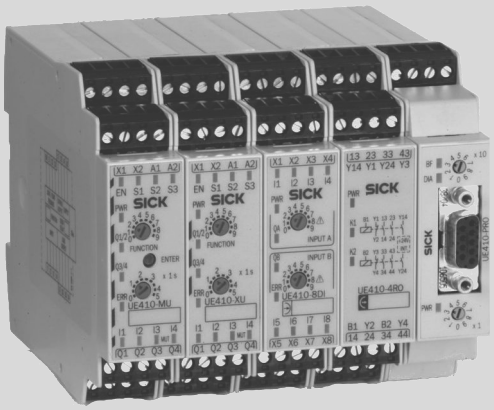
OPERATING INSTRUCTIONS

Flexi Classic

Safety controller

SICK
Sensor Intelligence.



Described product

Flexi Classic

Manufacturer

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Legal information

Original document

This document is an original document of SICK AG.

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1 About this document

1.1 Purpose of this document

These operating instructions are designed to address the technical personnel of the machine manufacturer or the machine operator in regards to safe mounting, configuration, electrical installation, commissioning, operation and maintenance of the Flexi Classic modular safety control.

These operating instructions do not provide instructions for operating machines on which the safety controller is, or will be, integrated. For information about this, refer to the operating instructions of the specific machine.

1.2 Scope

Product

These operating instructions are original operating instructions.

These operating instructions are valid for all Flexi Classic safety controller modules with the following type label entry in the Operating Instructions field: “E-01” or higher.

Document identification

Document part number:

- This document: 8011509
- Available language versions of this document: 8011562

You can find the current version of all documents at www.sick.com.

1.3 Target groups of these operating instructions

Some sections of these operating instructions are intended for certain target groups. However, the entire operating instructions are relevant for intended use of the product.

Table 1: Target groups and selected sections of these operating instructions

Target group	Sections of these operating instructions
Project developers (planners, developers, designers)	"Configuration", page 88 "Technical data", page 96
Installers	"Mounting", page 78
Electricians	"Electrical installation", page 81
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Configuration", page 88 "Commissioning", page 90 "Technical data", page 96
Operators	"Troubleshooting", page 92
Maintenance personnel	"Troubleshooting", page 92

1.4 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Indicates useful tips and recommendations.

Instructions to action

► The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.

✓ The check mark denotes the result of an instruction.

LED symbols

These symbols indicate the status of an LED:

○ The LED is off.
☼ The LED is flashing.
● The LED is illuminated continuously.

Symbols for sensors

Table 2: Sensor symbols

Icon	Sensors
	Electro-mechanical safety switches
	Emergency stop pushbutton
	Electro-sensitive protective equipment (ESPE)
	Testable sensors (e. g. photoelectric switches)
	Inductive safety sensors (e. g. IN4000)
	Two-hand operating panel (IIIA)

Icon	Sensors
	Two-hand operating panel (IIIC)
	Inching mode via two-hand operating panel (IIIA) (time limit 5 s)
	Muting lamp and Reset required lamp (not monitored) Lamp permanently ON: Muting active Lamp flashing 1 Hz: Reset required
	Pressure sensitive mats (4-wire system)
	Reset button
	Flexi Loop

Table 3: Module function symbols

Icon	Module functions
	Bypass function with electromechanical, dual-channel, equivalent switch (e.g. enabling switch), Bypass function limited to 60 s
	Muting station with two inputs for muting sensors
	Retriggering
	Monitored semiconductor output
	Off delay
	ENABLE (EN)

Table 4: Input assignment symbols

Icon	Input assignment
	Single channel N/C contact
	Single-channel N/C contact, cross-circuit detecting
	Single-channel N/C contact at two inputs
	Dual-channel N/C contact, equivalent, cross-circuit detecting, with monitoring of synchronization (1,500 ms)

Icon	Input assignment
	Dual-channel N/C contact, equivalent, cross-circuit detection
	Dualchannel N/C contact, equivalent
	Dual-channel N/C / N/O contact, complementary, cross-circuit detecting
	Dual-channel N/C / N/O contact, complementary, cross-circuit detecting, with monitoring of synchronization (1,500 ms), (e. g. magnetically coded switch RE300)
	Dual-channel semiconductor input, monitored (ESPE)
	Single-channel N/C contact/semiconductor input (e. g. testable sensors)
	Switching mats, pressure-sensitive (4-wire system)

Table 5: Logic symbols

Icon	Logic
	OR link
	AND link

2 Safety information

2.1 General safety notes

Product integration

DANGER
The product can not offer the expected protection if it is integrated incorrectly.

- ► Plan the integration of the product in accordance with the machine requirements (project planning).
- ► Implement the integration of the product in accordance with the project planning.

Mounting and electrical installation

DANGER
Death or severe injury due to electrical voltage and/or an unexpected startup of the machine

- ► Make sure that the machine is (and remains) disconnected from the voltage supply during mounting and electrical installation.
- ► Make sure that the dangerous state of the machine is and remains switched off.

