

# Muting Safety Light Curtains: Applications & Use

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## What is a Muting Safety Light Curtain?

A muting safety light curtain permits the safety (protection) function to be temporarily disabled for reasons related to the equipment or machine work cycle. Such disabling of the safety function for a limited period of time is referred to as "muting".

## Where are they typically used?

While there are a wide variety of situations in which the muting function may be necessary, there are two basic applications that can be considered as typical.

- (1) To permit the access of personnel inside the hazardous area during the non-hazardous portion of the equipment cycle ... for example, removal or repositioning of the work piece.
- (2) To permit the access of materials of production and prevent access by personnel ... for example, pallet entrance and/or exit from the hazardous area (see Figure 1).

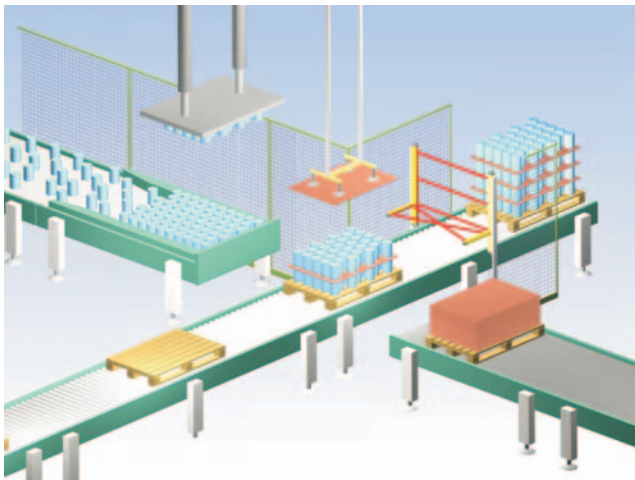


Figure 1

## Functional Safety Requirements

- (1) The muting function is a temporary interruption of the safety (protection) function that must be activated and de-activated automatically.
- (2) The safety category of the device, or of the part of the circuit that implements the muting function, must be the same as that of the safety function that disables so as not to compromise the protection of the entire system.
- (3) Activation and subsequent de-activation of the muting function must be achieved using two or more hard-wired and independent signals activated by a proper time or space sequence.
- (4) It must not be possible to activate the muting function when the Electro-Sensitive Protection Equipment (ESPE) has the safety outputs de-activated.

- (5) It must not be possible to initiate a muting function by switching the device "off" and then "on" again. For example, a fault to ground or power outage to which the muting sensors are connected must not cause a muting condition. Similarly, if the ESPE is already in the muting state, the temporary loss of power must return the muting outputs to an "off" state (de-activated). Access can only be achieved by a manual override command.

## Application Requirements

- (1) Muting must only be activated at an appropriate point in the machine cycle ... for example, when there are no risks to personnel.
- (2) Any residual risks must be carefully assessed.
- (3) Suitable measures must be taken to prevent, to the degree possible, any attempt to defeat the protection.
- (4) Where practical, the possibility of a person remaining undetected inside the hazardous area on re-activation of the muting phase must be avoided.
- (5) Muting sensors must be mechanically protected to avoid impacts that could compromise their alignment.

## Specific Requirements for Access Control in Palletizing and Goods Handling Systems

- (1) The material, and not the pallet, must be sensed ... otherwise a person could pass through the access point riding on a pallet.
- (2) Muting time must be restricted to the effective transit time of the material through the access point.
- (3) The clearing of the protection zone of the ESPE cannot be the sole condition for disabling the muting function.
- (4) The muting function must be time-restricted.
- (5) A misalignment of the muting sensors, which produces an effect similar to activation, must not allow the muting condition.
- (6) The configuration chosen for the muting sensors, and their positioning, must allow a safe discrimination between personnel and material.
- (7) The layout of the access point, and the positioning of the muting sensors and the side guards, must not permit the transit of a person toward the hazardous area during the muting phase ... and for the entire time during which the pallet transits through the access point.

## Four Most Common Muting Sensor Configurations

The four most common muting safety light curtain configurations are:

- Four (4) muting sensors with timing control
- Four (4) muting sensors with sequence control
- Two (2) cross-beam muting sensors and timing control (T- configuration)

- Two (2) muting sensors with timing control (L-configuration).



