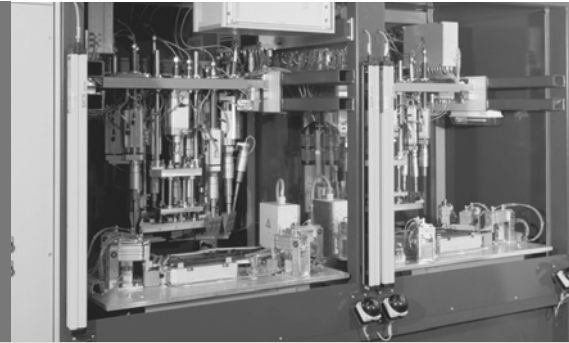


UE410 Muting

Modular Safety Controller



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1 About this document

Please read this chapter carefully before working with this documentation and the UE410 Muting Modular Safety Controller.

1.1 Purpose of this documents

These operating instructions are designed to address *the technical personnel of the machine manufacturer or the machine operator* with regard to the safe mounting, installation, configuration, electrical installation, commissioning, operation and maintenance of the UE410 Muting Modular Safety Controller.

These operating instructions do *not* provide instructions for operating machines on which the UE410 Muting has been, or could be integrated. Information on this is to be found in the appropriate operating instructions for the machine.

1.2 Target group

These operating instructions are intended to be used by *planning engineers, developers* and the *operators* of machines, plant and systems which are to be protected by an UE410 Muting Modular Safety Controller. These operating instructions are also intended for persons who integrate the UE410 Muting into a machine/system, initialise its use, or who are charged with servicing and maintaining such a machine/system.

1.3 Depth of information

These operating instructions contain information about the UE410 Muting Modular Safety Controller on the following subjects:

- Installation and mounting
- Electrical installation
- Commissioning and configuration
- Care and maintenance
- Error diagnosis and troubleshooting
- Part numbers
- Conformity and approval

Beyond this, the planning and use of SICK protective devices requires specialist technical knowledge which is not imparted by this documentation.

It is a fundamental rule that the national, local and statutory rules and regulations must be observed when operating the UE410 Muting Modular Safety Controller.

General information on accident prevention with the aid of opto-electronic protective devices is contained in the brochure "Safe Machines with Opto-electronic Protective Devices", which is available from SICK.

Note Please use the Internet website at www.ue410flexi.com.

There you will find:

- Product and application animations;
- Configuration aids;
- These operating instructions in several languages for viewing and printing;
- The brochure "Safe Machines with Opto-electronic Protective Devices".

1.4 Scope

Note These operating instructions are valid for all UE410 Muting Modular Safety Controllers. You must also take into account the relevant Brief Operating Instructions (see entries on the device type labels on the modules).

1.5 Abbreviations employed

ESPE	Non-contact protective device (e.g. C4000)
EDM	External device monitoring = relay/contactor monitor
OSSD	Output signal switching device = Signal output which controls a safety circuit
SIL	Safety Integrity Level = Safety class
PLC	Programmable logic controller

1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Notes inform you about special features of the device.

● **Red**, ● **Red**, ○ **Green** LED symbols indicate the status of the diagnosis LEDs.

Examples:

● **Red** The red LED is continuously on.

● **Red** The red LED blinks.

○ **Green** The green LED is off.

➤ **Take action ...** Instructions for taking action are shown by an arrow. Read the take-action instructions carefully and follow them precisely.



WARNING

Warning!

A warning notice indicates an actual or potential hazard. Warnings are intended to help protect you from accidents.

Read warnings carefully and follow them precisely!

2 On safety

This chapter deals with your own safety and the safety of persons operating the equipment.

- Please read this chapter carefully before starting to work with the UE410 Muting Modular Safety Controller or with machinery protected by a UE410 Muting.

2.1 Competent persons

The Modular Safety Controller UE410 Muting must only be installed, commissioned and maintained by competent persons.

Competent persons are those who:

- have undergone an appropriate technical training and education;
- have been instructed by the authority responsible for the machine in the operation of the machine and the current valid safety rules;
- have read and familiarised themselves with the operating instructions for the UE410 Muting;
- have access to the operating instructions for protective devices (e.g. C4000) connected to the safety controller and have also read and familiarised themselves with them.

2.2 Field of application

The UE410 Muting family is a range of modules within the UE410 Flexi family.

These muting modules can be used to solve both simple and more complex muting applications. Configuration is carried out by setting rotary switches on the modules.

The control category to EN 954-1 (or the SIL to EN 61508) depends on the external wiring and its execution, and the choice of control switches and their location on the machine.

The device complies with the requirements up to category 4 to EN 954-1; applications can achieve up to SIL3 to IEC 61508.



WARNING

With single-channel wiring to a signal input (EN) or to a UE410-2R0/UE410-4R0, category 3 to EN 954-1 is the best that can be achieved.

To comply with the safety-relevant characteristics for SIL3 to IEC 61508 (see Chapter 13 [Technical Data](#)) the proof test interval must not exceed 365 days. The proof test consists of:

- Switching power to the UE410 Muting system off.
- Switching power to the UE410 Muting system back on again.
- Verifying that all the safety functions of the connected sensors are operating correctly.

The connected control switches, safety and muting sensors, and the installation must all meet the requirements of the control category.

Opto-electronic and tactile safety sensors (e.g. light curtains, laser scanners), muting sensors (photoelectric switches, photoelectric sensors, inductive proximity switches, ...) and additional signals from other sensors, or from a higher-level control system are connected to the UE410 Muting Modular Safety Controller. In such cases, the safety outputs corresponding to the configured muting function are muted or securely switched off.

2.3 Correct use

The Modular Safety Controller UE410 Muting is only to be used as defined in Section 2.2 "Field of application". It must be used only by qualified personnel and only on a machine on which it has been installed and initialised by competent personnel in accordance with these operating instructions.

If the device is used for any other purposes or modified in any way — including during mounting and installation — any warranty claim against SICK AG shall become void.

2.4 General safety notes and protective measures



WARNING

Pay attention to the safety notes and observe protective measures!

Please observe the following procedures in order to ensure the correct and safe use of the UE410 Muting Modular Safety Controller.

- The standards and directives that apply in your country must be observed when mounting, installing and using the UE410 Muting.
- For installation and use of the UE410 Muting Modular Safety Controller, and for commissioning and periodical technical inspections, national and international rules and legally-binding regulations apply, in particular:
 - the Machinery Directive 98/37/EC,
 - the safety and health requirements of the Work Equipment Directive 89/655/EEC,
 - the Low Voltage Directive 73/23/EEC,
 - accident prevention and safety rules.
- The manufacturer and the authority responsible for operation of a machine on which a UE410 Muting is used must, on their own responsibility, ensure that all valid safety rules and regulations are agreed with the appropriate authorities and observed.
- The instructions, in particular the testing instructions, in these operating instructions (e.g. regarding application, mounting, installation, and implementation in the machine control system) must be observed without fail (see Section 10.2 [Testing instructions](#)).
- Tests must be carried out by competent persons, or, where appropriate, authorised persons from an external organization with special competence may be instructed to conduct the tests; in all cases, the tests must be documented so that the results are reproducible and comprehensible for a third party.
- These operating instructions are to be placed so that they are available to the operator of the machine on which a UE410 Muting is used. The machine operator must be instructed by a competent person and encouraged to read these operating instructions.
- In accordance with EN 60204, the external power supply must be capable of buffering a brief mains failure of 20 ms. Suitable power supply units are available as accessories from SICK.
- Group 1 comprises all ISM devices, in which there is intentionally generated and/or used conducted HF-energy, which is required for the internal function of the unit itself.

UE410 Muting



WARNING

The UE410 Flexi system complies with the conditions for Class A of the harmonised standard "Interference emissions" (industrial applications).

The UE410 Flexi system is, therefore, only suitable for use in industrial environments.

2.5 Environmental protection

The Modular Safety Controller UE410 Muting is designed so that it has the least possible impact on the environment. It consumes only a minimum of energy and resources.

- Always act in an environmentally responsible manner at your workplace.

2.5.1 Disposal

Unusable or irreparable devices should always be disposed of in accordance with the relevant national regulations on waste disposal (e.g. European waste code 16 02 14).

Note We would be pleased to assist you to dispose of this device. Just contact us.

2.5.2 Separation of materials



WARNING

The separation of materials is only to be carried out by competent persons!

Caution is required when dismantling devices. There is a risk of injuries.

Before you send the devices for appropriate recycling, it is necessary to separate the different materials of the UE410 Muting module.

- Separate the housing from the rest of the parts (in particular the circuit board).
- Send the separated parts for recycling as appropriate (see the table below).

Tab. 1: Overview of component disposal

Components	Disposal
Product Body, PCBs, wiring, plugs and electrical connectors	Electronics recycling
Packaging Cardboard , paper	Paper/cardboard recycling

3 Muting

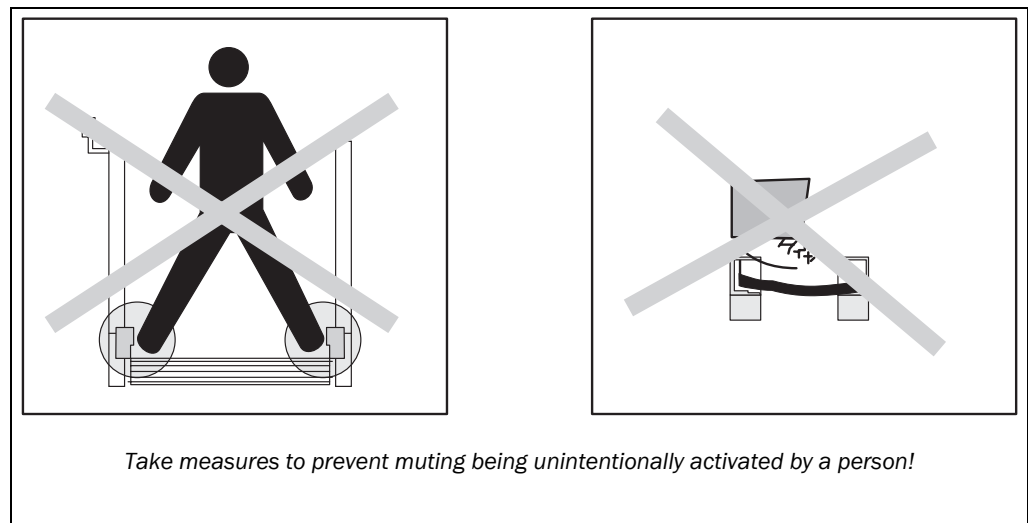


WARNING

Always observe the following safety instructions!

- Muting must only be activated for the period of time during which the transported material (e.g. on a pallet) blocks access to the hazardous area.
- Muting must take place automatically, but must not be dependent on a single electrical signal.
- Muting must be triggered by at least two independently wired signals (e.g. from muting sensors) and must not depend entirely on software signals (e.g. from a PLC).
- The muting condition must be cancelled as soon as the transported material no longer blocks access to the hazardous motion, so that the protective device becomes effective again.
- The material to be transported must be detected over its entire length, i.e. there must be no interruption in the output signals.
- Mount control switches for reset and override outside the hazardous area so that they cannot be operated by a person inside the hazardous area. In addition, when operating control switches, the operator must have full visual command of the hazardous area.
- Always position muting sensors so that the minimum safety distance to the safety device is complied with.
- Muting sensors must be positioned so that a person cannot unintentionally activate the muting function (see illustrations below)!

Fig. 1: Safe mounting of muting sensors



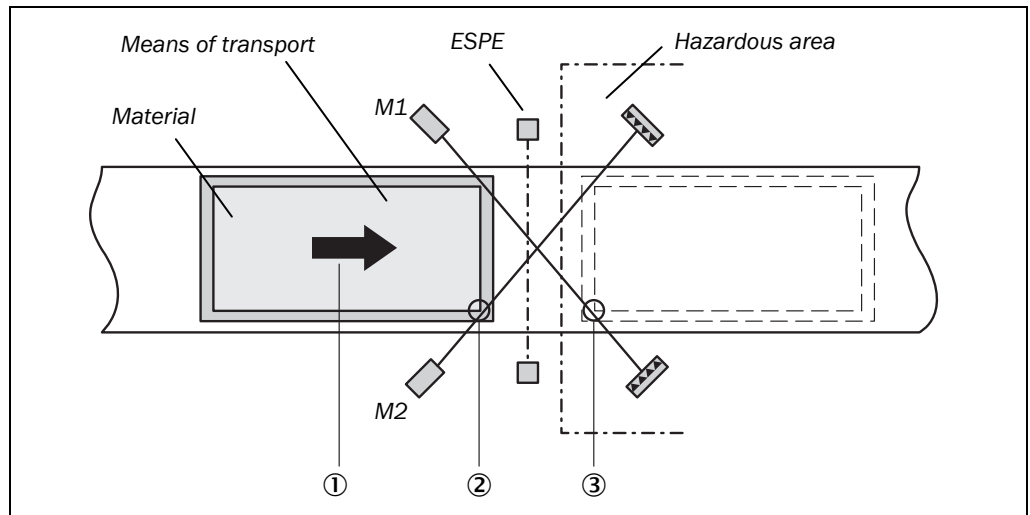
3.1 Muting principle

Muting is the temporary bypassing of the protective action of a safety device. In this way, material can be permitted to pass to or from a machine or plant without the need to interrupt a work process.

With the aid of additional sensor signals, muting distinguishes between objects and persons. A controller (e.g. the UE410 Muting switch unit) logically evaluates the signals from external sensors and, when the muting conditions are valid, bypasses the protective device, so that the material being transported can pass the protective device. Immediately anything other than the material enters the hazardous area, the work process is interrupted.

UE410 Muting

Fig. 2: Detection of material during muting



In the above figure, the material ① moves on a conveyor from left to right. As soon as the muting sensors M1 and M2 are activated ②, the protective action of the protective device ESPE is bypassed and material can enter the hazardous area. As soon as the muting sensors are free again ③, the protective action of the protective device is reactivated.

3.1.1 Muting cycle

The muting cycle is the fixed sequence of all procedures encompassed by muting. The cycle begins when the first muting sensor is activated. It ends when the last muting sensor returns to its initial state (e.g. free optical path for optical sensors). Muting can only then become active again.

Within a muting cycle, the material can be transported several times if the muting condition is continuously maintained, i.e. at least one pair of sensors remains continuously activated.

3.1.2 Muting sensors

Muting sensors detect material and supply the necessary signals that a controller (e.g. a UE410 Muting switch unit) needs. When the muting conditions are fulfilled, the controller will bypass the protective installation on the basis of the sensor signals.

If additional functions (C1, conveyor stopped) have been selected, these control signals (usually from a higher-level control system) must also be evaluated.

Muting sensor signals can be produced by the following external sensors:

- Optical sensors
- Inductive sensors
- Mechanical switches
- Signals from the control system

SICK muting sensors

A selection of optical muting sensors is given below. You can use them according to their type (light or dark switching).

Tab. 2: Selection of SICK optical muting sensors with their settings for muting applications

Sensor	Type	Function
Photoelectric proximity switches	WT24	Light switching
	WT27	
	WT260	Light switching
Photoelectric reflex switches	WL24	Dark switching
	WL27	
	WL260	Dark switching
	WL12	Dark switching
	WL14	Dark switching
	WL18	Dark switching
Through-beam photoelectric switches	WS24/WE24	Dark switching
	WS27/WE27	
	WS260/WE260	

Note For the selection and setting of SICK optical muting-sensors for muting applications, the following apply:

- Sensor outputs must be PNP switching
- Other component ranges can also be chosen
- Observe the output levels given in Table 3

Tab. 3: Outputs of muting sensors

Outputs of muting sensors	Status
HIGH	Activated, material detected
LOW	De-activated, no material detected

3.1.3 Muting lamp

To signal muting, it is recommended that a muting lamp is installed. The muting lamp indicates temporary muting.



WARNING

Install the muting lamp so that it is always clearly visible!

The muting lamp must be visible from all sides around the hazard zone and for the plant operator.



WARNING

A muting status signal or warning light must be installed!

EN 61496-1 requires that a muting status signal or a warning light is installed.

