been removed from the detection zone.

8.2 Device maintenance

The SBX8000 Evolution barrier does not require any maintenance procedures except cleaning of the fronts of the devices at regular intervals, or if they become particularly dirty for any reason:
To clean the clear polycarbonate fronts:

- Use a **soft cloth** wet with non-abrasive detergent or **alcohol**.
- Do not use abrasive cloths as they may **scratch the surfaces** of the fronts.
- **Do not apply an electrostatic charge** to the fronts by rubbing them with unsuitable cloths.

After cleaning, perform a complete check on operation of the device as described in the previous point.

9 Technical Specifications

9.1 General characteristics

Tab. 8: SBX8000 Evolution general characteristics

Type	Type 4 (EN 61496-1)
Category	Category 4 (EN ISO 13849-1)
Safety Integrity Level	SIL3 (EN62061)
Sil claim limit	SILCL3 (EN62061)
Performance Level	PL e (EN ISO 13849-1)
PFHd	6.55×10^{-8}
T_M Mission time	20 years (EN ISO 13849)
Safety device error state	At least one OSSD not active
Beam maximum range	5m
Beam diameter	10mm
Emission type	Infrared (850 nm)
Number of ESPE beams	4
ESPE beam pitch	300 mm
ESPE resolution	310mm
Number of muting beams	4
Muting beam pitch	Adjustable every 25 mm across 800 mm
Protection class	III (EN 50178)
Guard protection	IP 65 (EN60529)
Operating temperature	-20 ÷ +60 °C
Air humidity	15% ÷ 95%, without condensation
Resistance to vibration	5 g, 10-55 Hz (EN 60068-2-6)
Resistance to shocks	10 g for 16 ms (EN 60068-2-27)
Power supply voltage	24 Vdc ±20%
Power supply current	200 mA (not including outputs consumption)
Start-up time	5 s

9.2 Signal electrical specifications

Tab. 9: SBX8000 Evolution input/output signal electrical specifications

OSSD1/2 outputs	
Type	PNP 24 Vdc, Smart SIPMOS®
Response time	16 ms
Maximum current	0.5 A
On-state resistance	350 mΩ
Leakage current	1.8 mA (max)
Protective devices	Short-circuit, overvoltage and overtemperature
Monitoring for anomalies	Overload (> 0.8 A) Open load (< 20 mA) Short-circuit on +24V Short-circuit on 0 V reference External contactor state error (by EDM)
EDN input	
Switching threshold	11 V
High input current	4.2 mA (@ 24 V)
Check delay	300 ms
Auxiliary inputs (RES, IN1÷3)	
Switching threshold	11 V
High input current	4.2 mA (@ 24 V)
Software filtering	50 ms
Auxiliary outputs (RRO, ADO)	
Type	PNP 24 Vdc, Smart SIPMOS®
Maximum current	0.5 A
On-state resistance	350 mΩ
Protective devices	Short-circuit, overvoltage and overtemperature
Flasher	
Type	4 x RGB LEDS power 0.25W / colour