Figure 2

**Four Muting Sensors with Timing or Sequence Control** (see Figure 2).

Installation Requirements for Above Configuration

- For a short period of time, the four (4) muting sensors must all be interrupted ... with transfer of the muting function from sensors S1 - S2 to S3 - S4).
- An opaque cylindrical object, having a diameter of  $D = 500$  mm, must not activate the muting function (see Figures 3a and 3b).

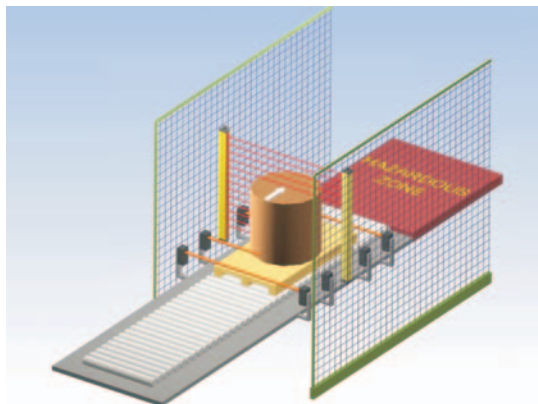


Figure 3a

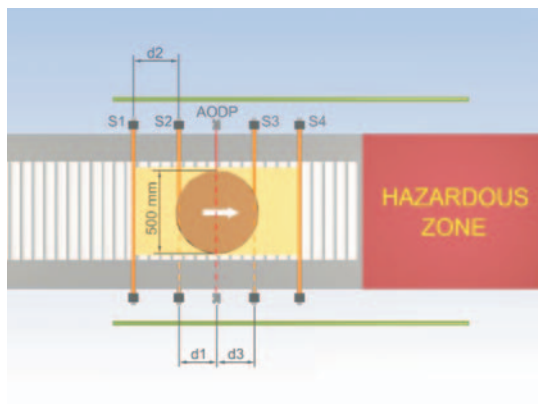


Figure 3b

- The distances between the muting sensors and the safety light curtain (Active Opto-Electronic Device... AOPD) must therefore comply with the following values:  $d1$  and  $d3$  200 mm,  $d2$  250 mm (see Figure 4).
- To prevent a person from reaching the hazardous area, while the pallet is passing through the muting area, the distance between the edge of the pallet and the side guard of the access point (or the body of the muting sensors if they protrude) must be less than 200 mm (see Figures 4a and 4b).

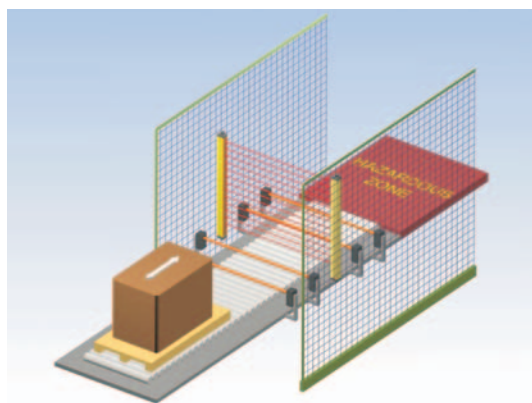


Figure 4a

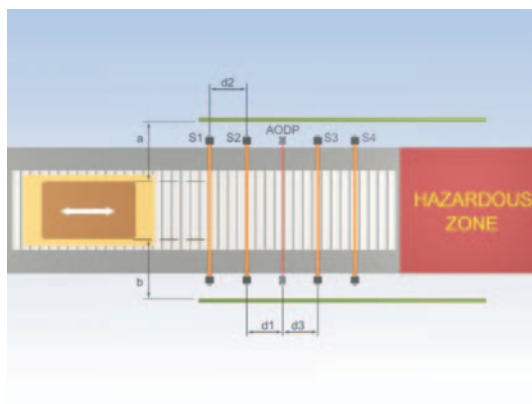


Figure 4b

- If pallets of different size can pass through the same access point, and it is possible that for some of these the distances "a" and "b" are greater than 200 mm, then distances "a" and "b" must be increased by at least 50 mm to avoid the danger of crushing between the side guard and the pallet. In this case, it may be necessary to use electrically-controlled flexible doors to prevent a person from reaching the hazardous area while the pallet is passing through the muting zone (see Figures 5a and 5b).