3.2 Arrangement of muting sensors

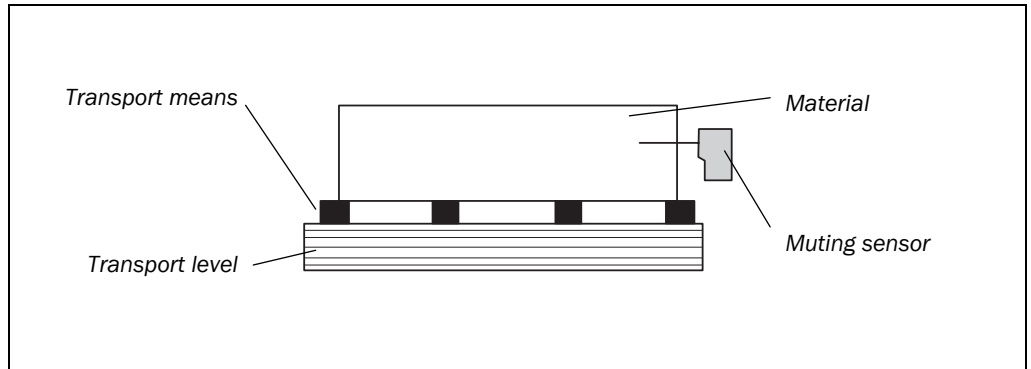


WARNING

When designing an arrangement of muting sensors, observe the following points!

- Always position the muting sensors such that only the material is detected and not the means of transport (pallet or vehicle).
- Always position muting sensors such that material can pass unhindered, but people are reliably detected.

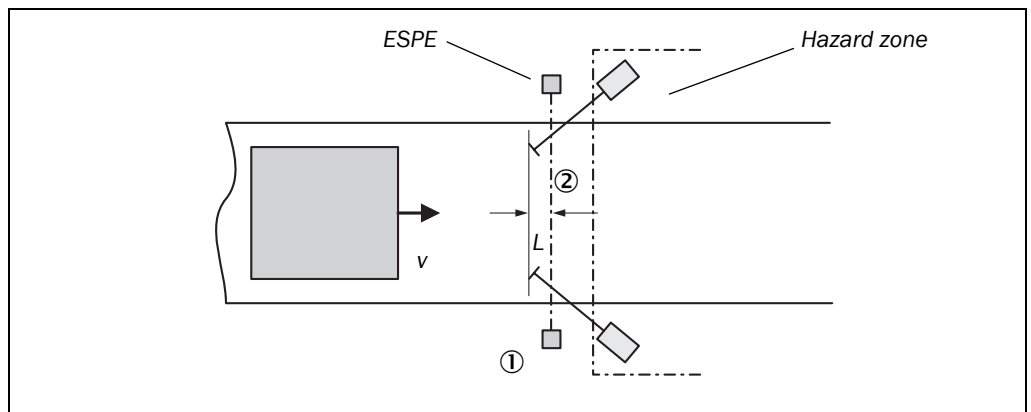
Fig. 3: Detection of material during muting



- Always arrange the muting sensors so that when material ① is recognised, the required minimum distance to the light beam of the ESPE ② is maintained.

Note The minimum distance ensures that there is sufficient time for processing data before muting is activated.

Fig. 4: Minimum distance between material detection and ESPE during muting



How to calculate the minimum distance:

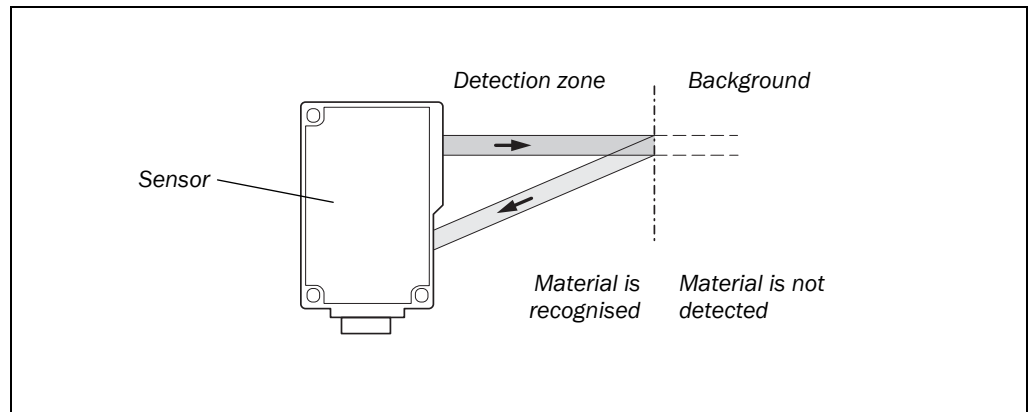
$$L \geq v \times (t_d + t_{res})$$

Where ...

- L = Minimum distance[m]
- v = Speed of material (e.g. conveyor speed) [m/s]
- t_d = Input delay of external switching device [s]
(see operating instructions for external switching device)
- t_{res} = Response time of UE410 Muting [s]
(see Chapter 13 [Technical data](#))

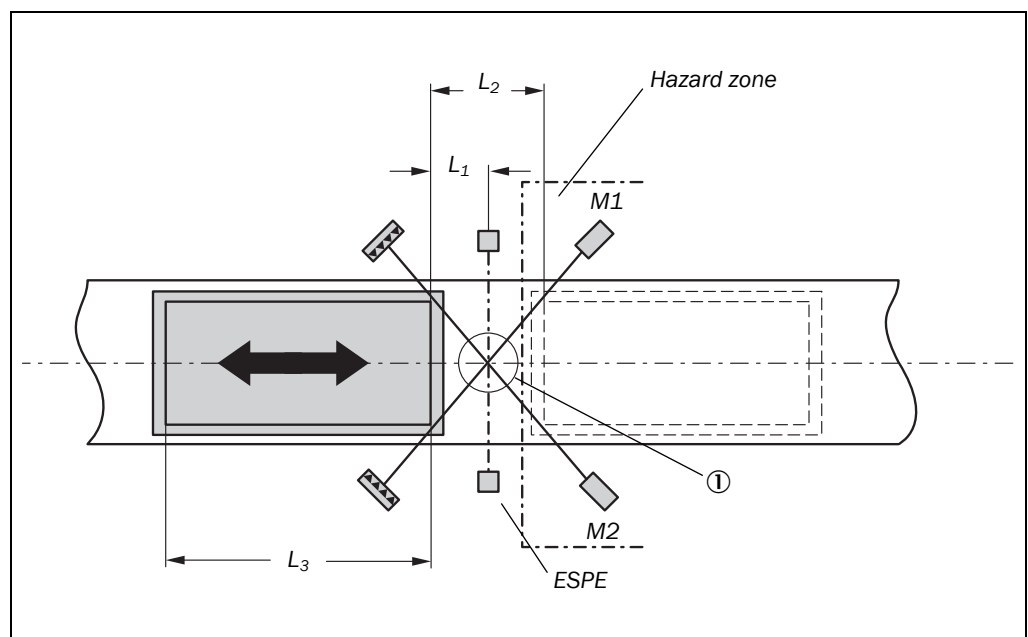
Use optical sensors with background suppression. This type of sensor recognises material presence only within a fixed distance. Objects that are further away are ignored.

Fig. 5: Function of sensor with background suppression



3.2.1 Muting with two sensors (a pair of sensors), crossed arrangement

Fig. 6: Muting with a pair of crossed sensors



In the example, the material moves from left to right, or, alternatively, from right to left. As soon as muting sensors M1 and M2 are activated, the protective action of the protective device (ESPE) is bypassed.

The following conditions must be met:

Tab. 4: Conditions for muting with a pair of crossed sensors

Condition	Description
M1 & M2	Muting applies as long as this condition is met.

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How to calculate the distance:

$$L_1 \geq v \times (t_d + t_{res})$$

$$v \times t > L_2 + L_3$$

Where ...

L_1 = Minimum distance between the ESPE light beams and the point of detection by muting sensors [m]

L_2 = Distance between the two detection lines of the sensors (sensors activated/sensors free) [m]

L_3 = Length of material in direction of travel [m]

v = Speed of material (e.g. conveyor speed) [m/s]

t = Setting for total muting time [s]

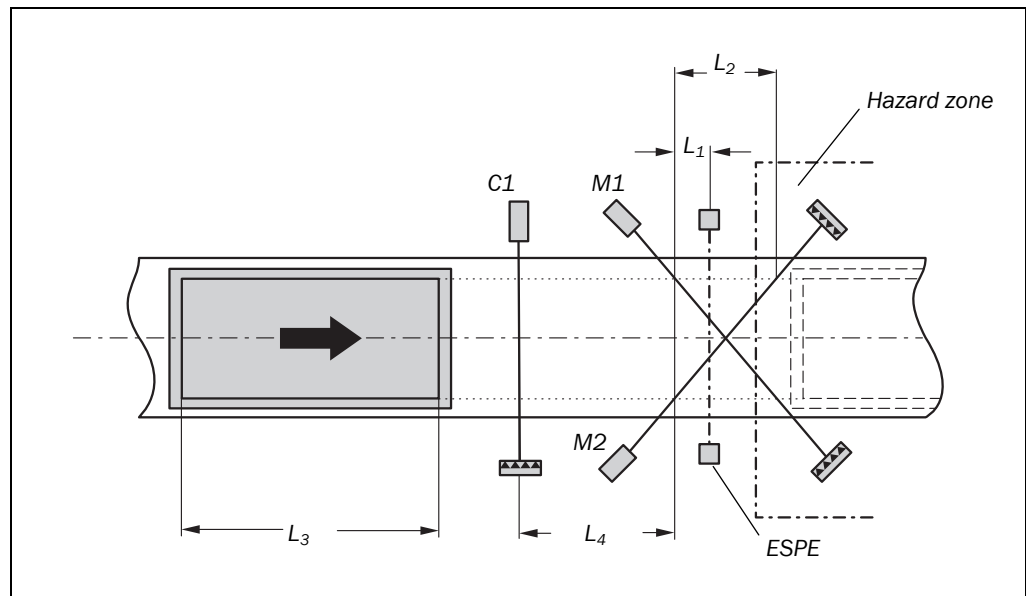
t_d = Response time of external switching device [s]
(see operating instructions for external switching devices)

t_{res} = Response time of UE410 Muting [s]
(see Chapter 13 [Technical data](#))

- Note**
- Material is permitted to travel in both directions.
 - Arrange for the crossing point of the muting sensors ① to be precisely on the ESPE light beams. If this is not possible, shift the crossing point towards the hazard zone.
 - This arrangement is suitable for both through-beam photoelectric switches and photoelectric reflex switches.
 - You can usefully increase the protection against manipulation and improve safety by using the following configurable functions:
 - Concurrence monitoring
 - Monitoring of the total muting time
 - End of muting by ESPE

3.2.2 Muting with two sensors (a pair of sensors), crossed arrangement, and a supplementary signal

Fig. 7: Muting with a pair of sensors, crossed arrangement, and a supplementary signal



The protective action of the protective device is bypassed when the muting sensors are activated in a defined sequence. The muting Sensor (Signal C1) must always be activated before **both** muting sensors of a pair (e.g. M1 and M2) (see Chapter 5.1.1 [Supplementary signal C1](#)).

Muting sensor input requirements:

Tab. 5: Conditions for muting with a pair of sensors and a supplementary signal

Condition	Description
C1 & M1 & M2	A short time before the start of muting: C1 must always be active before both muting sensors of a pair (e.g. M1 and M2).
M1 & M2	Muting applies as long as this condition is met.

How to calculate the distance:

$$L_1 \geq v \times (t_d + t_{res})$$

$$v \times t > L_2 + L_3$$

$$L_4 < L_3$$

Where ...

L_1 = Minimum distance between the ESPE light beams and detection by the muting sensors [m]

L_2 = Distance between the two detection lines of the sensors (sensors activated/sensors free) [m]

L_3 = Length of material in direction of travel [m]

L_4 = Maximum distance between C1 and the detection line of M1, M2 [m]

v = Speed of material (e.g. conveyor speed) [m/s]

t = Setting for total muting time [s]

t_d = Response time of external switching device [s]
(see operating instructions for external switching devices)

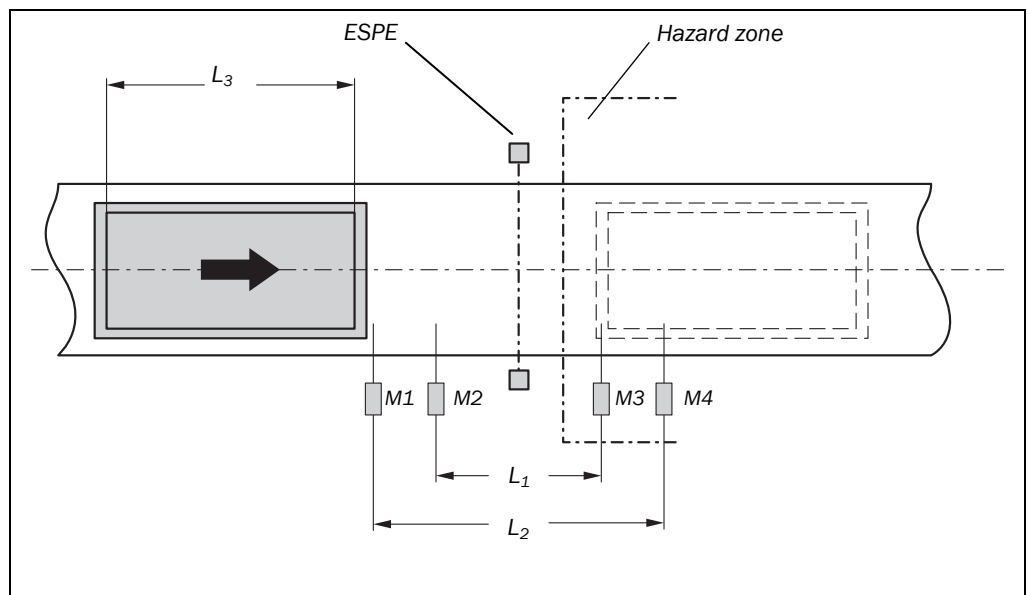
t_{res} = Response time of UE410 Muting [s]
(see Chapter 13 [Technical data](#))

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- Note**
- Material can travel in one direction only.
 - This arrangement is suitable for both through-beam photoelectric switches and photoelectric reflex switches.
 - Avoid mutual interference between the sensors.
 - You can usefully increase the protection against manipulation and improve safety by using the following configurable functions:
 - Concurrence monitoring
 - Monitoring of the total muting time
 - End of muting by ESPE

3.2.3 Muting with four sensors (two pairs of sensors), sequential arrangement

Fig. 8: Muting with two sequential pairs of sensors



In the example, material moves from left to right. As soon as muting sensors M1 & M2 are activated, the protective action of the protective device (ESPE) is bypassed. The protective action remains bypassed until one sensor of the pair of muting sensors M3 & M4 is free again.

Muting sensor input requirements:

Tab. 6: Conditions for muting with four sequential sensors

Condition	Description
M1 & M2 (or M3 & M4)	A short time before the start of muting: depending on the transport direction of the material, the first pair of sensors is activated.
M1 & M2 & M3 & M4	Briefly for continuation of the muting condition.
M3 & M4 (or M1 & M2)	Muting applies as long as this condition is met. Depending on the transport direction of the material, the second pair of sensors is activated.

How to calculate the distance:

$$L_1 \geq v \times 2 \times (t_d + t_{res})$$

$$v \times t > L_1 + L_3$$

$$L_2 < L_3$$

Where ...