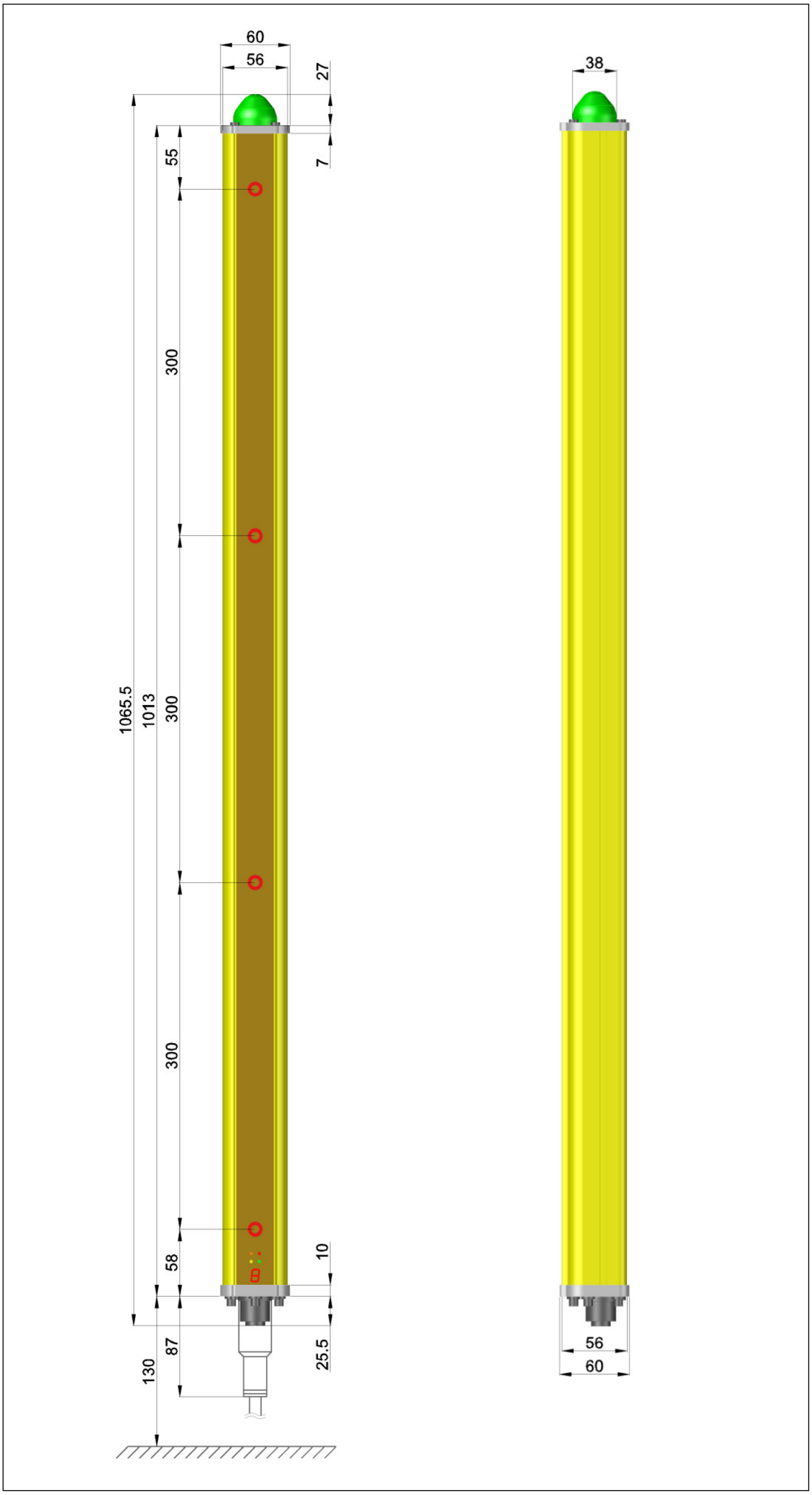
9.3 Connection specifications

Tab. 10: SBX8000 Evolution connection and wiring specifications

Main device connector	
Type	M26 male
Poles	11 + PE
Model	N11R AM 5 HIRSCHMANN
System connection cable	
Connector	M26 female
Poles	11 + PE
Model	N11R EF HIRSCHMANN
Cable	12 x 0.75 mm^2 / 18AWG UL 2464 300V - 80°C
Length	15 m
Connection between main and secondary devices	
Connectors on devices	M8 x 4 female
Connection cable	Length 5 m, M8 x 4 male connectors
Auxiliary I/O connection adapter cable	
Connector on device	M8 x 4 female
Connection cable	Length 50 cm, M8 x 4 male, M12 x 4 female connectors
Muting transmitters connection	
Connector on device	M8 x 3 female
Connection cable	Y wire length 30 + 2 x 30 cm, M8 x 3 male connector
Muting receiver connection	
Connector on device	M8 x 3 female
Connection cable	Length 60 cm, M8 x 3 male connector