The above safety requirements establish the minimum dimensions of the protection zone and the minimum pallet size. To prevent tampering the use of a safety timer, that restricts the muting function only to the time necessary for the material to pass through the access point, is recommended.

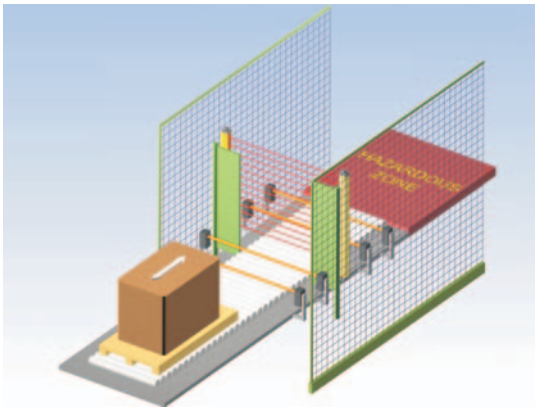


Figure 5a

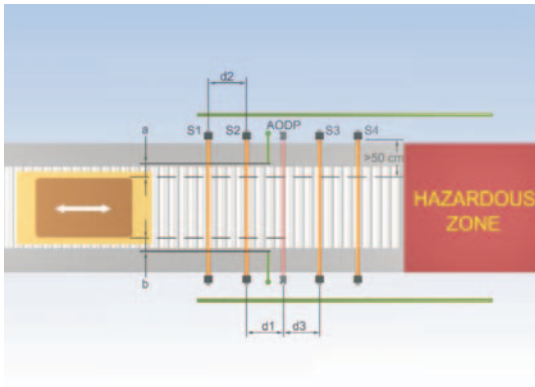


Figure 5b

**Two (2) Crossed Beams with Control of Concurrent Activation ... T-Configuration** (see Figure 6)  
Installation Requirements for T-Configuration

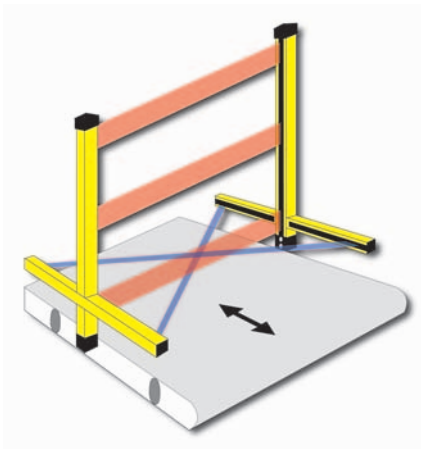


Figure 6

- Muting sensors S1 and S2 must be positioned such that the point of intersection of the two beams is in the hazardous area beyond the safety light curtain (see Figure 7).
- A safety timer that restricts the muting function to the time necessary for the material to pass through the access point is mandatory.

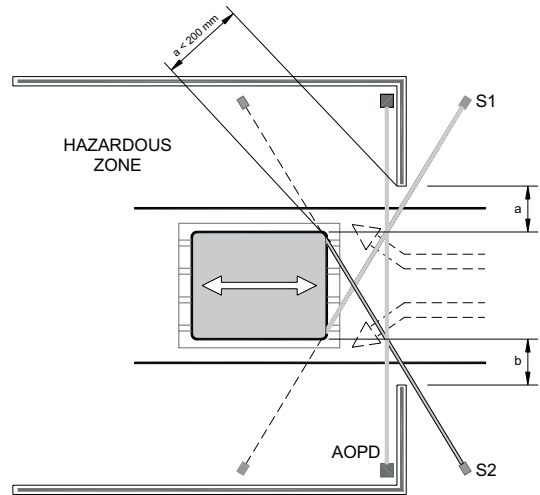


Figure 7

- The two muting sensor beams must be continuously interrupted by the pallet throughout the period of transit between the muting sensors.
- The distance between the edge of the pallet and the side guard of the access point (or body of protruding muting sensors) must be less than 200 mm to prevent a person from reaching the hazardous area while the pallet is passing through the muting zone.
- The muting function can only be activated if the two muting sensors are activated at the same time  $t2(S2) - t1(S1) = 4$  seconds (maximum).
- An opaque cylindrical test object, having a diameter of 500 mm, must not be able to initiate the muting function. The 500 mm diameter cylindrical test object must be detected by the safety light curtain before it activates the muting sensors (see Figure 8).