L_1 = Distance between the inner sensors (positioned symmetrically about the ESPE light beams) [m]

L_2 = Distance between the outer sensors (positioned symmetrically about the ESPE light beams) [m]

L_3 = Length of material in direction of travel [m]

v = Speed of material (e.g. conveyor speed) [m/s]

t = Setting for total muting time [s]

t_d = Response time of external switching device [s]
(see operating instructions for external switching devices)

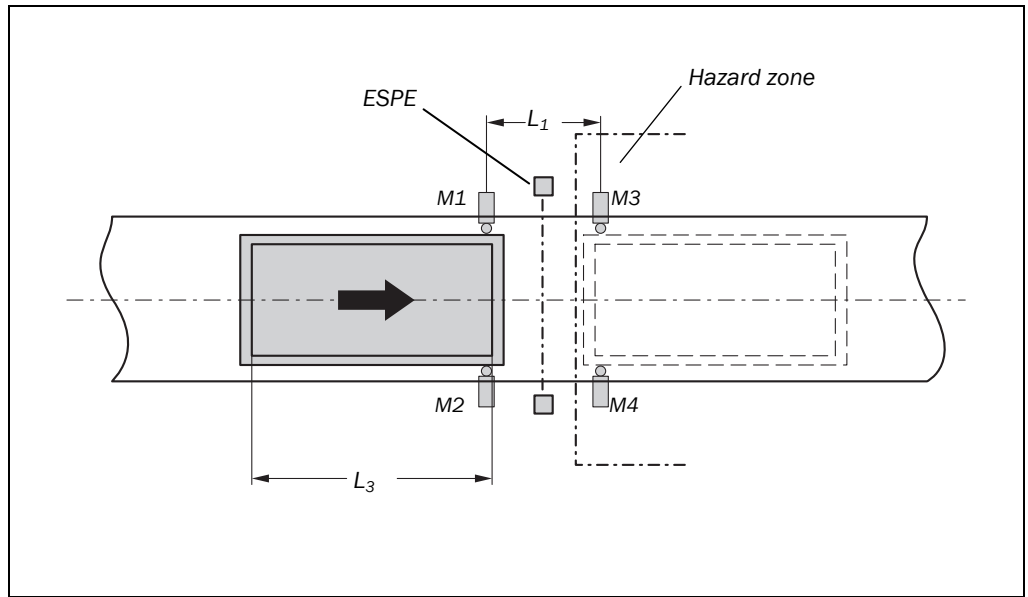
t_{res} = Response time of UE410 Muting [s]
(see Chapter 13 *Technical data*)

- Note**
- The material can travel in both directions.
 - The direction can also be permanently defined:
 - With supplementary signal C1: signal C1 must always be activated before the two muting sensors of the first pair (e.g. M1 and M2);
 - Using the function "Direction recognition", configurable by setting rotary switches (see Chapter 5.3 *Direction recognition*).
 - With this arrangement, all types of sensor can be employed.
 - You can usefully increase the protection against manipulation and improve safety by using the following configurable functions:
 - Concurrence monitoring
 - Monitoring of the total muting time
 - End of muting by ESPE

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3.2.4 Muting with four sensors (two pairs of sensors), parallel arrangement

Fig. 9: Muting with two parallel pairs of sensors



In the example, material moves from left to right. As soon as the first pair of muting sensors M1 & M2 is activated, the protective action of the protective device (ESPE) is bypassed. The protective action remains bypassed until the pair of muting sensors M3 & M4 is free again.

Muting sensor input requirements:

Tab. 7: Conditions for muting with four sensors arranged in parallel

Condition	Description
M1 & M2 (or M3 & M4)	A short time before the start of muting: depending on the transport direction of the material, the first pair of sensors is activated.
M1 & M2 & M3 & M4	Briefly for continuation of the muting condition.
M3 & M4 (or M1 & M2)	Muting applies as long as this condition is met. Depending on the transport direction of the material, the second pair of sensors is activated.

How to calculate the distance:

$$L_1 \geq v \times 2 \times (t_d + t_{res})$$

$$v \times t > L_1 + L_3$$

$$L_1 < L_3$$

Where ...

L_1 = Distance between the inner sensors (positioned symmetrically about the ESPE light beams) [m]

L_3 = Length of material in direction of travel [m]

v = Speed of material (e.g. conveyor speed) [m/s]

t = Setting for total muting time [s]

t_d = Response time of external switching device [s]
(see operating instructions for external switching devices)

t_{res} = Response time of UE410 Muting [s]
(see Chapter 13 [Technical data](#))

- Note**
- The material can travel in both directions.
 - With the parallel arrangement, the muting sensors are positioned so that they also verify the width of permissible objects. Objects passing the muting sensors must always be identical in width.
 - The direction can also be permanently defined:
 - With supplementary signal C1: signal C1 must always be activated before the two muting sensors of the first pair (e.g. M1 and M2);
 - Using the function "Direction recognition", configurable by setting rotary switches (see Chapter 5.3 [Direction recognition](#))
 - With this arrangement, optical sensors and all types of non-optical sensor can be employed. Use sensors and feelers with background suppression.
 - Avoid mutual interference between the sensors.
 - You can usefully increase the protection against manipulation and improve safety by using the following configurable functions:
 - Concurrence monitoring
 - Monitoring of the total muting time
 - End of muting by ESPE

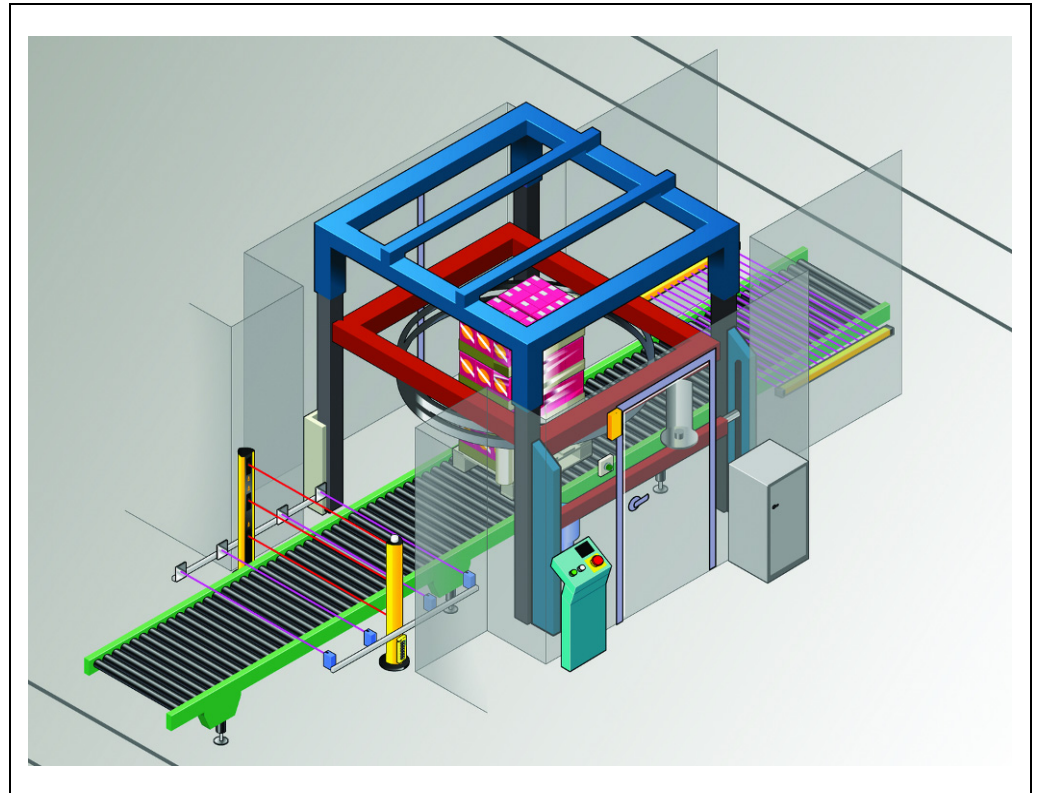
4 Product description

This chapter informs you about special features of the UE410 Muting Modular Safety Controller. It describes the structure and the function of the device.

- Be sure to read this chapter, before you install the equipment, configure or commission the device.

4.1 Special features

Fig. 10: Safety application employing the UE410 Muting Modular Safety Controller



The UE410 Muting family is part of the larger UE410 Flexi family of safety controllers that allow you to realise solutions for muting applications. These can be used either as an autonomous safety system or connected together as an integrated muting system within a Flexi system.

The compact housing of these modules is 22.5 mm wide.

Modules are plugged together, whereby communication between individual units occurs on an internal bus (Flex bus).

The necessary muting functions and parameter settings are implemented using rotary switches on the modules.

The UE410 Muting family consists of 3 modules:

- Main-Muting UE410-MM (main module)
- Extension-Muting UE410-XM (slave module)
- Muting Digital Input UE410-MDI (MDI module)

Note For diagnosis, optional gateways can be connected.

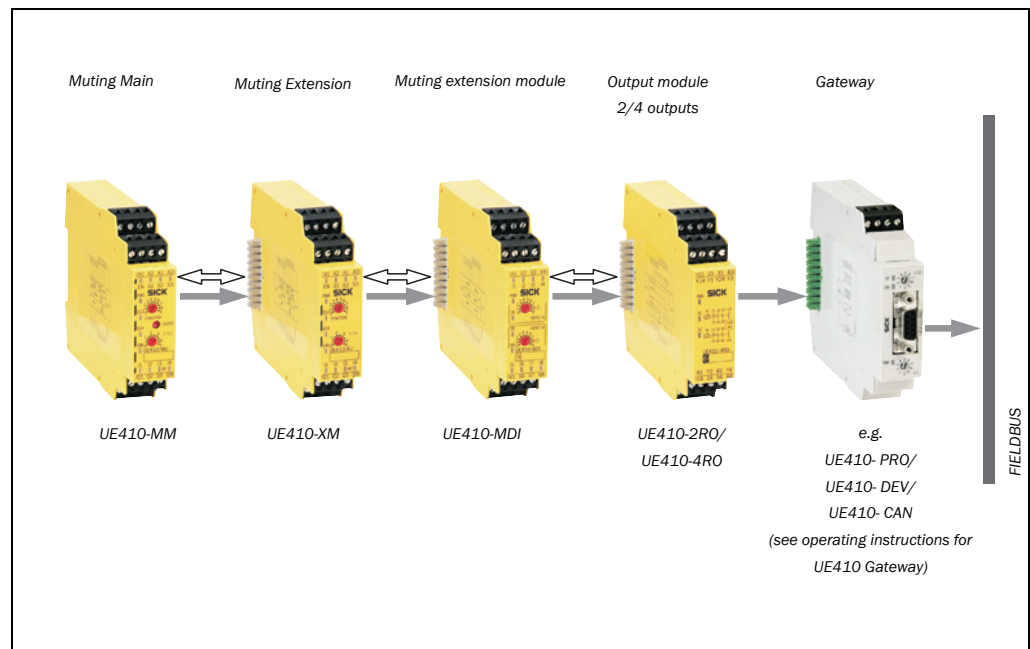
Optionally, the UE410 Muting Modular Safety Controller can be coupled with other modules in the UE410 Flexi family (see Section 4.3 *UE410 Muting in the Flexi family*).

4.2 System structure

The structure of a UE410 Muting system depends on your muting application requirements and on the other safety-related tasks you have to implement with the UE410 Flexi. The muting modules UE410-MM and UE410-XM will operate in conjunction with other UE410 Flexi components.

1. For a pure, isolated, basic muting application, such a system consists of a single main module and, if necessary, modules from the UE410 Flexi family, together with an output module. An optional Gateway can be connected for diagnosis.
2. If further muting functions have to be implemented in addition to the basic muting function, then a muting Digital Input Module (MDI) is required in addition to the system described under 1., above.
3. If an installation consists of several muting stations, the system can be extended by adding muting Extension Units (XM).
4. For diagnosis, Gateways are available in the UE410 Flexi family.

Fig. 11: Structure of UE410 Muting Modular Safety Controller system



4.2.1 Main-Muting module UE410-MM

The Main-Muting module UE410-MM is the main module, in which the system configuration of the complete UE410 Muting system is stored.

The Main-Muting module UE410-MM can be used to implement basic muting functions such as 2 or 4-sensor muting, with or without override. For this purpose it has 2 inputs for connecting the main sensor that is to be muted, 4 inputs for the muting sensors, and 2 control inputs. Outputs from this module include 2 semiconductor-based, safety-rated outputs, 2 signal outputs and 2 test outputs.

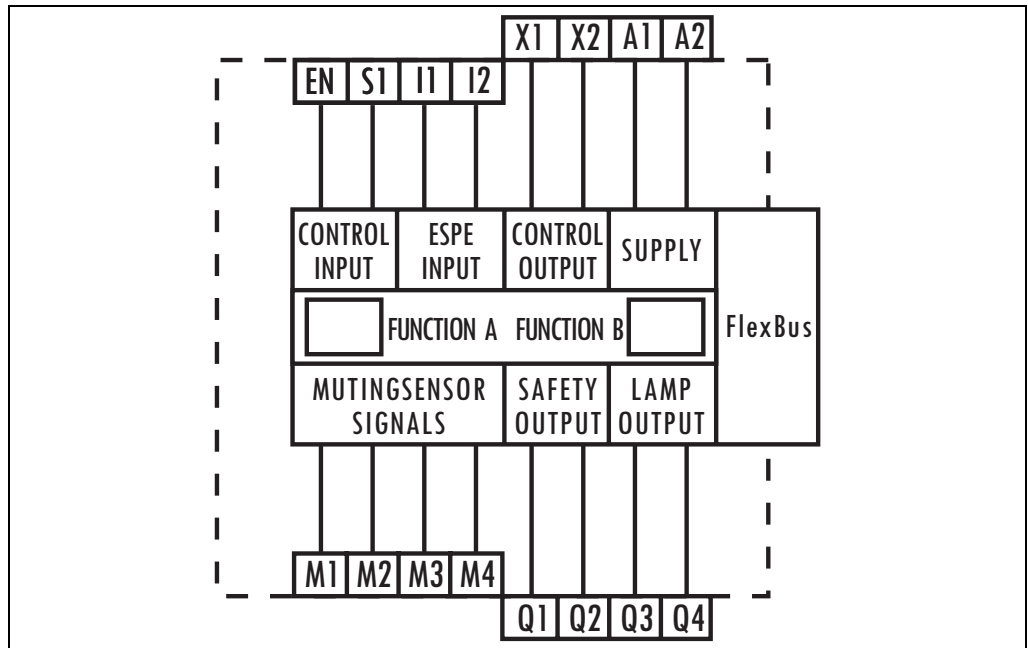
Mode of operation and parameters are configured using two rotary switches on the upper surface of the module. The Function A rotary switch is used to define the mode of operation, with/without override, muting end condition and direction monitoring. The Function B rotary switch is used to define muting duration and with/without concurrence monitoring of sensors.

Functions such as EDM, restart etc. are implemented by control wiring to terminal S1.

UE410 Muting

Connections to Main-Muting module:

Fig. 12: Inputs and outputs of the Main-Muting module



Inputs:

Tab. 8: Inputs of the Main-Muting module

EN	Enable input used in supervisory control applications and cascaded systems
S1	Input: manual reset incl. EDM; override automatic reset incl. EDM; override
M1, M2	Inputs for pair of muting sensors 1
M3, M4	Inputs for pair of muting sensors 2
I1 and I2	Inputs for OSSD of relevant ESPE (ESPE = Electro-Sensitive Protective Equipment)

Outputs:

Tab. 9: Outputs of the Main-Muting module

Q1/Q2	Safety output (OSSD)
Q3	Signal output for muting system status, used for controlling the lamp
X1/X2	Test outputs
Q4	Signal output for override system status

Note Safe semiconductor outputs

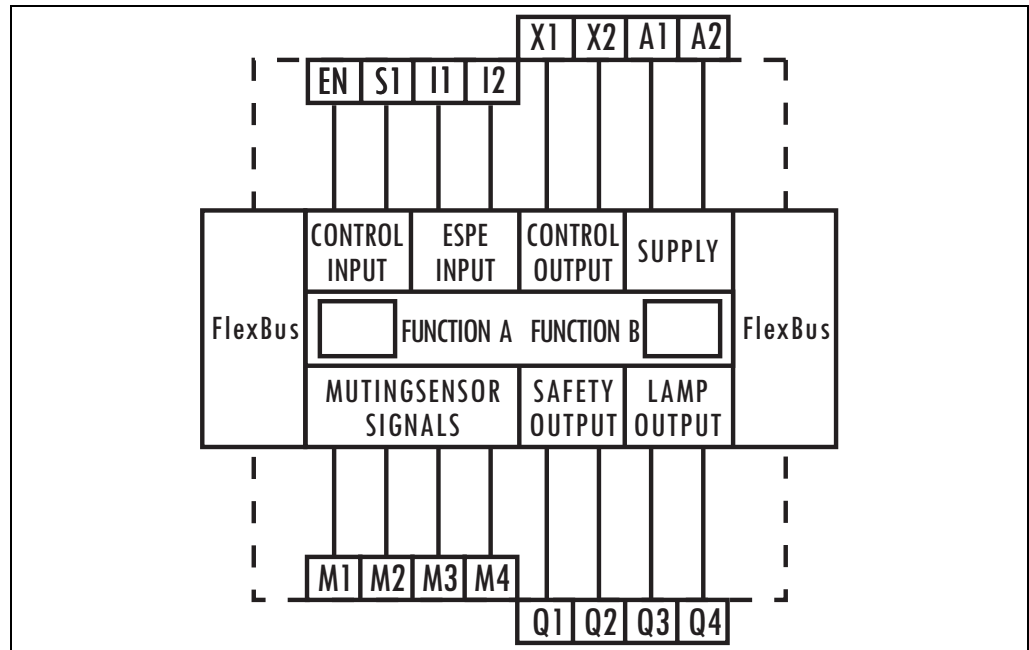
The safe semiconductor outputs Q1 and Q2 on the UE410-MM/XM module are used to control actuators. The outputs are suitable for loads up to 2 A, and are resistant to short-circuits. The switchability of the outputs is continuously monitored. This is achieved by periodically switching off the outputs and checking the resulting signal for the expected LOW state. When a fault is detected, the outputs are switched off by removal of the control signal and switching the output current supply to LOW.