Repairs and modifications

DANGER
Improper work on the product

A modified product may not offer the expected protection if it is integrated incorrectly.

- ► Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

2.2 Intended use

The Flexi Classic modular safety controller is a configurable controller for safety applications.

Opto-electronic and tactile safety sensors (e.g. light curtains, laser scanners, safety switches, sensors, emergency stop pushbuttons) are connected and logically linked to the modular safety controller. The corresponding actuators of the machines or systems can be switched off safely via the switching outputs of the safety controller.

The category according to ISO 13849 or the SIL according to IEC 61508 and IEC 62061 depend on the external wiring, the type of wiring, the choice of control switches and their arrangement on the machine.

The device corresponds to up to category 4 according to ISO 13849, applications can reach up to SIL3 according to IEC 61508 / IEC 62061 or PL e according to ISO 13849. The emergency stop function of the device corresponds to stop category 0 or 1 according to EN 60204--1.

To meet the safety-related parameters of SIL3 according to IEC 61508, the following proof testing must be performed at least every 365 days:

- The supply voltage of the Flexi Classic system must be switched off.
- The supply voltage of the Flexi Classic system must be switched on.
- All safety functions of all connected sensors must be verified.

The connected control switches or safety sensors as well as the routing must comply with the required category.

The Flexi Classic safety controller has been tested according to UL 508.

The product may be used in safety functions.

The product is only suitable for use in industrial environments.

The product must only be used within the limits of the prescribed and specified technical specifications and operating conditions at all times.

Incorrect use, improper modification or manipulation of the product will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

2.3 Requirements for the qualification of personnel

The product must be configured, installed, connected, commissioned, and serviced by qualified safety personnel only.

Project planning

You need safety expertise to implement safety functions and select suitable products for that purpose. You need expert knowledge of the applicable standards and regulations.

Mounting, electrical installation and commissioning

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Configuration

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Operation and maintenance

You need suitable expertise and experience. You must be instructed in machine operation by the machine operator. For maintenance, you must be able to assess if the machine is operating safely.

3 Product description

3.1 Specific features

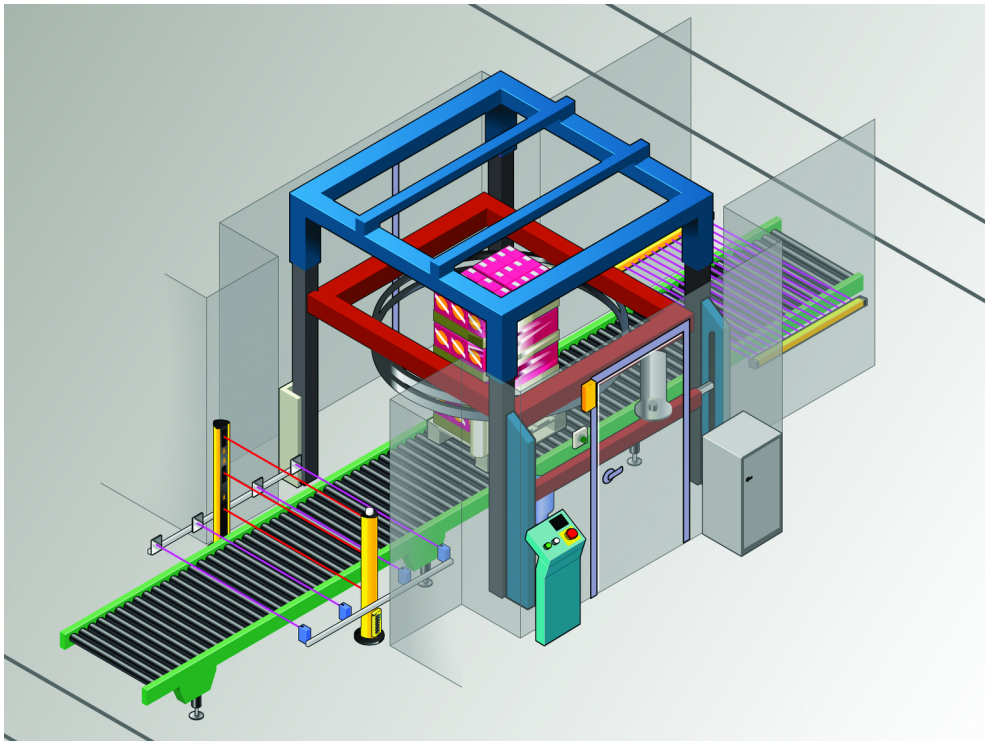


Figure 1: Flexi Classic modular safety controller

The Flexi Classic series is a safety controller concept comprising different modules that can be interconnected individually. This allows the system to be extended to up to 104 inputs or outputs.

Each of these modules has a compact width of 22.5 mm. The units are of plug-in style with communication between the individual units over an internal bus.