9.4 Dimensions and drawings

Fig. 34: ESPE main device dimensions



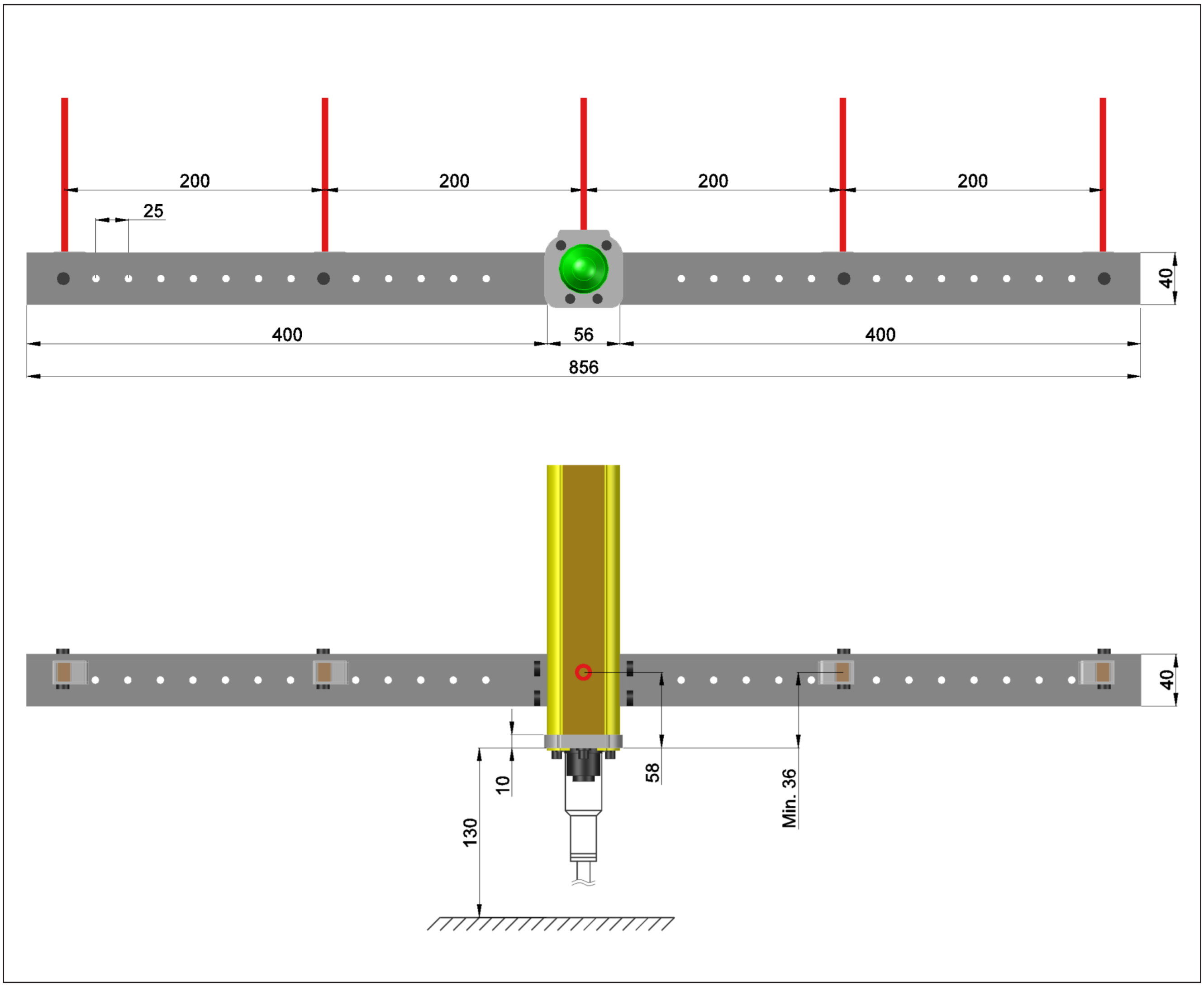


Fig. 35: Muting photocell positions and dimensions

Note: The muting photocell positions are totally arbitrary and are intended solely to highlight all the possible positions along the side supports. The actual positions must be decided on the basis of the specific program and safety requirements.