Note When electromechanical relay contacts are required, they are available on output modules UE410-2RO/UE410-4RO.

For further information on output modules UE410-2RO/UE410-4RO, see the UE410 Flexi operating instructions (8011737) or go to www.ue410flexi.com.

4.2.2 Connections to Extension-Muting module UE410-XM

Fig. 13: Inputs and outputs of Extension-Muting module UE410-XM



The UE410-XM module is a further muting module from the Flexi range. In its structure, connections and functionality, it is substantially identical to the Main-Muting module UE410-MM. It has the same switching positions, muting functions, parameter settings and connections for a safety sensor and up to 4 muting sensors. It differs from the UE410-MM in that the UE410-XM cannot store the system configuration. The system must, therefore, include a further Main-Muting module or an MU module from the Flexi family.

Note The module UE410-XM can be integrated into a UE410 Flexi system. For further information on the UE410 Flexi system see the UE410 Flexi operating instructions (8011737) or go to www.ue410flexi.com.

UE410 Muting

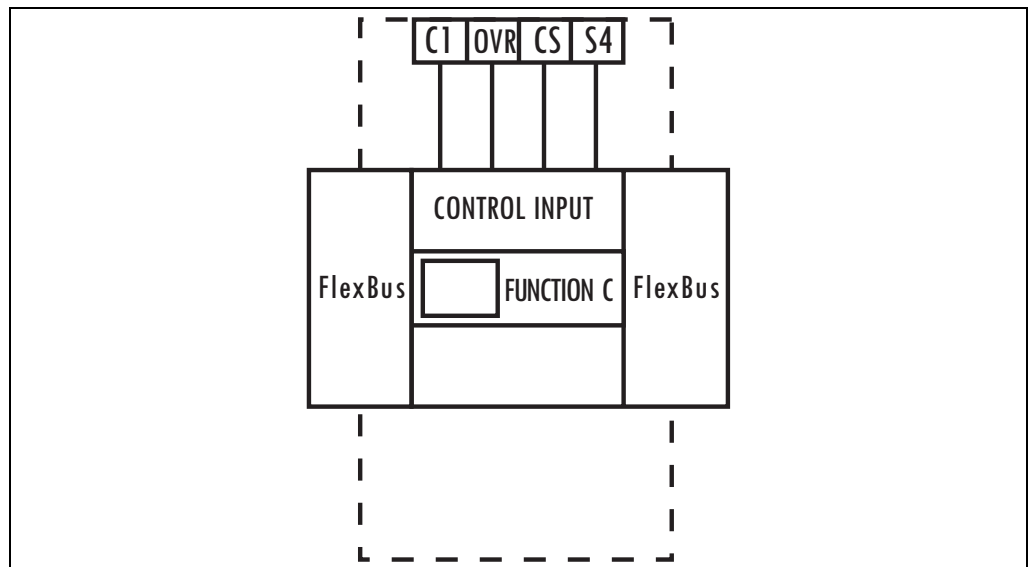
4.2.3 Muting extension module UE410-MDI

Where the application requires it, additional muting functions can be implemented with an MM or XM-Module by adding a UE410-MDI module. The user then has a total of three further control inputs for the integration or evaluation of control or conveyor signals. These functions are activated and their parameters set using the Function C rotary switch on the upper face of the module.

Note UE410-MDI can never be used separately in a Flexi system; it can only be used as an extension to a Main-Muting module UE410-MM or an Extension-Muting module UE410-XM.

Connections to Extension-Muting module UE410-MDI:

Fig. 14: Inputs of Extension-Muting module UE410-MDI



Inputs:

Tab. 10: Inputs of Extension-Muting module UE410-MDI

C1	Control input for supplementary muting signal <C1>. Depending on the configuration, this signal will be evaluated by an MM or XM module.
OVR	Input for a separate button to acknowledge an override request.
CS	Input for connecting a conveyor-stopped signal.
S4	Currently has no function.

4.3 UE410 Muting in the Flexi family

UE410 muting modules can be combined with other modules from the Flexi family in several different ways:

A muting system can, for example, consist of a UE410-MM module with a sub-system comprising a UE410-XU module and, where necessary, a UE410-8DI module. In this case, the complete system configuration would be stored in the UE410-MM.

Another example would be a UE410 Flexi system comprising a UE410-MU module with a muting sub-system made up of a UE410-XM module and, where necessary, a UE410-MDI. Here, the complete system configuration would be stored in the UE410-MU.

UE410 Flexi module

- Main module UE410-MU
- Input/output extension module UE410-XU
- Input extension module UE410-8DI

Output module UE410-2RO/UE410-4RO

As with the UE410 Flexi system, these output modules can also be used to implement electromechanical contacts for a UE410 muting module.

Gateways

With a UE410 Gateway module, information can be transmitted from a UE410 muting module to a non-safety field-bus.

For further information on the UE410 Flexi family and the output modules, see the UE410 Flexi operating instructions (8011737). For further information about Gateways, see the UE410 Gateway operating instructions (8011834).

Further information on the UE410 Flexi family, the output modules, and Gateways, is also available at www.ue410flexi.com.

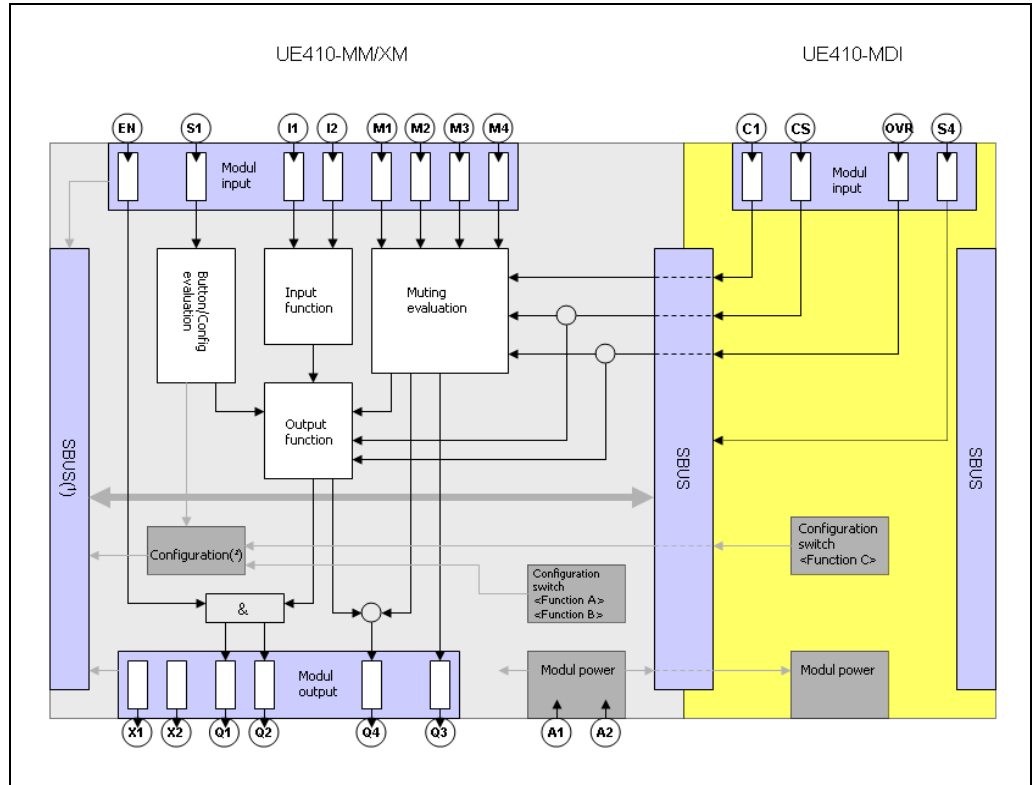
UE410 Muting

4.4 Module description

Depending on the functional requirements of the muting application, a system will consist of at least one UE410-MM module or a UE410-XM module. If the functional requirements cannot be met in this way, an extension module UE410-XM or UE410-MDI must be used.

The modules and the functions they offer are described below.

Fig. 15: Circuit function diagram



(¹) Not on MM module

(²) Not on XM module

Tab. 11: Assignment of functions to the modules

Functions	MM	XM	MDI
Muting with 4 muting sensors	x	x	
Muting with 2 muting sensors	x	x	
Concurrence	x	x	
Muting duration	x	x	
Internal override	x	x	
End muting when ESPE is clear	x	x	
Direction monitoring	x	x	
Muting duration (max.)	x	x	
Reset	x	x	
EDM	x	x	
Sequence monitoring			x
Supplementary signal C1			x
Conveyor stopped			x

4.4.1 Module description MM/XM

Differences between modules UE410-XM and UE410-MM

- UE410-XM is an extension module and has connections on both sides (plugs/sockets)
- UE410-MM has a configuration memory

Configuration MM/XM

The functions of muting modules MM/XM as defined in *Table 12* are set using the rotary switches Function A and Function B on the appropriate module. The switch settings for the required function result from the combination of individual functions.

Configuration using Function A

Tab. 12: Function A rotary switches on UE410-MM/XM module

Number of muting sensors	Internal override possible	Muting end when ESPE clear	Direction monitoring		Switch setting
2/4	No	No	No	->	0
4	No	No	Yes	->	1
2/4	No	Yes	No	->	2
4	No	Yes	Yes	->	3
2/4	Yes	No	No	->	4
4	Yes	No	Yes	->	5
2/4	Yes	Yes	No	->	6
4	Yes	Yes	Yes	->	7
Not assigned					8
					9

Example showing choice of switch setting:

(with reference to *Table 13*)

Required configuration:

- 4 muting sensors
- Internal override possible
- Normal end of muting
- Direction monitoring activated

Result:

- Switch setting 5

Tab. 13: Result of Function A example

Number of muting sensors	Internal override possible	Muting end when ESPE clear	Direction monitoring		Switch setting
4	Yes	No	Yes	->	5

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Configuration using Function B

Tab. 14: Function B rotary switches on module UE410-MM/XM

Muting duration (max.)	Concurrency monitoring		Switch setting
∞	∞	->	0
20 s	∞	->	1
1 min	∞	->	2
15 min	∞	->	3
60 min	∞	->	4
∞	3 s	->	5
20 s	3 s	->	6
1 min	3 s	->	7
15 min	3 s	->	8
60 min	3 s	->	9

Example showing choice of switch setting:

(with reference to Table 15)

Required configuration:

- Muting duration: 1 minute
- Concurrency: 3 seconds

Result:

- Switch setting 7

Tab. 15: Result of Function B example

Muting duration (max.)	Concurrency monitoring		Switch setting
1 min	3 s	->	7

4.4.2 Module description MDI

Module function

The extension module provides supplementary signal C1, conveyor stop CS and an override input OVR.

The Function C rotary switch is used for configuration of additional function parameters.

Configuration of MDI

Tab. 16: Function C rotary switches on module UE410-MDI

Sequence monitoring	C1 evaluation		Switch setting
No	No	->	0
No	Yes	->	1
Yes	No	->	2
Yes	Yes	->	3
Not assigned		->	4
		->	5
		->	6
		->	7
		->	8
		->	9

Example showing choice of switch setting:

(with reference to Table 17)

Required configuration:

- Sequence monitoring activated
- C1 evaluation activated

Result:

- Switch setting 3

Tab. 17: Result of Function C example

Sequence monitoring	C1 evaluation		Switch setting
Yes	Yes	->	3

For setting/modifying a configuration, see Section 11.1 [Accepting system configuration](#).

5 Configurable functions

5.1 Number of muting sensors

Muting can be achieved using either two or four sensors. The number of sensors used depends on the geometry of the object to be detected.

The following sensor combinations are possible:

- Two sensors (one pair of sensors)
- Two sensors (one pair of sensors) and a supplementary signal C1 (requires module MDI in addition)
- Four sensors (two pairs of sensors)
- Four sensors (two pairs of sensors) and a supplementary signal C1 (requires module MDI in addition)

The electrical connection of muting sensors is described in the Chapter *Examples of applications and connections* in the operating instructions of the switching device used.

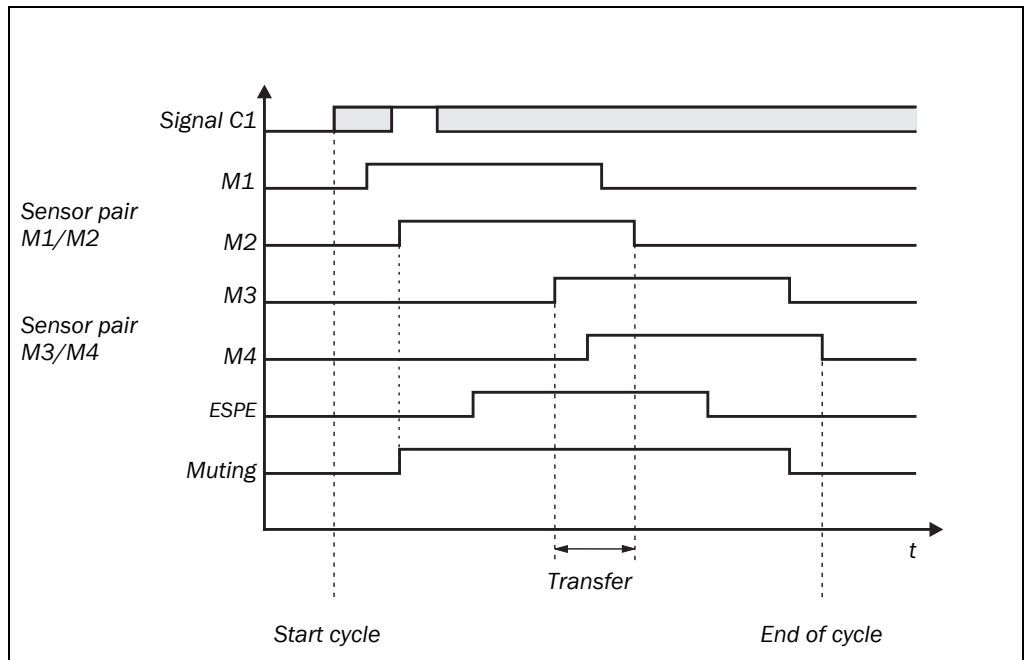
Note There must always be connections to all 4 muting sensor inputs, i.e. for applications with only 2 muting sensors, bridges must be installed between M1 and M3, and M2 and M4.

5.1.1 Supplementary signal C1

You can also connect a supplementary signal C1 to the muting sensors. The signal can be a control signal from a PLC or from an additional sensor. The supplementary signal C1 must not be a static signal. It will be checked during the muting cycle for dynamic behavior. If the signal does not change during a cycle, no further muting will take place.

Dynamic sequence of input signals:

Fig. 16: Signal sequence with active input C1 during the muting cycle



- Note**
- To activate muting, there must be a LOW/HIGH signal change at input C1 before both muting sensors of the first pair (e.g. M1 and M2) are active. If this sequence fails, muting will not occur.
 - If muting has become active, there must then be a HIGH/LOW signal change at input C1. If this sequence fails, subsequent muting cycles will not occur.
 - The supplementary signal C1 is only possible in conjunction with extension module MDI.
 - When sequence monitoring is configured, a LOW/HIGH signal change must occur at input C1 before the first muting sensor of a pair (M1 or M4) becomes active.
 - C1 must remain HIGH until a muting sensor is active.