The required logic and function is specified by means of rotary switches on the modules. An exception thereof are the relay modules and the fieldbus modules that are used for integration in a higher level controller without a safety function. These modules are output units and have no effect on the logic set or the function of the upstream units.

The Flexi Classic series consists of the following modules:

- Main module UE410-MU
- Main module UE410-GU
- Input/output extension module UE410-XU
- Input expansion module UE410-8DI
- Output modules UE410-2RO and UE410-4RO
- Gateways, e. g.
  - UE410-PRO (PROFIBUSDP)
  - UE410-DEV (DeviceNet)
  - UE410-CAN (CANopen)
  - UE410-EN1 (EtherNet/IP)
  - UE410-EN3 (Modbus® TCP)
  - UE410-EN4 (PROFINET IO)

3.2 Design

A Flexi Classic system always consists of a single main module (UE410-MU or UE410-GU) and, if necessary, additional input and output extensions as well as a corresponding bus module.

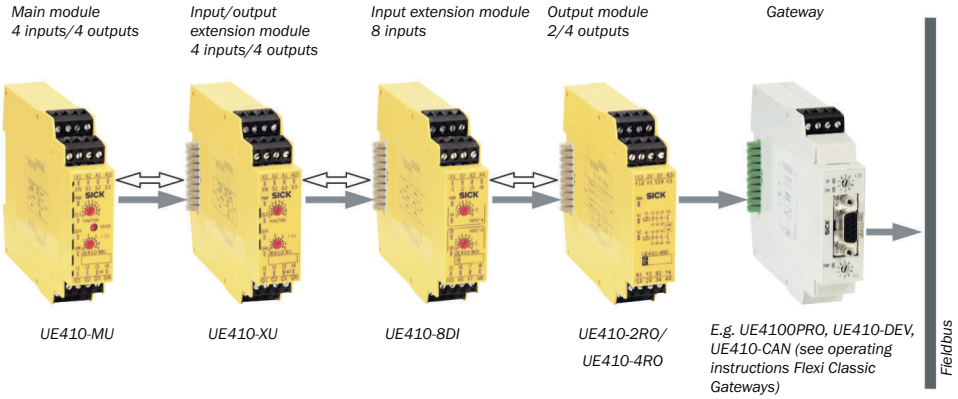


Figure 2: Flexi Classic safety controller system construction (example with UE410-MU)

3.2.1 Main module UE410-MU

The UE410-MU is the main module in which the system configuration of the entire Flexi Classic system is stored.

The UE410-MU has 4 safety inputs, 4 semiconductor outputs and 2 test outputs. The 9 programs that are available can be set by means of rotary switches that ensure the connection of a large number of safety components. Functions such as EDM, restart, etc. are selected by means of the wiring of S1, S2 and S3. The UE410-MU can control two applications acting independently as well as two applications that are dependent on each other.

The devices listed in the following can be connected to the UE410-MU and the modules connected to it:

- Emergency stop pushbutton
- Pressure sensitive mats
- Two-hand controllers
- Safety switches
- Non-contact safety switches (e.g. RE300, T4000 Compact, IN4000)
- Safety single-beam sensors (e.g. L21, L41)
- Safety light curtains and safety multibeam sensors (e.g. MSL, miniTwin, C/M2000, C/M4000)
- Safety laser scanners and safety camera sensors (e.g. S300, V300, S3000)

Typical applications such as muting and OR links can be implemented simply, depending on the setting of the program switch. If additional inputs or outputs are required, the UE410-MU can be supplemented with a UE410-XU input/output expansion module and/or one or several UE410-8DI input expansion modules.

If relay outputs are required, these can be implemented with the UE410-2RO/ UE410-4RO output modules.

3.2.2 Main module UE410-GU

The UE410-GU is a main module that can be used as an alternative to the UE410-MU. As in the UE410-MU, the system configuration for the entire Flexi Classic system is saved in the UE410-GU. The UE410-GU makes possible a global emergency stop function for several stations connected together that must each be equipped with a UE410-GU. A local emergency stop is also possible on each UE410-GU.

The UE410-GU has 4 safety capable inputs (I1-I4), 1 semiconductor output (Q1), 1 output for a lamp for “Global emergency stop status” and “Reset required” (Q2), 2 test outputs (X1, X2) and 2 inputs and 2 outputs for the global emergency stop function (I_P, I_N, O_P and O_N). The safe control inputs I5 and I6 are used to connect external device monitoring and a reset button. The 9 available programs can be set using a rotary switch and make it possible to connect a variety of safety components.

The following devices can be connected to the UE410-GU:

- Emergency stop pushbutton
- Interlock safety switch
- Non-contact safety switches (e.g. RE300, T4000 Compact)
- Safety single-beam sensors (e.g. L21, L41)
- Safety light curtains and safety multibeam sensors (e.g. MSL, miniTwin, C/M2000, C/M4000)
- Safety laser scanners and safety camera sensors (e.g. S300, V300, S3000)

If additional inputs are required, the UE410-GU can be supplemented with one or more UE410-8DI input expansion modules.