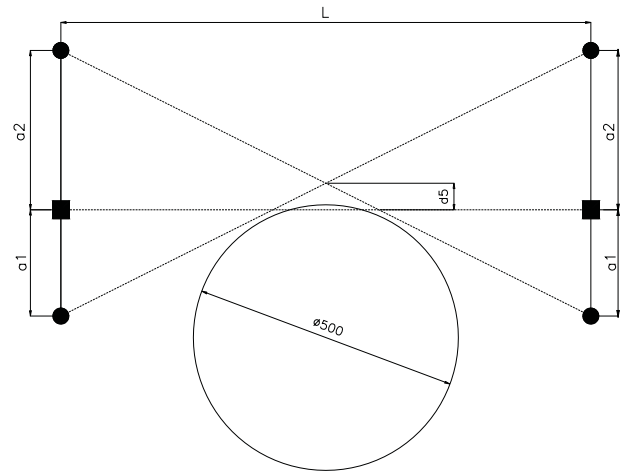


Figure 8

- The 500 mm opaque cylindrical test object activates a muting sensor and the safety light beam before activating the second muting sensor. Thus the muting function is not activated, and the safety outputs of the light curtain are activated (see Figure 9).

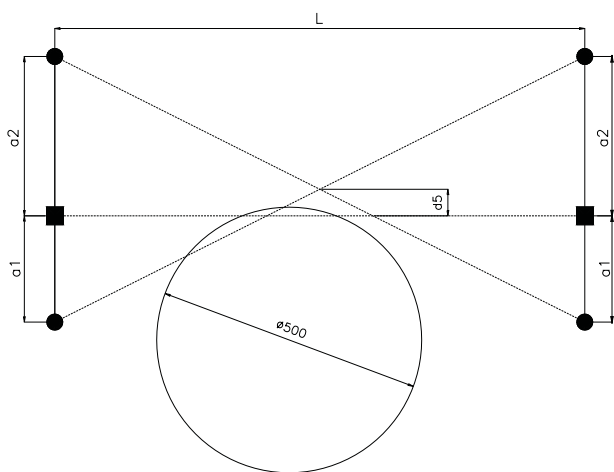


Figure 9

- The point of intersection of the two muting sensors must be positioned higher than, or at most at the same level, as the lower beam of the safety light curtain to avoid easy tampering (see Figures 10a and 10b).

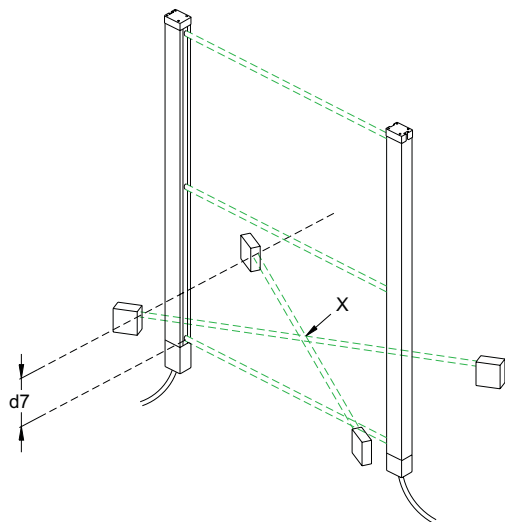


Figure 10a

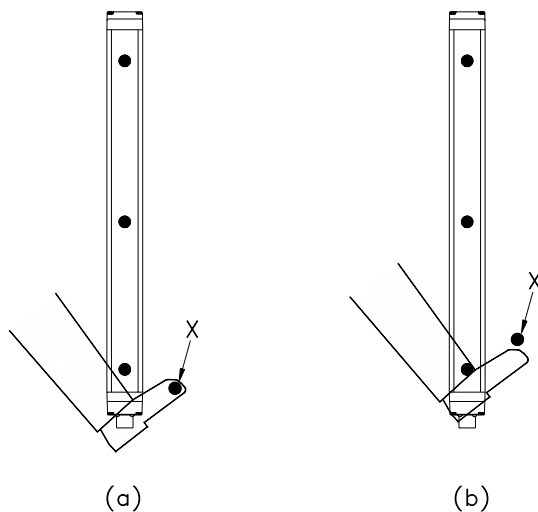


Figure 10b

**Major Muting Safety Light Curtain Application Mistakes**

The following are among the more frequent application mistakes when using muting safety light curtains:

- No control of the activation and de-activation time (or excessive time) of the muting sensors ... making man-pallet discrimination impossible.
- The muting function is achieved by “jumping” the safety outputs of the ESPE via the contacts of a selector that is activated manually or by the transit of the pallet.
- Bypassing the safety outputs of the ESPE via the conveyor activation command.
- Activating the muting function using a single muting sensor.
- Incorrect positioning of the muting sensors, or of the protection zone of the ESPE, thus facilitating defeat of the safety system.

**Safety Light Curtains with Integral Muting Sensors**

To facilitate easier compliance with the standard requirements for safe muting in selected applications, safety light curtains are now available with integral muting sensors in “T” and “L” configurations (see Figures 11a, 11b, and 11c). The integrated muting sensors are pre-wired and pre-aligned in height to facilitate easy installation and a reliable functioning of the safety system.

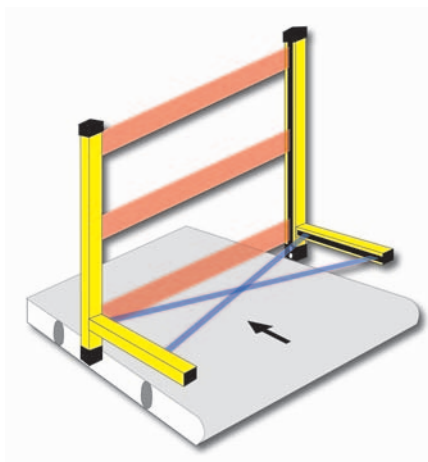


Figure 11a

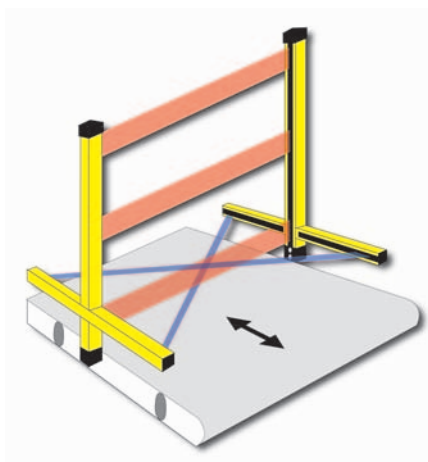


Figure 11b

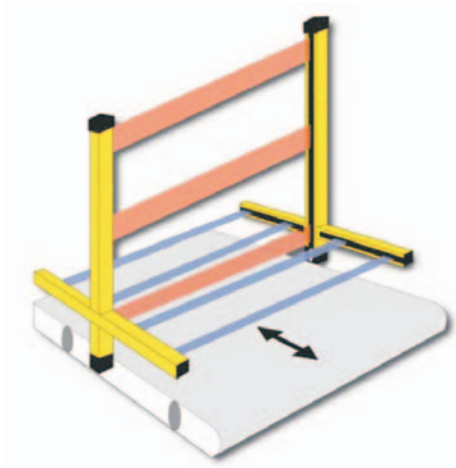


Figure 11c

Depending upon model and configuration, features include:

- Height and angle-adjustment of the muting sensors for reliable sensing of the material in-transit.
- Selectable maximum muting time-out ... 30 seconds to 90 minutes.
- Special models for sensing transparent materials.
- Control of maximum time between muting activation signals: 4 seconds.
- Integrated override function with time-out and 2-selectable modes of operation ... manual latched action and impulse with automatic latching.
- Models complying with ATEX 94/9/EEC Directive - Dust Zone 22 and Gas Zone 2 for applications in potentially explosive atmospheres.
- Suitability for one-way (pallet exit) or two-way (pallet entry and exit) transit.
- Reduced installation time and cost.
- Reduced possibility of assembly and positioning errors.