5.2 Time monitoring

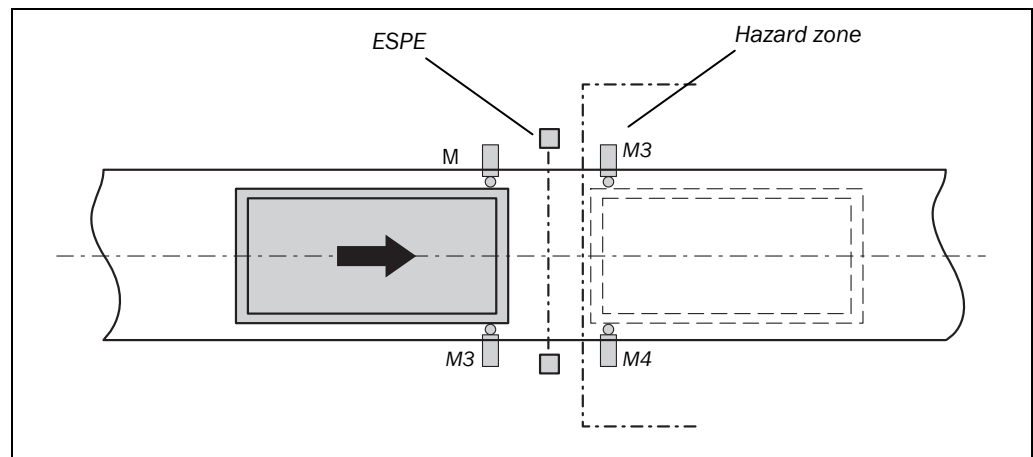
5.2.1 Concurrence monitoring

To protect against manipulation (e.g. covering an optical sensor) of the safety application, *concurrence monitoring* can be configured.

When this function is selected, both muting sensors must become active within a defined time (see Chapter 13 *Technical data*). When this function is not selected, there is no time monitoring.

- Note** Configuration is carried out using Function B rotary switch on module UE410-MM or UE410-XM. The configurable time for concurrence monitoring applies to both sensors of a pair.

Fig. 17: Concurrence monitoring



5.2.2 Monitoring the total muting duration

When *Monitoring the total muting duration* is active, the maximum duration of muting is limited. Monitoring of the total muting duration can be set in stages. The times are configurable (see Chapter 13 *Technical data*).

Muting is ended, at the latest, when the total muting duration expires.

- Note** Configuration is set using the Function B rotary switch on module UE410-MM or UE410-XM.

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5.2.3 Sensor gap monitoring

When a valid muting state has been achieved for a pair of sensors, it is permissible for one sensor to briefly change state (become inactive) for a defined time without causing the muting state to be discontinued (see Chapter 13 *Technical data*).

- Note**
- Only one sensor of a pair may briefly become clear (inactive).
 - At the affected pair of sensors, one valid muting condition must always be met.

5.2.4 Conveyor stopped

To prevent valid muting conditions from being cancelled by the expiry of time monitoring when the conveyor stops, the function *Conveyor stopped* and a conveyor-stopped signal can be used to suspend time monitoring. At the same time, the conditions of the active muting sensors and the ESPE, when the conveyor has stopped, are monitored for changes. The following timeout controls are suspended when the conveyor stopped signal is active:

- Monitoring of the total muting time
- Concurrence monitoring

When the conveyor restarts, the muting state ...

- continues, if the muting conditions remain valid;
- is terminated, if the muting conditions became invalid.

- Note** Monitoring of the condition of the sensors and the ESPE begins after a fixed deceleration time (see Chapter 13 *Technical data*).

When the *Conveyor stopped* function is configured, the signal from the conveyor must be connected to the "Conveyor stopped" input.

The function *Conveyor stopped* is only possible in conjunction with extension module MDI.

Tab. 18: Conveyor stopped input signals

Conveyor stopped input	Status
HIGH	Conveyor is running, muting timeout controls are active
LOW	Conveyor is not running: <ul style="list-style-type: none"> • Muting timeout controls are paused and <ul style="list-style-type: none"> • The last states of all active muting sensors and the ESPE are monitored.



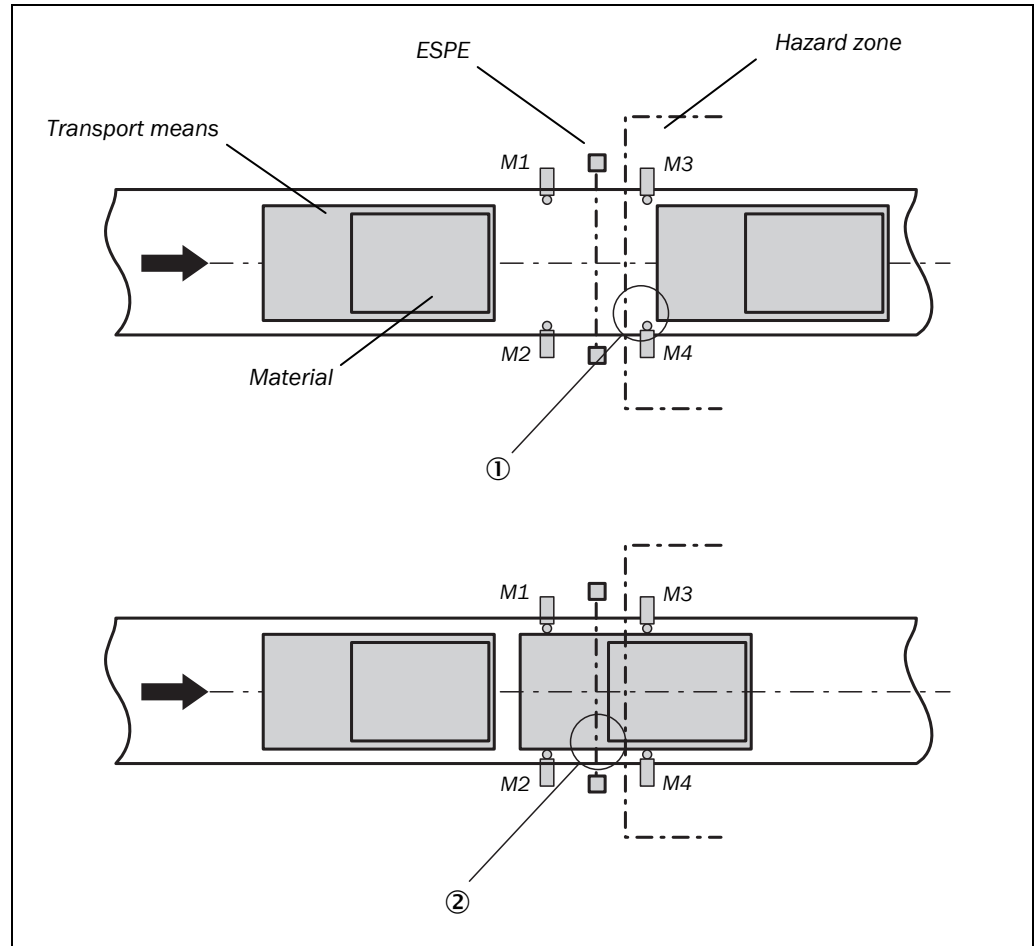
WARNING

If this function is not used, its input must be connected to +24 V!

5.2.5 Muting end by ESPE

Muting ends when one sensor of the last pair becomes inactive, and, thus, there is no longer a valid muting condition fulfilled. The function *Muting end by ESPE* shortens the duration of muting to the time at which the light beam of the ESPE is cleared again. In this way, you achieve a shorter muting time and, simultaneously, greater safety.

Fig. 18: Muting end by ESPE



Without the function *Muting end by ESPE*, muting is not ended before one sensor of the last pair becomes free again ①.

With the function *Muting end by ESPE*, muting ends as soon as the ESPE beam is clear again ②.

- Note**
- Material and means of transport must be detected by the muting sensors or the ESPE over their entire length. There must be no detectable gaps, otherwise muting will be ended too early.
 - If the ESPE light path does not become clear, then muting will be ended, at the latest, when the muting condition is no longer met.
 - Observe the muting-end delay time (see Chapter 13 [Technical data](#)).
 - Configuration of the *Muting end by ESPE* function is carried out using the Function A rotary switch on module UE410-MM or UE410-XM.
 - When muting with 4 muting sensors, detection by the second pair of sensors is necessary.

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5.3 Direction recognition

When *Direction recognition* is activated, a pair of sensors must be activated and be cleared again in a particular sequence. The material can then only pass the protective installation in a specified direction. The sequence of sensors within a pair is, in this case, not relevant. The following table shows the precise conditions in relation to the number of sensors.

Tab. 19: Conditions for direction recognition

Number of muting sensors	Conditions to be met
2 (1 pair of sensors)	Direction recognition not possible
4 (2 pairs of sensors)	According to the direction set, the pairs of sensors must be activated in the following sequence: <ul style="list-style-type: none"> • sensor pair A before sensor pair B or <ul style="list-style-type: none"> • sensor pair B before sensor pair A

For muting conditions to be met, the object can only move in the defined direction and sequence through the muting sensors.

Note Configuration is carried out using the Function A rotary switch on module UE410-MM or UE410-XM.

5.4 Sequence monitoring

When *Sequence monitoring* is activated, the sensors must become active and then be cleared again in a certain sequence. The material must pass completely through the protective installation for there to be no muting error. In addition, the direction can be defined by configuring *Direction recognition*. The following table shows the precise conditions in relation to the number of sensors.

Tab. 20: Conditions for sequence monitoring

Number of muting sensors	Conditions to be met
2 (1 pair of sensors)	Sequence monitoring not possible
4 (2 pairs of sensors)	<ul style="list-style-type: none"> • M1 before M2 before M3 before M4 (defined direction, defined sequence) or <ul style="list-style-type: none"> • M4 before M3 before M2 before M1 (defined direction, defined sequence) or <ul style="list-style-type: none"> • M1 before M2 before M3 before M4, alternatively M4 before M3 before M2 before M1 (changing direction, defined sequence)

In order to fulfill muting conditions, the object may only move through the muting sensors in the defined direction and sequence.

Note

- Sequence monitoring can only be implemented with an MDI module.
- Configuration is carried out using the Function C rotary switch on the MDI module.

5.5 Override function

Override is manual initiation of muting after a muting condition error. By briefly simulating a valid muting condition, you can bypass the protective installation (muting) and run the system to clear it, or to achieve an error-free state.

The system differentiates between two conditions: *Override* and *Override required*.

Override

The *Override* function is activated using the Function A rotary switch.

Override required

The condition *Override required* means that the switched outputs (OSSD) are in the OFF condition and the system is waiting for the Override control to be operated. The system signals this condition by a blinking muting lamp (2 Hz).

The condition *Override required* is only triggered by the system when, during a valid muting condition ...

- an error occurs

and

- muting is ended

and

- the ESPE is interrupted by an object.

Errors can arise due to concurrence monitoring, total muting time monitoring, direction recognition, sequence monitoring, and sensor gap monitoring, all governed by the muting sensors, or due to a restart after an emergency stop or power failure.



WARNING

Observe the following safety instructions for the Override condition!

- Install the *Override* control in a position where the operator has a clear view of the entire hazardous area.
- Before operating *Override*, ensure that the muting system components are operating properly, in particular the muting sensors.
- When two successive muting cycles require the *Override* to be used, then the muting arrangement and muting sensors must be examined and verified for correct operation.

The *Override* function can only be started in the condition *Override required* by operating the *Override* control. The system will resume muting at the point at which it was interrupted. The switch outputs (OSSD) change to the ON status and the system will then monitor the *Override* condition.

Override can be started in two ways:

- Using a separate *Override* control (only with the MDI module)
- Using a common control for Reset and *Override*

Electrical connection of the control device is described in Chapter 9 [Examples of applications and connections](#).

Note When using a common control device for *Reset* and *Override* the Reset and *Override* input terminals must be bridged if an MDI module is also used.

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Admissibility of Override conditions

For safety reasons, the permissible number of Override conditions is limited.

The permissible number depends on configuration of the function *Monitoring of total muting time*.

Tab. 21: Permissible numbers of Override conditions

Configuration of the function <i>Monitoring of total muting time</i>	Permissible number of Override conditions
Deactivated	5×
Activated	Values: 20 s ⇒ 180× 60 s ⇒ 60× 15 m ⇒ 5× 60 m ⇒ 5×

Notes

- Every time the system is switched on, and after a muting cycle in which no errors were detected the counter for the number of Override cycles allowed is automatically reset.
- When the permissible number of muting cycles using Override is exceeded, the system goes to the *Lock-out* state. This is indicated by an error signal at the muting lamp.

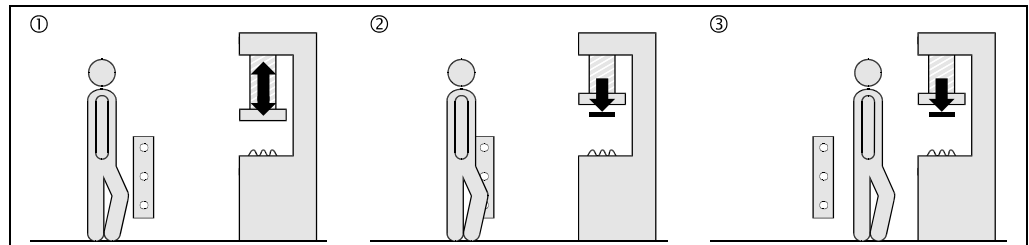


WARNING

Concurrency and direction monitoring are deactivated for the duration of Override operation!

5.6 Restart interlock

Fig. 19: Schematic illustration of protective operation



The hazardous movement of the machine ① is stopped when the optical protective device is interrupted ②, and restarting cannot occur until the operator is outside the hazardous area and operates the Reset button ③.

Note

Do not confuse the restart interlock with the machine's start interlock. The start interlock prevents the machine from starting when it is switched on. The restart interlock prevents the machine from restarting after an error or after a light beam has been interrupted.

You can prevent the machine from restarting in two ways:

- With the internal restart interlock in the modules UE410-MM or UE410-XM: then the muting module controls restarting.
- With the restart interlock of the machine (external): then the muting module has no control over restarting.

The following table shows the possible combinations:

Tab. 22: Permissible configurations of the restart interlock

Restart interlock of muting module	Restart interlock of the machine	Permissible applications
Deactivated	Deactivated	Observe the conditions in EN 60204-1!
Deactivated	Activated	All
Activated	Deactivated	Observe the conditions in EN 60204-1!
Activated	Activated	The restart interlock in the muting module takes over the <i>Reset</i> function.

When the function is activated, the status "Reset required" is indicated by the muting lamp blinking at a rate of 1 Hz.



WARNING

Observe the following safety instruction!

- Always configure an application with restart interlock! Make sure that there is always a restart interlock. The UE410 muting family cannot verify if the machine's restart interlock is connected.

If you deactivate both the internal and the external restart interlocks, you expose the plant operator to acute danger.

5.6.1 Reset

When you both activate the restart interlock (internal) and implement the restarting interlock of the machine (external), then each restart interlock must have its own button.

When the Reset button is operated (for the internal restart interlock), the safety outputs are activated in the modules UE410-MM and UE410-XM.

Then, only the external restart interlock prevents a restart of the machine. After pressing the reset button for the muting module, the operator must press the restart button for the machine. If the reset button and restart button are not operated in the order given, the dangerous state remains interrupted.

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Tab. 23: Reset without MDI

	Without MDI	Without EDM	With EDM
Manual reset			
Automatic reset			
Manual reset with override			
Automatic reset with override			

Recommendation With the aid of the reset button, you can eliminate unintentional operation of the external restart button. The user must first acknowledge the safe condition by pressing the reset button.

5.7 External device monitoring (EDM)

On reset, this static external device monitor checks whether the controlled relays have dropped out. The external device monitor can thus recognise if, for example, a pair of relay contacts have become welded. In such cases, the external device monitor switches the system to a safe condition. Then, the safety outputs are not re-activated.

6 Sub-systems and cascaded systems

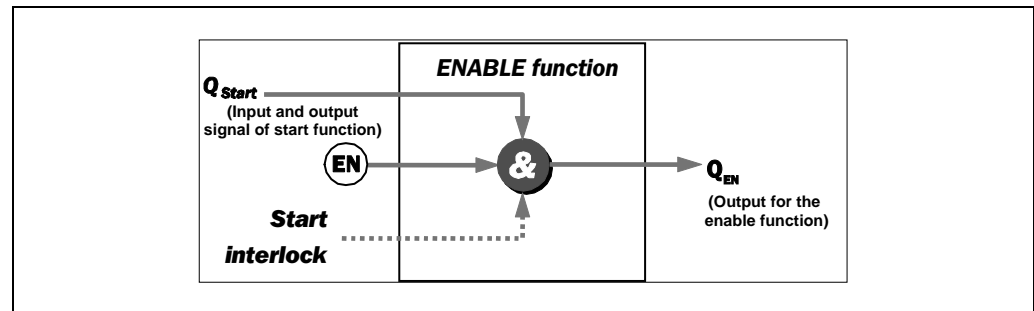


WARNING

In the case of single-channel wiring of a safety output (Q1–Q4) to a signal input (EN), Category 3 according to EN 954-1 is the best that can be achieved.