9.5 Standards and declarations

Reg. Numero	C17E370/01	Revisione	00
Data di rilascio	2017-02-27	Data di ultima modifica	2017-02-27
Data di prossimo rinnovo	2022-02-26		

Certificato

Attestato di Esame CE del Tipo

Si dichiara che il blocco logico per funzioni di sicurezza del Fabbricante:

M.C.E SRL

Sede Legale
ZONA ARTIGIANALE BOLCIANO
61040 - MERCATELLO SUL METAURO
PU – ITALIA

Designazione/*Designation***:**
Barriera fotoelettrica di sicurezza/*Safety light courtain*

Tipo-i/*Type-s***:**
SBX 8000 EVO

Modello-i/*Model-s:*
SBX 8000 EVO

Fascicolo Tecnico rev. 01 del 2017-02-22
Technical Construction File rev. 01 of 2017-02-22

è conforme ai requisiti applicabili della Direttiva 2006/42/CE - allegato IV - Procedura di esame CE del tipo di cui all'allegato IX
Is in compliance with 2006/42/EC Directive, Annex IV - EC type-examination procedure provided for in Annex IX

Il presente Certificato è soggetto al rispetto dei requisiti contrattuali di Kiwa Cermet Italia ed è valido solo per i prodotti sopra identificati. Le principali caratteristiche sono specificate nell'Allegato Tecnico che è parte integrante del presente Attestato.

Chief Operating Officer
Giampiero Belcredi

CE
Organismo Notificato n. 0476

Kiwa Cermet Italia S.p.A.
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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
SGQ N° 007A SSI N° 006G
SGA N° 010D FSM N° 004I
PRD N° 069B

Reg. Numero	C17E370/01	Revisione	00
Data di rilascio	2017-02-27	Data di ultima modifica	2017-02-27
Data di prossimo rinnovo	2022-02-26		

Allegato tecnico all'attestato di esame CE del Tipo

Modelli/Models:	**BARRIERA FOTOELETTRICA SBX 8000 EVO**
Norme Armonizzate/ Harmonized standards:	EN 61496-1:2013 e EN61496-2 : 2013
Tipo	Tipo 4 (EN 61496-1)
Categoria	Categoria 4 (EN ISO 13849-1)
Safety Integrity Level	SIL3 (IEC 62061)
Sil claim limit	SILCL3 (EN62061)
Performance Level	PL e (EN ISO 13849-1)
PFHd	6.55 x 10-8
T_M Mission time	20 anni (EN ISO 13849)
Stato sicurezza in errore	Almeno un'uscita OSSD non attiva
Massima portata raggi	5m
Diametro raggi	10mm
Tipo di emissione	Infrarossi (850 nm)
Numero raggi ESPE	4
Passo raggi ESPE	300 mm
Risoluzione ESPE	310mm
Numero raggi muting	4
Passo raggi muting	Regolabile ogni 25 mm su 800 mm
Classe di protezione	III (EN 50178)
Protezione chiusura	IP 65 (EN60529)

………..Continuo pag 3 di 3

Chief Operating Officer

Giampiero Belcredi

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Certificato

Kiwa
Partner for progress

Reg. Numero	C17E370/01	Revisione	00
Data di rilascio	2017-02-27	Data di ultima modifica	2017-02-27
Data di prossimo	2022-02-26		

Allegato tecnico all'attestato di esame CE del Tipo

Modelli/Models:	**BARRIERA FOTOELETTRICA SBX 8000 EVO**
Temperatura operativa	-20 ÷ +60 °C
Umidità aria	15% ÷ 95%, senza condensa
Resistenza a vibrazioni	5 g, 10-55 Hz (EN 60068-2-6)
Resistenza a shock	10 g per 16 ms (EN 60068-2-27)
Tensione alimentazione	24 Vdc ±20%
Assorbimento alimentazione	200 mA (esclusi assorbimenti uscite)
Tempo di start-up	5 s

Chief Operating Officer

Giampiero Belcredi

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CERMET

IAF International Accreditation Forum

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

SGQ N° 007A SSI N° 006G
SGA N° 010D FSM N° 004I
PRD N° 069B