The UE410-GU can also be expanded with a UE410-XU. This module does not act on the global emergency stop.

If relay outputs are required, these can be implemented with the UE410-2RO/ UE410-4RO output modules.

NOTE
The UE410-GU does not support all data sets from all gateways.

3.2.3 Input expansion module UE410-8DI

The UE410-8DI module is an input expansion with 8 inputs that can be linked using the OR, AND or Bypass logic function to the respectively upstream UE410-MU, UE410-GU or UE410-XU module. The 9 switch settings of the UE410-8DI rotary switch determine which safety components can be connected to the UE410-MU/GU/XU and which type of logic is used. The input expansion module UE410-8DI acts exclusively on the next UE410-MU, UE410-GU or UE410-XU module positioned to the left in the module structure, thus forming a function group. It is allowed to connect a maximum of 8 UE410-8DI modules to a UE410-MU, UE410-GU or UE410-XU.

For more information, see "Grouping of subsystems", page 75.

3.2.4 Input/output extension module UE410-XU

The UE410-XU module is an input/output expansion module with 4 safety capable inputs, 4 semiconductor outputs and 2 test outputs. It has the same switch settings, logic functions and facilities for connecting sensors as the UE410-MU. In contrast to the UE410-MU and UE410-GU, the UE410-XU cannot store the system configuration.

NOTE

- A UE410-XU can only be operated in combination with a UE410-MU or UE410-GU main module.
- A main module and a UE410-XU can be linked logically with each other, thus forming a subsystem (for further information see section "Grouping of subsystems", page 75.

3.2.5 UE410-2RO/UE410-4RO output modules

The UE410-2RO/UE410-4RO output extensions make one or two dual-channel, contact-based outputs available. They do not have any influence on the specified logic instructions of a system construction and are controlled by the UE410-MU, UE410-GU or UE410-XU outputs.

3.2.6 Gateways

Gateways (fieldbus modules) can be added to the Flexi Classic modular system for diagnostic purposes. They output the system configuration and the input/output states as well as the error and status information of all the modules.

Several gateways are available, e. g.:

- UE410-PRO for PROFIBUSDP
- UE410-DEV for DeviceNet
- UE410-EN1 for EtherNet/IP

NOTE

The UE410-GU does not support all data sets from all gateways.

You will find a complete list of all gateways and the data sets supported in the operating instructions “Flexi Classic Gateways” or in the Internet on our homepage www.sens-control.com.

All gateways have 4 non-safe application diagnostic outputs. The outputs are short-circuit protected (see also the Flexi Classic Gateways operating instructions).

3.2.7 Module overview, adjustments and facilities for connecting sensors

Table 6: Module overview

Module	Description
UE410-MU	• Main unit of the Flexi Classic modular safety controller • 4 safe inputs and 4 safe outputs • Storage of the system configuration
UE410-GU	• Main unit of the Flexi Classic modular safety controller • Global emergency stop can be realized • 4 safe inputs • 1 safe output • Storage of the system configuration
UE410-XU	• Input/output extension/subsystem • 4 safe inputs and 4 safe outputs • Identical functionality as UE410-MU
UE410-8DI	• Input extension • 8 safe inputs • Information coupling to the upstream UE410-MU, UE410-GU or UE410-XU module
UE410-2RO	2 contacts (N/O), 1 signal contact (N/C)
UE410-4RO	4 contacts (N/O), 2 signal contacts (N/C)
Flexi Classic gateways e. g. UE410-PRO, UE410-DEV, UE410-CAN	Status and diagnostics (information that is not safety relevant) of a Flexi Classic system on a fieldbus (see Flexi Classic Gateways operating instructions)

Table 7: Overview of setting possibilities

Possibility of setting	Can be set at the module	Comments
ENTER pushbutton	UE410-MU/UE410-GU	Saving of all Flexi Classic system programs, settings and wiring
Program 1-9	UE410-MU/UE410-GU/ UE410-XU	Selection of the safety sensors and of the logic elements to be connected
Off delay 0-5 s, 0-50 s or 0-300 s	UE410-MU/UE410-XU	Delays 1 or 2 outputs on the module 3 different variants available (Not on UE410-xxxT0)
Switch setting 0-9	UE410-8DI	Selection of the logic elements and of the safety sensors to be connected

Table 8: Connection of sensors to the UE410-MU, UE410-XU and UE410-8DI

Sensor	Program			
	UE410-MU/UE410-XU		UE410-8DI	
	A (I1/I2)	B (I3/I4)	A (I1-I4)	B (I5-I8)
	7, 8	1, 2, 7, 8, 9	1, 6, 7	1, 6, 7
	7, 8	1, 2, 7, 8, 9	6, 7	6, 7
	1, 5, 6, 9	5, 6	2, 3, 8	2, 3, 8
	–	–	4	4
	2	–	5	5
	1	–	2	2
	3, 7, 8	1, 2, 7, 8, 9	6, 7	6, 7
	3, 7, 8	1, 2, 7, 8, 9	6, 7	6, 7
	3, 7, 8	1, 2, 7, 8, 9	6, 7	6, 7
	4	4	–	–
	–	5.2	–	–