6.1 ENABLE input

Fig. 20: ENABLE input function



ENABLE input makes it possible to cascade safety circuits or to form sub-systems. ENABLE input has a higher ranking than all other input signals (sensors, muting).

Note Unused ENABLE inputs must be permanently connected to the supply voltage +U_B. When ENABLE input goes to LOW (0 V DC), the OSSDs (Q1 – Q4) always go to LOW as well, and, simultaneously, signals such as Reset and Muting are not recognised until ENABLE input is HIGH again.

Switching ENABLE off and then on again does not require a new Reset at the appropriate modules; the OSSDs (Q1 – Q4) go to HIGH.

For further information on sub-systems and cascading, see operating instructions UE410 Flexi (8011737) or go to www.ue410flexi.com.

7 Mounting and dismantling

This chapter describes how to mount modules of the UE410 Muting Modular Safety Controller.

After they have been mounted, the following steps are necessary:

- Making the electrical connections
- Configuration
- Checking the installation

7.1 Mounting the modules

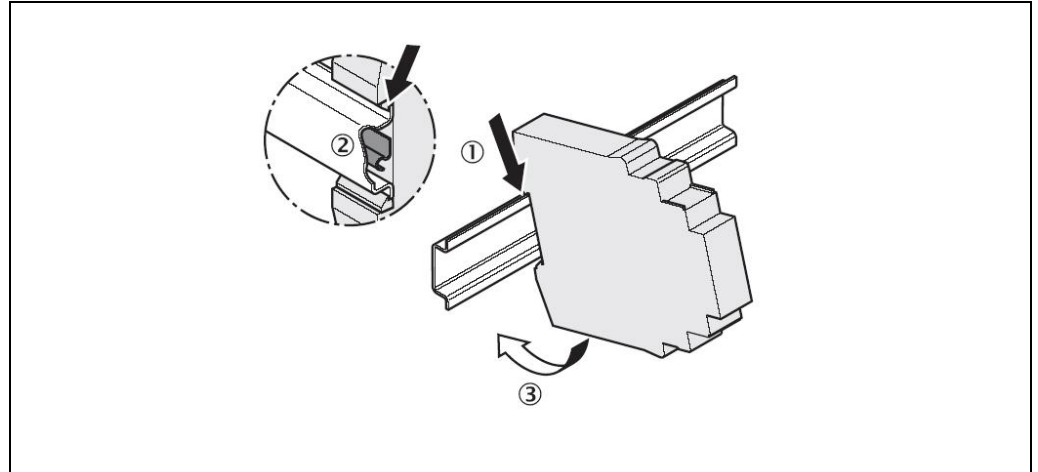


WARNING

The UE410 Muting system must be mounted in an enclosure with at least degree of protection IP 54.

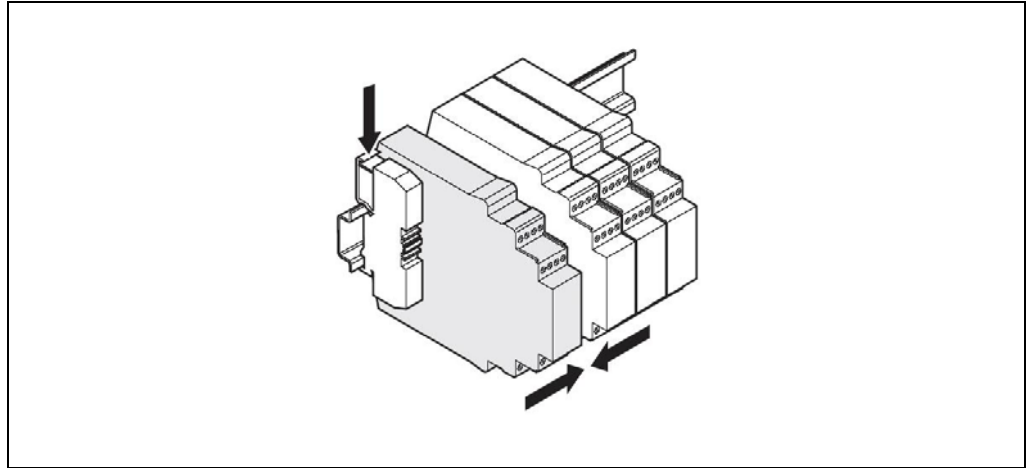
- In a UE410 Muting system the main module UE410-MM is installed at the extreme left, one of the optional Gateways, e.g. UE410-PRO, at the extreme right.
- Connections between the modules are by means of connectors integrated into the housings.
- The installation must comply with EN 50274.
- The modules are in 22.5 mm wide housings for installation on 35 mm standard DIN rails to EN 50022.

Fig. 21: Hook module on to the DIN rail



- Hook the top of the module on to the DIN mounting rail ①.
- Ensure that the grounding clip ② is correctly seated. The grounding clip of the module must have secure contact and good electrical conductivity to the DIN rail.
- Apply light pressure in the direction of the arrow to click the module on to the rail ③.

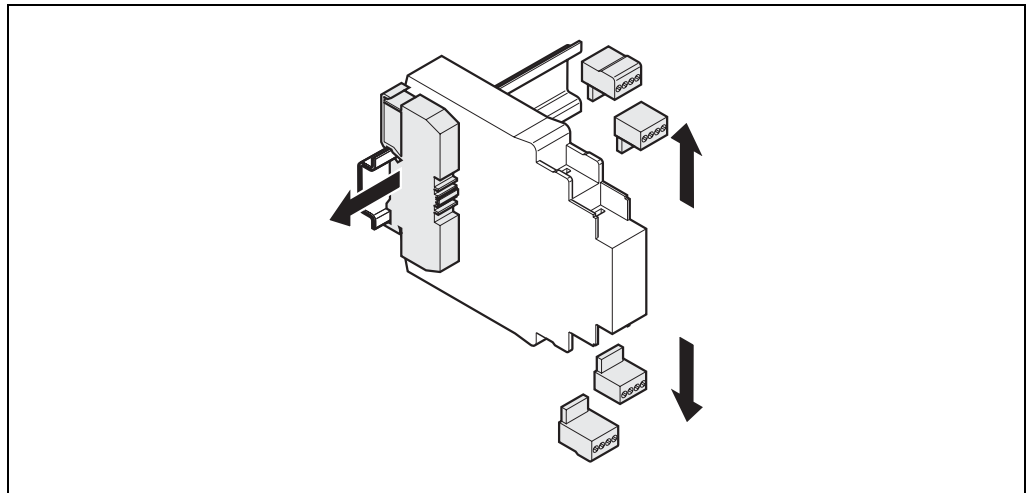
Fig. 22: Install end stops



- When several modules are used, slide the modules together in the direction of the arrows until the connectors between modules are fully engaged.
- Install end stops at each end of the module assembly.

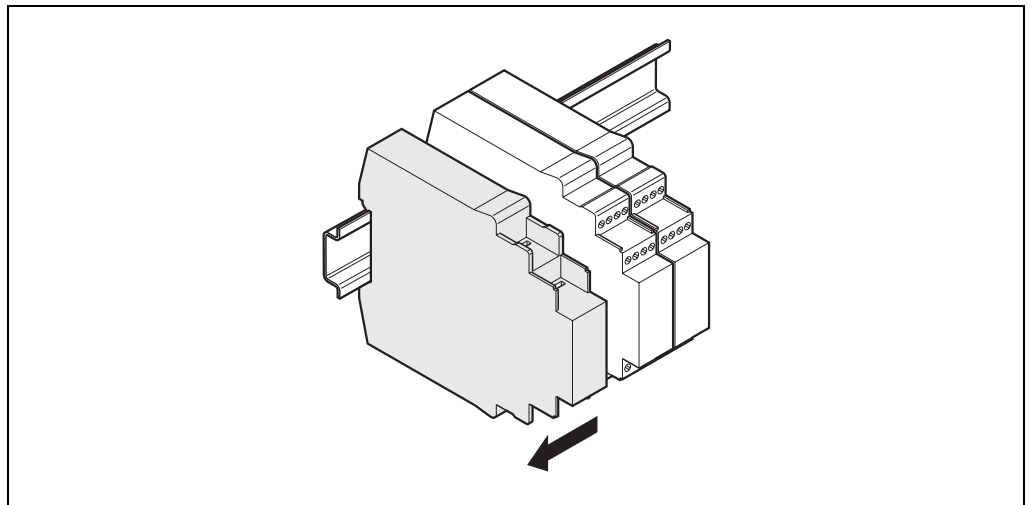
7.2 Dismounting modules

Fig. 23: Unplug the terminal blocks



- Unplug the terminal blocks with their wiring and remove the end stops.

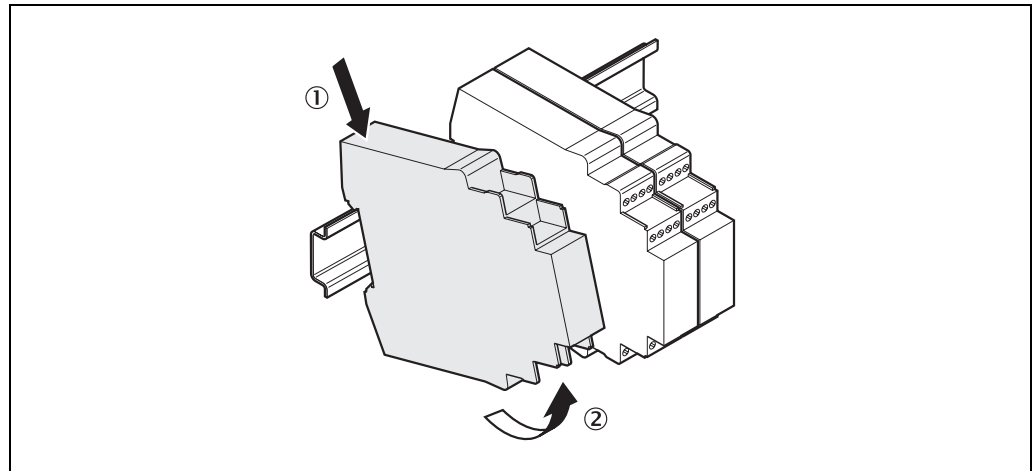
Fig. 24: Separate the connectors



- If there are several modules, slide them apart in the direction of the arrow until the connectors on the module sides have separated.

UE410 Muting

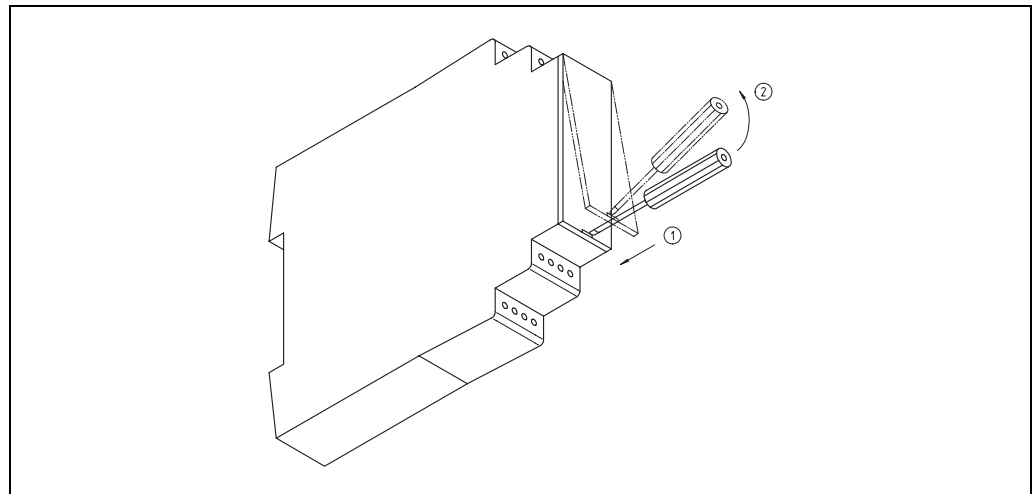
Fig. 25: Remove the module from the DIN rail



- Press the top of the module down ① at the rear and, while maintaining the pressure, rotate in the direction of the arrow to remove it from the DIN rail ②.

7.3 Removing the anti-manipulation cap

Fig. 26: Anti-manipulation cap



- Push a screwdriver into the opening ①.
- Move the screwdriver upwards to release the cap. The cap can then be removed ②.
- A cap can be replaced by just clicking it into its opening.

8 Electrical installation



WARNING

Disconnect the installation from the power supply!

While you are connecting the devices, the installation could start unintentionally.

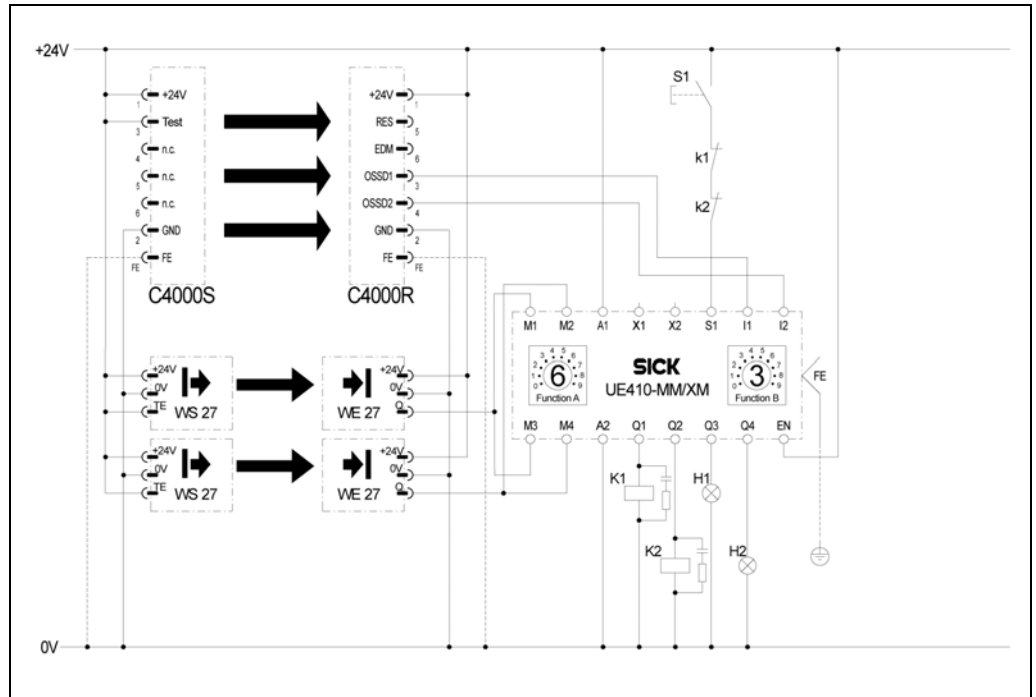
- Notes** The UE410 Muting Modular Safety Controller complies with EMC requirements for industrial applications as specified in EN 61000-6-2:2001.
- The control cabinet or housing for the UE410 Muting must have at least degree of protection IP 54.
 - The installation must comply with EN 50274.
 - To comply with EMC requirements, the DIN mounting rail must be connected with functional earth (FE).
 - You must connect the UE410 Muting to the same power supply as is used for the protective installation.
 - In accordance with EN 60204, the power supply must be capable of buffering a brief mains failure of 20 ms.
 - The voltage supply must satisfy safety extra-low voltage (SELV) and protective extra-low voltage (PELV) requirements in accordance with EN 60664 and DIN 50178 (electronic equipment for use in power installations).
 - The wiring to a reset button must be installed as a separate screened and sheathed cable.
 - All connected control elements, the subsequent controllers, their wiring and its installation must comply with the specified category to EN 954-1 or SIL3 to EN 61508 (e.g. protected wiring, individual sheathed cables with screening etc.).
 - To protect safety outputs and increase their operating life, external loads must be equipped, for example, with varistors or RC elements. However, it is important to note that some components will affect the response time of outputs.
 - The safety outputs, external device monitoring (EDM) and ENABLE (EN) inputs must be connected within the control cabinet.
 - External errors (e.g. cross-talk) between two modules within a UE410 Flexi system must be prevented by adopting appropriate measures (separate conduits, sheathed cables etc.).
 - Install the control element for Reset and/or Override outside the hazard zone so that it cannot be operated by a person who is inside the hazard zone. In addition, when operating the control element, the operator must have a complete and clear view of the hazard zone.
 - All 4 muting-sensor inputs must always be connected; for applications with only 2 muting sensors wire bridges must be installed between M1 and M3, and between M2 and M4.