Sensor	Program			
	UE410-MU/UE410-XU		UE410-8DI	
	A (I1/I2)	B (I3/I4)	A (I1-I4)	B (I5-I8)
	–	5.1	–	–
	2	–	5	5
	3	–	–	–
	1, 5, 6, 7, 8	1, 2, 6, 7, 8, 9	2, 3, 6, 7, 8	2, 3, 6, 7, 8
	3	–	1	1
	3	3	–	–
	1, 5, 6, 9	5, 6	2, 3, 8	2, 3, 8

3.3 Main module UE410-MU

The UE410-MU main module is the main module of the Flexi Classic modular safety controller. Only one UE410-MU can be integrated for each Flexi Classic system. A UE410-MU can control up to two applications acting independently or two applications that are dependent on each other.

In order to increase the number of inputs, one or more UE410-8DI extension modules can be used additionally.

An additional UE410-XU module can be used in order to increase the number of outputs (for further information refer to "Grouping of subsystems", page 75).

The system configuration is stored in the UE410-MU main module (ENTER pushbutton to accept the program settings and system configuration) (for further information refer to "Accepting the system configuration", page 88).

9 programs that can be set with a screwdriver at the program switch are available.

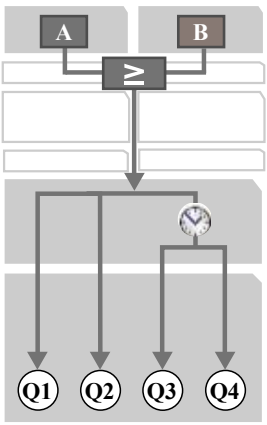


Figure 3: Scheme programs 1-3

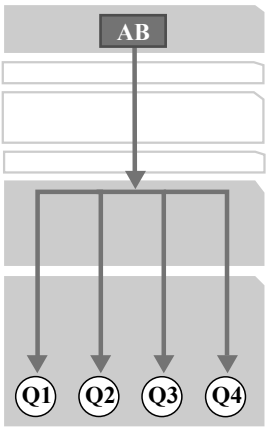


Figure 4: Scheme program 4

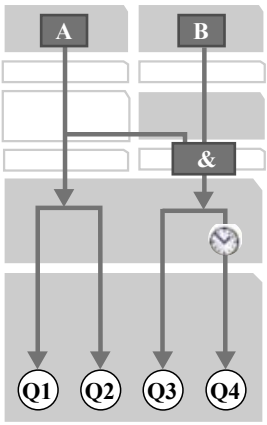


Figure 5: Scheme programs 5-7, 9

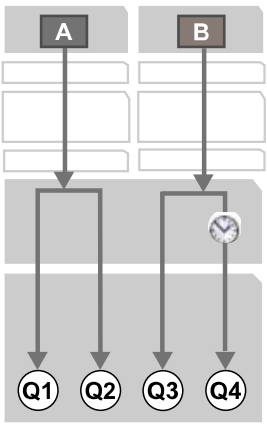


Figure 6: Scheme program 8

The following functions can be set by selecting the program and wiring the terminals S1, S2, and S3 at the module:

- Type of the logic and of the safety sensors to be connected
- Restart interlock
- External device monitoring (EDM)

Q1 and Q2 always switch off within the response time.

Using the lower rotary switch, you can select the switch-off delay Q3[1)] and Q4 (depending on the device variant 0-5 s; 0-50 s; 0-300 s; not on UE410-xxxT0).

NOTE
The outputs are tested periodically in order to detect errors in the safety outputs Q1-Q4. When using XU modules see section "Grouping of subsystems", page 75

For more information, see "UE410-MU/UE410-XU programs", page 36.

NOTE
Subsequent changes to the program or to the wiring (S1-S3) without saving will result in a safety-related shutdown.

1)) Q3 has various functions, see "UE410-MU/UE410-XU programs", page 36.

3.3.1 Operating elements and status indicators

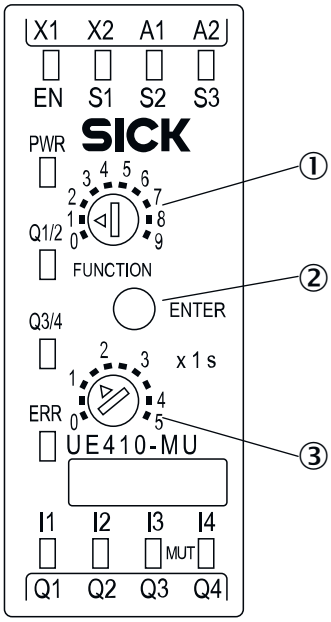


Figure 7: UE410-MU controls and status indicators

① Program switch

② Pushbutton for accepting the system configuration

③ Switch for switch-off delay (not for UE410-xxxTO)

Table 9: UE410-MU indicators

Display	Description
PWR (green)	Supply voltage on.
Q1/Q2, Q3/Q4 (green)	State of the safety outputs (high level)
Q3/Q4 (green flashing)	Q3/Q4 to high level during the course of the delay time
ERR (red flashing)	Indicator for erroneous operational status on this module, see "Troubleshooting", page 92
ERR (red)	Indicator for erroneous operational status on the whole system (the error is on another module), see "Troubleshooting", page 92
EN, S1-S3 (green)	Voltage applied.
I1–I4 (green)	Signal is present.
I1/I2 flash in phase	Cross-circuit between I1/I2
I3/I4 flash in phase	Cross-circuit between I3/I4
I1/I2 flash out of phase	Sequence error at I1 / I2
I3/I4 flash out of phase	Sequence error at I3 / I4
I1 to I4 flashes	Synchronization time/concurrence error, expected signal is not present at the respective input.
S1-S3 flashes	Expected signal is not present (e. g. EDM or Reset).
Other indicators	For device errors, see "Troubleshooting", page 92

Table 10: UE410-MU operating elements

Control element	Function
FUNCTION	10-step rotary switch (position 0 forbidden) for setting an input circuit function, see "UE410-MU/UE410-XU programs", page 36

Control element	Function
X1s, X10s, X1min[2)]	10-step rotary switch for setting the off delay time, see "UE410-MU/ UE410-XU programs", page 36
ENTER	Pushbutton for accepting the system configuration (Teach-in), see "Accepting the system configuration", page 88

3.3.2 Terminal assignment

Table 11: UE410-MU terminal assignment

Pin assignment	Description
I1/I2	Input for logic path A
I3/I4	Input for logic path B
EN	ENABLE input, activates the logic path(s)
S1	Input for reset buttons (RESET), restart interlock (EDM), retriggering, etc.
S2	
S3	
A1 (+U_B)	Voltage supply
A2 (GND)	
X1	Test outputs: cross-circuit detecting and short-circuit detecting control signals for controlling safety sensors[3)]
X2	
Q1–Q4	Monitored semiconductor outputs (OSSD)
Q3	Is used in Program 3 as the output for the muting lamp and Reset required.

3.3.3 Outputs

You have two possibilities to reach SIL3 or Category 4 for your application:

- Dual-channel connection of the outputs, e.g. Q1 / Q2 to K1 / K2
- Single-channel connection only when laid in protected areas such as in a control cabinet, e.g. Q1 to K1 / K2.

DANGER

Safety-relevant devices must be suitable for safety-relevant signal requirements!

Serious injury may occur due to breakdown of safety outputs or loss of required safety functions.

- Do not connect loads that exceed the rated value of the safety outputs.
- Wire the Flexi-Classic system so that 24-V DC signals cannot contact the safety outputs.
- Connect the GND wires of the voltage supply to earth so that the devices do not switch on when the safety output line is applied to frame potential.
- Use appropriate components or devices in accordance with regulations and standards.

Actuators at the outputs can be wired single-channeled. In order to maintain the respective Safety Integrity Level the wires have to be routed in such a manner that cross circuits to other live signals can be excluded, for example by routing them within protected areas such as in a control cabinet or in separate plastic-sheathed cables.

2) The maximum adjustable duration of the switch-off delay is 5, 50 or 300 s, depending on the device variant, see "Ordering information for modules", page 114

3) When using multiple modules, see "Grouping of subsystems", page 75.

3.4 Main module UE410-GU

The UE410-GU is a main module that can be used as an alternative to the UE410-MU. The system configuration is stored in the main module (for further information please refer to "Accepting the system configuration", page 88).

Only one UE410-GU can be used per Flexi Classic system.

In order to increase the number of inputs, one or more UE410-8DI extension modules can be used additionally.

An additional UE410-XU module can be used in order to increase the number of outputs (see "Grouping of subsystems", page 75). A total of up to 12 Flexi Classic modules and one gateway can be connected to the UE410-GU.

The UE410-GU makes possible a global emergency stop function for several stations connected together that must each be equipped with a UE410-GU. If the global emergency stop on a module is operated, the safety outputs on all modules switch off. To reset a global emergency stop, the reset button must be operated on the same module on which the global emergency stop was triggered.

NOTE
A global emergency stop must always be reset manually.

Along with the global emergency stop function, on each module it is also possible to select a local emergency stop function with or without restart interlock. The local emergency stop only acts on the safety output on the related module. A local emergency stop can be reset either automatically or manually.

The safety output Q1 always switches within the response time. A switch off delay as on the UE410-MU is not possible with the UE410-GU.