UE410 Muting

9 Examples of applications and connections

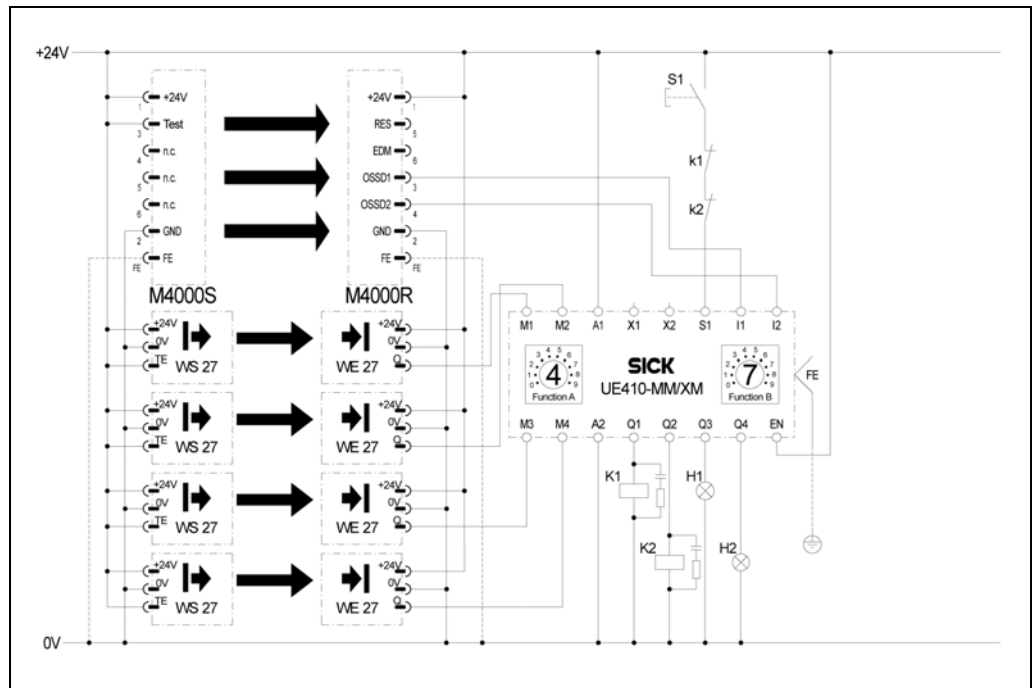
Note By taking into account all applicable boundary conditions and evaluating them in a failure mode effect analysis (FMEA), applications can satisfy up to SIL3 (IEC 61508).

Fig. 27: 2-sensor muting with C4000



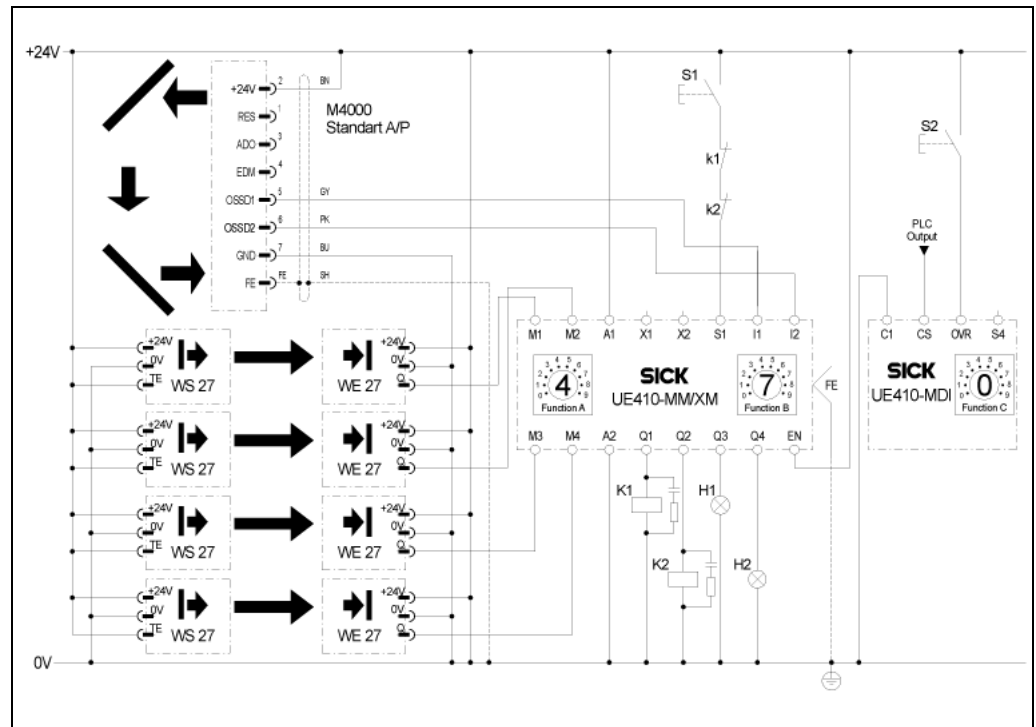
- Functions:
- External Device Monitoring (EDM)
 - S1: Manual Reset and Override
 - H1: lamp: Reset or Override required/Muting active
 - H2: lamp: Override required

Fig. 28: 4-sensor muting with M4000



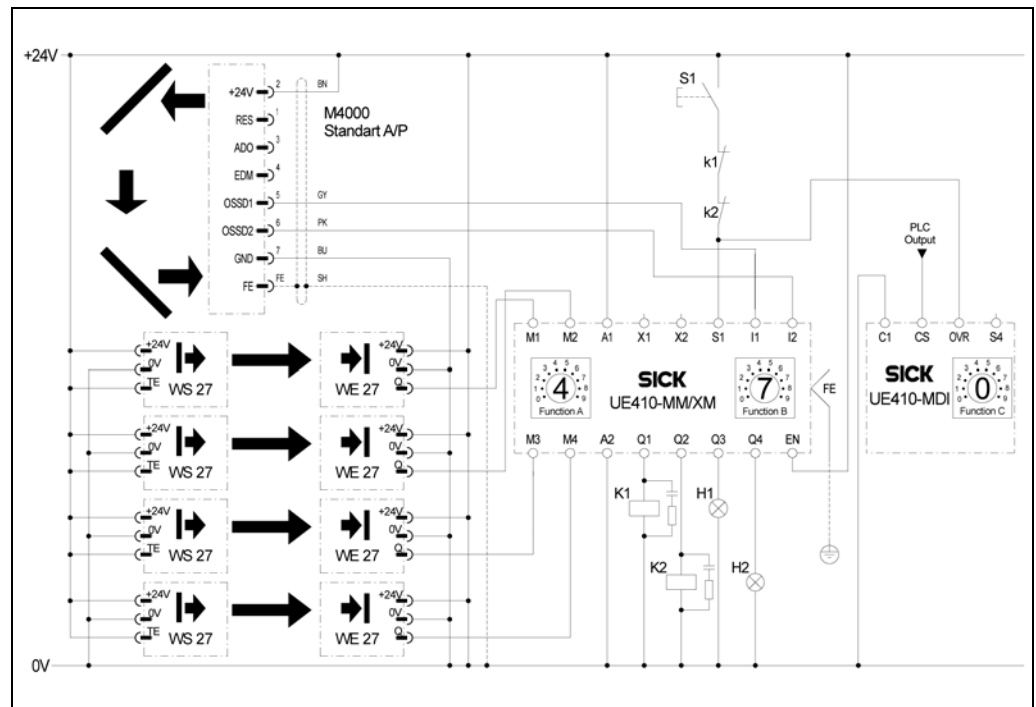
- Functions:
- External Device Monitoring (EDM)
 - S1: Manual Reset and Override
 - H1: lamp: Reset or Override required/Muting active
 - H2: lamp: Override required

Fig. 29: 4-sensor muting with M4000 A/P (Example 1)



- Functions:
- External Device Monitoring (EDM)
 - Conveyor stopped
 - S1: Manual Reset
 - S2: Override
 - H1: lamp: Reset or Override required/Muting active
 - H2: lamp: Override required

Fig. 30: 4-sensor muting with M4000 A/P (Example 2)



- Functions:
- External Device Monitoring (EDM)
 - Conveyor stopped
 - S1: Manual Reset and Override
 - H1: lamp: Reset or Override required/Muting active
 - H2: lamp: Override required

10 Commissioning



WARNING

No start-up without inspection by a competent person!

Before you commission a plant in which you are using a UE410 Muting Modular Safety Controller, the installation must be examined by a competent person and its release documented.



WARNING

Check the hazard zone!

Before start-up and commissioning, make absolutely certain that there is no one in the hazard zone.

- Check the hazard zone and secure it so that persons cannot enter (e.g. place warning signs, install a barrier, etc.). Observe applicable laws and local regulations.

10.1 Application acceptance

The machine may only be put into operation after a successful application for acceptance of the system. Acceptance of the system may only be carried out by suitably trained technical personnel.

Acceptance comprises the following points:

- Examining the machine to determine whether the components and associated connections are in accordance with the required category to EN 954-1 or IEC 61508;
- Checking that devices connected to the safety controller comply with the testing instructions in their operating instructions.

Note In the operating instructions for any ESPE from SICK AG, you will always find a section "*Tests before first commissioning*".

- Mark all wiring and plugs connected to the safety controller so that they cannot be confused.
- Perform a complete verification of the safety functions of the installation in all modes of operation, and carry out an error simulation. Pay particular attention to the response times of individual applications.
- Document the configuration of the installation completely (e.g. using UE410-PRO), including the individual devices and the results of safety testing.
- You will find software for documenting the configuration on the Internet at www.ue410flexi.com.

10.2 Testing instructions

10.2.1 Tests before first commissioning

The purpose of the tests before the first commissioning is to confirm the safety requirements specified in the national/international rules and regulations, especially in the Machinery Directive and the Work Equipment Directive (EU Conformity).

- Check the effectiveness of the protective installation mounted on the machine, in all selectable operating modes and functions.
- Make sure that the operating personnel for a machine fitted with a safety controller are instructed by a competent person before they are allowed to operate the machine. Instructing the operating personnel is the responsibility of the authority responsible for the machine.

10.2.2 Periodic testing

The UE410 Flexi muting system must be tested at regular intervals.



WARNING

To comply with the safety-relevant characteristics (see Chapter 13 *Technical data*) of SIL3 to IEC 61508, the following proof test must be carried out at least every 365 days:

- Switch off the power supply to the UE410 Flexi Muting system.
- Switch on the power supply to the UE410 Flexi Muting system.
- Verify that all the safety functions of the connected sensors are operating correctly.

10.2.3 Regular inspection of the protective installation by a competent person

- Check the system according to the valid national regulations within the time limits. The objective is to discover changes to the machine and manipulations of the protective installation since first commissioning.
- Each safety application must be checked daily or at the start of every shift for correct operation and detectable manipulations by an authorised and assigned person. In accordance with the safety performance requirements given in the *Technical data*, a complete check of function and wiring must be carried out at appropriate intervals.
- If any modifications have been made to the machine or the protective installation, or if the safety controller has been changed or repaired, then you must check the system again as specified in the checklist in the Annex.

UE410 Muting**10.3 Meanings of optical signals**

Tab. 24: LED signals

Signal	Meaning
Signals of MM/XM	
PWR on	Supply voltage OK
M1-M4, I1, I2 on	Appropriate inputs are active (High)
I1, I2 blink alternately	A procedure error has occurred at inputs I1, I2
M1, M2 blink alternately	A procedure error has occurred at inputs M1, M2
M3, M4 blink alternately	A procedure error has occurred at inputs M3, M4
M1, M3 and M2, M4 blink alternately	Procedure error of both pairs (wrong direction, missing muting condition. Also possible: concurrence error between the sensors of both pairs)
M1 or M2 blinks	Concurrence monitoring error, the input that reaches the "good" state too late blinks
M3 or M4 blinks	Concurrence monitoring error, the input that reaches the "good" state too late blinks
EN, S1 on	Appropriate input is active (High)
S1 blinks	Time for operation of the reset button has expired (only for restart interlock)
Q1, Q2 on	Appropriate output is active (High)
OVR REQ blinks	System is in Override-required condition and is waiting for the restart button to be pressed
ERR off	There is no error condition
Signals of MDI	
PWR on	Supply voltage OK
C1, CS, OVR	Appropriate inputs are active (High)
ERR off	There is no error condition

11 Configuration



WARNING

Check the configuration for the protective installation after every change!

- If you change the configuration, you must check that the protective installation is still effective. When checking the system, observe the testing instructions in the operating instructions for the protective device used.

For configuration of the UE410 Muting modules, you require:

- a screwdriver

11.1 Accepting system configuration

- Switch off the power supply to all main modules (terminals A1, A2);
- Use the screwdriver to set the rotary switches for the required functions on all system modules;
- Set up the control functions of the system by connecting the external devices at terminals S1 on MM/XM modules;
- With the ENTER button on main module UE410-MU/MM held down, switch on the power supply to all main modules.



WARNING

It is important that no connected RESET button is operated with the system in this condition!

- When the display ERR starts to blink, release the ENTER button within 3 seconds. The configuration is now stored, active, and protected against power loss.

Note

If the ENTER button is pressed for longer than 3 seconds, the whole system goes to the fault condition. The display ERR blinks (see also Section 12.3 [Error-LED displays \(ERR\)](#)).



WARNING

All subsequent changes to the circuits at S1 result in a lockout condition (ERR).

11.2 Configuration with the PROFIBUS-Master simulator

With the PROFIBUS-Master simulator, you can export diagnosis data, e.g. to an Excel file.

- Connect a UE410-PRO Gateway;
- Use a screwdriver to set the rotary switches for the required programs and functions on all system modules;
- Set up the control functions of the system by connecting the external devices at terminals S1 on all system modules;
- Connect the PROFIBUS-DP-Master simulator to the UE410-PRO;
- Read out the PROFIBUS-DP data (see operating instructions UE410 Gateway).

12 Diagnosis

12.1 Behavior in the event of an error



WARNING

Do not run the machine if you cannot clearly determine the cause of a fault!

Take the machine out of service if you are not certain of the cause of a fault or are not sure how to correct it.



WARNING

Perform a full function test after an error has been corrected!

After correcting a fault, carry out a complete function test.

The operating condition ERROR

After certain faults, and when there is a configuration error, the UE410 Muting goes to a safe condition. The ERR-LEDs on the individual modules of the safety controller indicate what type of error has occurred.

To put the device into service again, proceed as follows:

- Correct the cause of the fault as indicated by the ERR-LED display;
- Switch the power supply to the UE410 Muting off and on again.

12.2 SICK support







If you cannot remedy an error with the help of the information provided in this chapter, please contact your local SICK agency.

Note When you send a device to us for repair, it will be returned to you with our standard delivery settings. Please, therefore, note the configuration of your devices before you send them to us.

12.3 Error-LED displays (ERR)

This section explains what the ERR-LED displays mean and how you should react to them.

Tab. 25: Fault displays at ERR-LED

Display	Possible cause	How to correct the fault
Fault displays of MM/XM/MDI		
●	Sequence error. Error is not at this module	Eliminate the error at the respective module
2 x 	Error in module configuration	Repeat the configuration procedure
3 x 	Rotary switch manipulated	Turn the rotary switch back to the original position Carry out a power-up or repeat teach-in
4 x 	Change to the configuration (at S1-S3 or rotary switches) with power off, or slot list comparison has found a difference	Reset configuration to original state, or re-connect module to original position, or carry out a power-up and repeat teach-in
5 x 	Supply voltage defective	Check power supply
6 x 	Self-diagnostics, internal error, etc.	Carry out a power-up
7 x 	Maximum permissible number of override cycles exceeded	Check the muting arrangement and sensors

12.4 Anti-manipulation measures

Certain safety measures are incorporated as anti-manipulation measures to help eliminate misbehavior.