Different programs for the local inputs can be selected with the aid of a rotary switch. 9 programs are available using which the following functions can be set:

- Type of the safety sensors to be connected
- Global emergency stop or global and local emergency stop
- Automatic or manual reset of a local emergency stop

For more information, see "UE410-GU programs", page 47.

NOTE
Subsequent changes to the program will result in a safety-related shutdown without saving.

3.4.1 Operating elements and status indicators

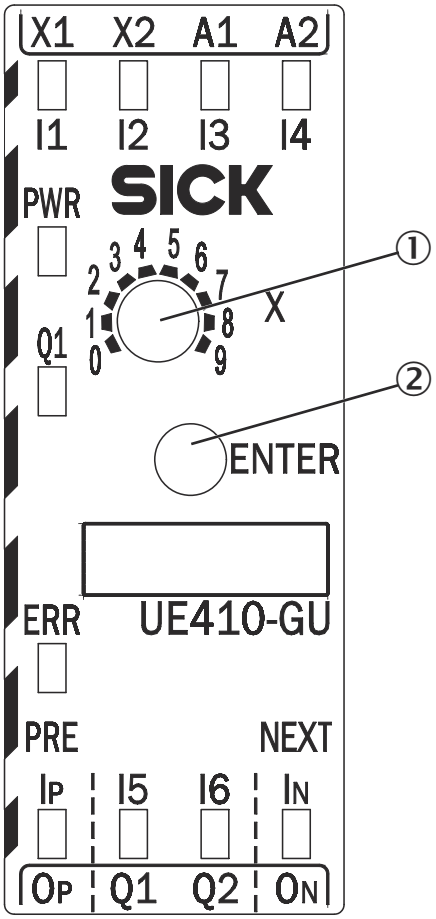


Figure 8: UE410-GU controls and status indicators

① Program switch

② Pushbutton for accepting the system configuration

Table 12: UE410-GU indicators

Display	Description
PWR (green)	Supply voltage on.
Q1 (green)	Safety output Q1 is high.
ERR (red flashing)	Indicator for erroneous operational status on this module, see "Troubleshooting", page 92
ERR (red)	Indicator for erroneous operational status on the whole system (the error is on another module), see "Troubleshooting", page 92
I1/I2 (green)	Global cut-off path closed
I3/I4 (green)	Cut-off path closed
I1/I2 (green flashing in phase)	Cross-circuit between I1/I2
I3/I4 (green flashing in phase)	Cross-circuit between I3/I4
I1/I2 (green flashing out of phase)	Sequence error at I1 / I2
I3/I4 (green flashing out of phase)	Sequence error at I3 / I4
I5 (green)	External device monitoring contact is closed.

Display	Description
I6 (green)	Reset button is closed.
I_P (green)	Input I_P is high.
I_N (green)	Input I_N is high.
Other indicators	For device errors, see "Troubleshooting", page 92

Table 13: UE410-GU operating elements

Control element	Function
X	10-step rotary switch (position 0 forbidden) for setting an input circuit function, see "UE410-GU programs", page 47
ENTER	Pushbutton for accepting the system configuration (Teach-in), see "Accepting the system configuration", page 88

3.4.2 Terminal assignment

Table 14: UE410-GU terminal assignment

Pin assignment	Description
I1/I2	Global emergency stop (equivalent switch with test pulses)
I3/I4	Local emergency stop (local input, depending on the program set)
A1 (+U_B)	Voltage supply
A2 (GND)	
X1	Test outputs: cross-circuit detecting and short-circuit detecting control signals for controlling safety sensors[4)]
X2	
Q1	Single-channel safety output (OSSD)
Q2	Connection for the lamp for “Global emergency stop status” and “Reset required”
I5	Connection for the external device monitoring (EDM)
I6	Connection for the reset button
I_P	Input signal from the previous module (PRE_IN)
I_N	Input signal from the next module (NEXT_IN)
O_P	Output signal to the previous module (PRE_OUT)
O_N	Output signal to the next module (NEXT_OUT)

3.4.3 Global emergency stop with the UE410-GU

The global emergency stop makes possible the simultaneous shut down of the safety outputs on several Flexi Classic stations connected together that are each equipped with a UE410-GU as the main module.

4) When using multiple modules, see "Grouping of subsystems", page 75.

NOTE

- In theory as many UE410-GU modules as required can be connected together to form a global emergency stop system. However, it is recommended not to exceed 32 modules, because each module increases the response time of the overall system (see the information on the global response time in section "UE410-GU module", page 100 of the technical data).
- The different UE410-GU modules that together form a global emergency stop circuit do not need to be in the same protected area. Errors in the O_X and I_X area, e.g. a short-circuit or cross circuit, are detected and will result in shutdown.
- All UE410-GU modules that are on a common global emergency stop cut-off path must be connected to the same GND connection.