Tab. 26: Anti-manipulation measures

Reaction of the system	Cause	How to correct the fault
<ul style="list-style-type: none"> • Immediate disconnection of all outputs • System goes into status "System error" • Red ERR LED of the affected module blinks • Green PWR LED blinks • All other ERR LEDs are continuous red • Message via Gateway 	A rotary switch has been turned.	<ul style="list-style-type: none"> • Return the switch back to the old position (setting aid if voltage remains activated: flashing PWR LED changes to steady green). • Restart the system by switching the voltage off and on again.
<ul style="list-style-type: none"> • De-activation of the outputs of the system/subsystem during the next cycle • Red ERR LED of the respective module blinks • Message via diagnostics module 	Change in the control circuit configuration (Input S1)	<ul style="list-style-type: none"> • Reset the old configuration at S1. • Restart the system by switching off and on again.
<ul style="list-style-type: none"> • The last configurations are saved internally in non-volatile memory and can be read by the manufacturer if required. 	Intentional use of an incorrect configuration	<ul style="list-style-type: none"> • You can read out the last (correct) configuration using one of the UE410 Gateways. • Check the configuration visually at regular intervals.
<ul style="list-style-type: none"> • Outputs of the system cannot be activated • Red ERR LED of the main module (UE410-MM) blinks • All other ERR LEDs to steady red 	A rotary switch has been turned.	<ul style="list-style-type: none"> • Return the switch back to the old position (setting aid if voltage remains activated: flashing PWR LED changes to steady green). • Restart the system by switching the voltage off and on again.
<ul style="list-style-type: none"> • Outputs of the system/subsystem cannot be activated • Red ERR LED of the master module (UE410-MM) blinks • All other ERR LEDs are steady red 	Change in the control circuit configuration (Input S1)	<ul style="list-style-type: none"> • Reset the old configuration at S1. • Restart the system by switching off and on again.

For further information on anti-manipulation measures, see operating instructions UE410 Flexi (8011737) or go to www.ue410flexi.com.

13 Technical data

13.1 Data sheet

13.1.1 Module UE410-MM/UE410-XM

Tab. 27: Data sheet
UE410-MM/UE410-XM

	Minimum	Typical	Maximum
Supply circuit (M1, M2)			
Supply voltage U_B	19.2 V DC	24 V DC	30 V DC
	When using a UE410-2RO/4RO and the output current paths have loads: $U > 25 \text{ V AC}/60 \text{ V DC (PELV)}$ $U < 25 \text{ V AC}/60 \text{ V DC (SELV/PELV)}$		
Residual ripple U_{SS}	-	-	3 V
Power consumption	-	-	3 W
Maximum switch-on time	-	-	10 s
Short circuit protection	4 A gG with release characteristic B or C		
Input circuits (I1, I2, EN, S1, M1 - M4)			
Number of inputs	-	-	8
Input voltage HIGH	15 V DC	-	30 V DC
Input voltage LOW	-5 V DC	-	5 V DC
Input current HIGH	2.3 mA	3 mA	3.6 mA
Input current LOW	-2.5 mA	-	0.15 mA
Minimum switch-on time	70 ms	-	-
Minimum switch-off time	see Response time	-	-
Maximum inactive state without causing tripped condition	-	-	1 ms
Muting-on time	-	-	70 ms
Teach-in time, ENTER button UE410-MM see ¹⁾	-	-	3 s

Control outputs (X1, X2)			
Number of outputs	-	-	2
Output type	PNP semiconductor, short circuit protected, cross-circuit monitoring		
Output voltage	18 V DC	-	30 V DC
Output current	-	-	150 mA
Load capacity	-	-	1000 nF
Line resistance	-	-	100 ohm

UE410 Muting

	Minimum	Typical	Maximum
Output circuit (Q1, Q2, Q3, Q4)			
Number of outputs	-	4	-
Type of output	PNP semiconductor, short circuit protected, cross-circuit monitoring		
Switched voltage	18 V DC	-	30 V DC
Switched current	-	-	2 A
Switched current I _{sum}	-	-	3.2 A
Load capacity	-	-	500 nF
Length of cable (single, Ø 1.5 mm ²)	-	-	100 m
Response time (I1/I2) (when not in muting mode)	-	-	14 ms
Response time (EN) see ²⁾	-	-	13 ms
General system data			
Weight (not including packing)	-	0.18 kg	-
Electrical safety	Class III		
Electromagnetic compatibility	EN 61131-2 (Zone B), EN 61000-6-2, EN 55011 Class A		
Operating data			
Operating temperature	-25 °C	-	55 °C
Storage temperature	-25 °C	-	70 °C
Relative humidity	10 % to 95 %, non-dewing		
Climatic conditions	EN 61131-2		
Mechanical strength			
Vibration	EN 61131-2		
Vibration resistance (EN 60068-2-64)	5-500 Hz/5 grms		

Terminals and connection data			
Single or fine stranded wire	1 x 0.14 mm ² to 2.5 mm ² or 2 x 0.14 mm ² to 0.75 mm ²		
Fine stranded wire with terminal sleeves to EN 0815	1 x 0.25 mm ² to 2.5 mm ² or 2 x 0.25 mm ² to 0.5 mm ²		
Fine stranded wire with terminal sleeves to EN 46288	1 x 0.25 mm ² to 2.5 mm ² or 2 x 0.25 mm ² to 0.5 mm ²		
Insulation stripping length	-	-	8 mm
Maximum tightening torque	-	-	0.6 Nm
Functional safety to EN 954	-	-	Cat. 4

	Minimum	Typical	Maximum
Functional safety to EN 61508	-	-	SIL3
Safety-relevant characteristics			
These data refer to an ambient temperature of +55 °C.			
PFD	1.3 x 10 ⁻⁵		
PFH	3 x 10 ⁻⁹ h ⁻¹		
SFF	96 %		
DC	92 %		

⁽¹⁾ Only for UE410-MM module during power-up phase

⁽²⁾ Cascading/sub-systems

For further information on the output modules UE410-2RO/UE410-4RO, see operating instructions UE410 Flexi Standard at www.ue410flexi.com.

Activation times/deceleration times/response times	
Concurrence monitoring	3 s
Monitoring of total muting time	Min: 20 s Max.: 60 min Off: no monitoring
Sensor gap monitoring	200 ms
Conveyor stopped	3 s
Muting ended by ESPE	200 ms
Response time UE410 Muting	0.07 s

13.1.2 Special data UE410-MDI

The following data apply to the muting extension module UE410-MDI only. Otherwise, the general data in Section 13.1.1 apply.

Tab. 28: Data sheet
UE410-MDI

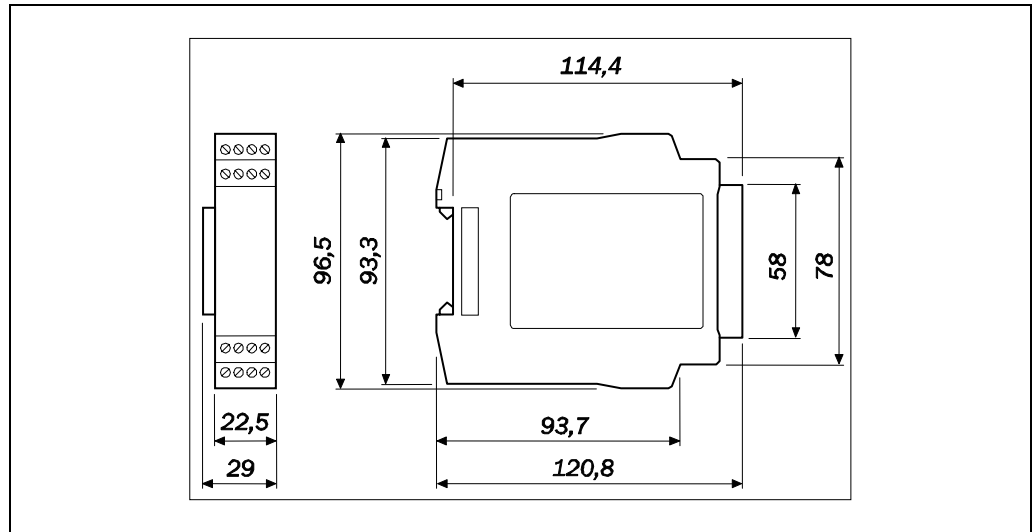
	Minimum	Typical	Maximum
Power consumption	-	-	1.8 W
Input circuit (C1, CS, OVR)			
Number of inputs	-	-	3
Input voltage (HIGH)	15 V DC	-	30 V DC
Input voltage (LOW)	-5 V DC	-	5 V DC
Input current (HIGH)	2,3 mA	3 mA	3.6 mA
Input current (LOW)	-2.5 mA	-	0.15 mA
Input response time	70 ms	-	-
General system data			
Weight (not including packing)	-	0.15 kg	-

UE410 Muting

13.2 Dimensions

13.2.1 Main module UE410-MM

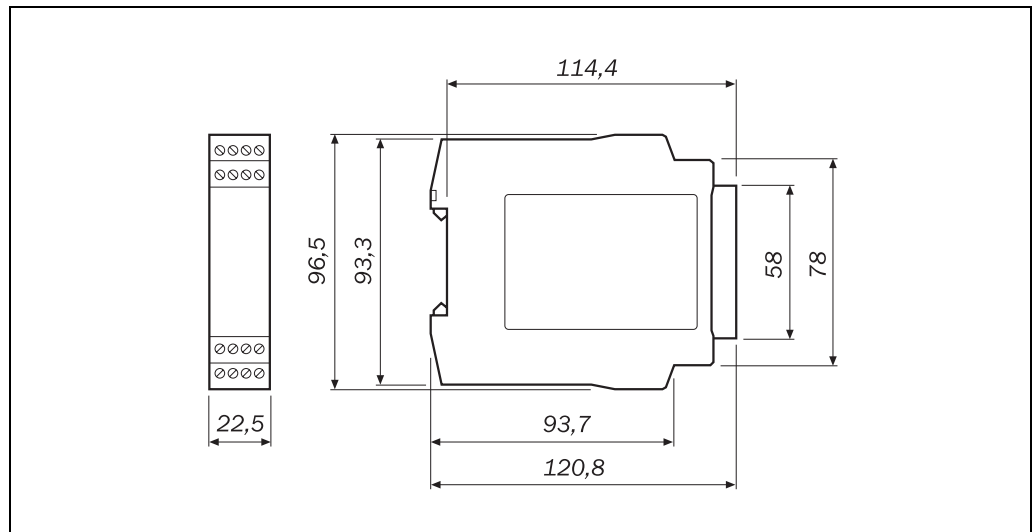
Fig. 31: Dimensions of UE410-MM



All dimensions in millimetres

13.2.2 Modules UE410-XM, MDI

Fig. 32: Dimensions of UE410-XM, UE410-MDI



All dimensions in millimetres

14 Ordering information

14.1 Available modules

Tab. 29: Part numbers of
UE410 Muting Modular
Safety Controllers

Model	Description	Part Number
Modules with coded screw terminals		
UE410-MM	Main module	6034482
UE410-XM	Module	6034483
UE410-MDI	Input extension module	6034484
Modules with double-deck spring terminals		
UE410-MM	Main module	6034645
UE410-XM	Module	6034646
UE410-MDI	Input extension module	6034647
Other modules		
UE410-PRO3	PROFIBUS-DP diagnosis module, plugs with screw terminals	6028407
UE410-DEV3	DeviceNet diagnosis module and 4 information signals, 24 VDC, plugs with screw terminals	6032469
UE410-CAN3	CANopen diagnosis module and 4 information signals, 24 VDC, plugs with screw terminals	6033111
UE410-PRO4	PROFIBUS-DP diagnosis module and 4 information signals, 24 VDC, plugs with spring terminals	6032678
UE410-DEV4	DeviceNet diagnosis module and 4 information signals, 24 VDC, plugs with spring terminals	6032679
UE410-CAN4	CANopen diagnosis module and 4 information signals, 24 VDC, plugs with spring terminals	6033112

14.2 Accessories and spare parts

14.2.1 Single-beam photoelectric safety switches (Type 2)

Tab. 30: Part numbers of single-beam photoelectric safety switches (Type 2)

Model	Description	Part Number
WS/WE12-2P460	Single-beam photoelectric safety switch WS/WE12-2P460, 24 V DC, operating range 10 m, PNP, device plug M12, 4- pin	1018047
WS/WE12-2P160	Single-beam photoelectric safety switch WS/WE12-2P160, 24 V DC, operating range 10 m, PNP, connection lead 2 m	1018046
WS/WE18-3P460	Single-beam photoelectric safety switch WS/WE18-3P460, 24 V DC, operating range 12 m, PNP, device plug M12, 4-pin	1026751
WS/WE24-2P250	Single-beam photoelectric safety switch WS/WE24-2P250, 24 V DC, operating range 40 m, PNP, terminal connections	1018049
WS/WE24-2P450	Single-beam photoelectric safety switch WS/WE24-2P450, 24 V DC, operating range 40 m, PNP, device plug M12, 4-pin	1018051
WS/WE24-2P260	Single-beam photoelectric safety switch WS/WE24-2P260, 24 V DC, operating range 40 m, PNP, terminal connections and heater	1018050
WS/WE24-2P460	Single-beam photoelectric safety switch WS/WE24-2P460, 24 V DC, operating range 40 m, PNP, device plug M12, 4-pin, heater	1018052
WS/WE27-2F460	Single-beam photoelectric safety switch WS/WE27-2F460, operating range 35 m, PNP, Q+Q, device plug M12, 4-pin	1019561
WS/WE27-2F450S05	Single-beam photoelectric safety switch WS/WE27-2F450S05, operating range 35 m, PNP, Q+Q, device plug M12, 4-pin, heater	1016025
WS/WE27-2F730	Single-beam photoelectric safety switch WS/WE27-2F730, with device plug, 7-pin	1015124
WS/WE27-2F750	Single-beam photoelectric safety switch WS/WE27-2F750 with device plug, 7-pin, heater	1015752
VS/VE18-204450	VS/VE18-204450 Single-beam photoelectric safety switch consisting of sender and receiver, PNP, NPN, Q, Q \bar{O} , device plug M12, 4-pin, operating range 16 m, metal housing	6011846
VS/VE18-204550	VS/VE18-204550 Single-beam photoelectric safety switch consisting of sender and receiver, PNP, NPN, Q, Q \bar{O} , device plug M12, 4-pin, angled, operating range 16 m, metal housing	6011845

14.2.2 Non-contact safety switches

Tab. 31: Part numbers of non-contact safety switches

Model	Description	Part Number
RE300-DA03P	Set consisting of sensor and actuator RE300, sensor with cable 3 m long	6025080
RE300-DA10P	Set consisting of sensor and actuator RE300, sensor with cable 10 m long	6025079
T4000-2DRNAC	Sensor T4000 Compact	6022052
T4000-1KBA	Actuator	5306531
DOL-1208-G10MA	T4000 Compact connecting cable M12 – 8-pin with cable 10 m long	6022152
IN40-D0101K	IN4000 Sensor Q40	6027389
IN40-D0202K	IN4000 Sensor M30	6027392
IN40-D0303K	IN4000 Sensor M18	6027391
DOL-1204-G10M	IN4000 connecting cable M12 – 8-pin with cable 10 m long	6010543

14.2.3 Safety light curtains, multiple light beam safety devices

Tab. 32: Safety light curtains, multiple light beam safety devices

Model	Description	Part Number
C4000	All variants	–
M4000	All variants	–
C2000	All variants	–
M2000	All variants	–
FGS	All variants	–
MSL	All variants	–

14.2.4 Muting lamp with cable

Tab. 33: Part numbers of muting lamps with cable

Model	Description	Part Number
–	Muting display lamp with mounting kit	2020743
–	LED-muting lamp with cable, 2 m	2019909
–	LED-muting lamp with cable, 10 m	2019910

14.2.5 Anti-manipulation cap

Tab. 34: Part number of anti-manipulation cap

Model	Description	Part Number
–	Anti-manipulation cap	5319789

15 Annex

15.1 Checklist for the manufacturer

SICK

Checklist for the manufacturer/installer for installation of the UE410 Muting Modular Safety Controller

The answers to the questions listed below must be available at least before first commissioning. They depend on the application, whose requirements the manufacturer/installer has to verify.

This checklist should be retained or included with the machine documentation, so that it can be used as a reference for the periodic tests and inspections.

- | | | |
|---|------------------------------|-----------------------------|
| 1. Were the safety regulations according to the valid directives and standards for the machine used as a basis? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 2. Are the directives and standards used listed in the declaration of conformity? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 3. Does the protective installation correspond with the category required? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 4. Are the necessary protective measures against electric shock effective (degree of protection)? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 5. Has the protective function been checked as specified in the testing instructions in this documentation? In particular: | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| <ul style="list-style-type: none"> • Function testing of the control elements, sensors and actuators connected to the safety controller • Testing of all switch-off paths | | |
| 6. Have measures been adopted to ensure that, after every configuration change, a complete check of the safety functions of the safety controller will be carried out? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

This checklist does not replace initial commissioning or regular inspections and tests by a competent person.

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