Principle of operation

As long as the system is enabled, each UE410-GU sends a signal to the previous UE410-GU (PRE) and to the next UE410-GU (NEXT). If the global emergency stop is activated on a module (falling edge on I1/I2), then this module sets its safety output Q1 as well as the signals to its neighboring modules (outputs O_P and O_N) to low. The neighboring modules now also set their safety output Q1 as well as their outputs O_P and O_N to low.

The status of the global emergency stop is also output via the output Q2. If the global emergency stop is activated on this UE410-GU, this status is indicated with a signal flashing at 2 Hz on output Q2. If the global emergency stop has been activated on another UE410-GU, then this status is indicated with a continuous high on output Q2.

Once the cause of the global emergency stop has been rectified (inputs I1 and I2 are high again, e.g. protective field clear), then the UE410-GU on which the global emergency stop was originally triggered signals on output Q2 the status Reset required with a signal flashing at 1 Hz.

Reset

A global emergency stop can only be reset manually. The reset must be undertaken on the same module on which the global emergency stop was triggered.

Once the global cut-off path for this module is closed again (inputs I1 and I2 are high again, e.g. protective field clear) and the reset button on this module is then operated, the safety output Q1 on this module as well as the outputs O_P and O_N switch to high again.

The following conditions are to be noted for the reset:

- Only the falling edge is evaluated.
- The minimum actuation time for the reset button is ≥ 50 ms.
- The maximum actuation time for the reset button is ≤ 5 s.

If one of these criteria is not met, the emergency stop is not reset.

Wiring of the modules

To connect several UE410-GU modules together, the input I_N on the previous UE410-GU must be connected to the output O_P on the next UE410-GU and the output O_N on the previous UE410-GU must be connected to the input I_P on the next UE410-GU.

For the specification of the connection cables, please refer to the data sheet in "UE410-GU module", page 100.

The first and last UE410-GU in an emergency stop system act as end modules. An end module is a UE410-GU that has only one neighboring station. These modules are defined by the wiring of the outputs X1 and X2.

- The end module without PRE is defined by wiring X1 to I_P.
- The end module without NEXT is defined by wiring X2 to I_N.

This wiring is saved with the configuration and checked each time on switching on.

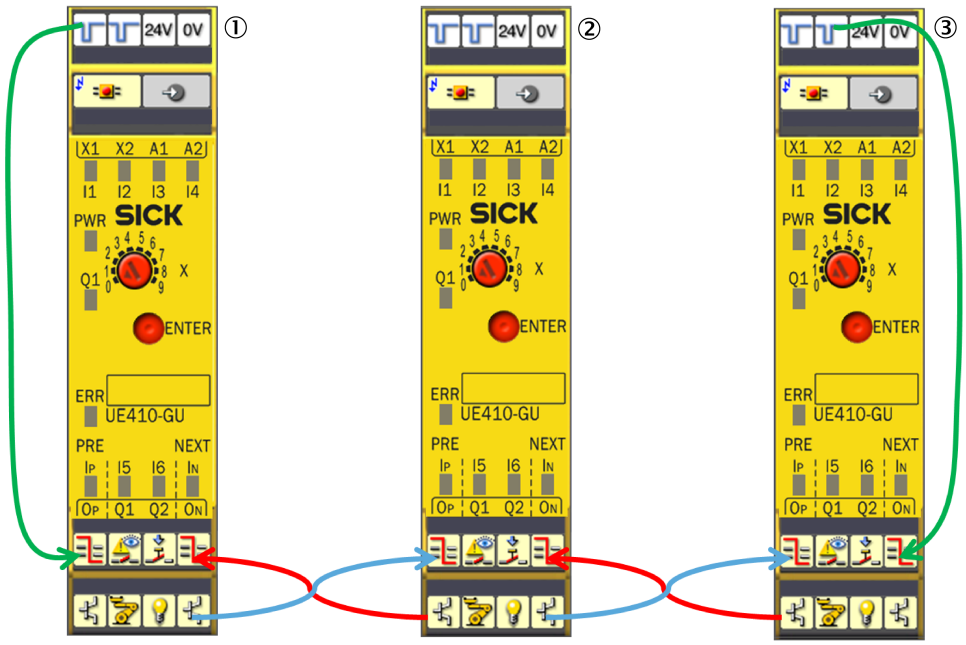


Figure 9: Connecting several UE410-GU modules

① First module
② Module(s) in the middle
③ Last module

DANGER
Test the entire emergency stop function after any change to the wiring!

If a UE410-GU is subsequently removed from an emergency stop system and the system is then correctly wired, this change will not be detected. For this reason the entire emergency stop function must always be tested after any change to the wiring.

Stand-alone operation of a UE410-GU

It is also possible to operate a UE410-GU as a standalone device. For this purpose X1 must be wired to I_P and X2 must be wired to I_N on this device.

3.4.4 Local emergency stop on the UE410-GU

A local emergency stop can be configured on each UE410-GU depending on the program set (see "UE410-GU programs", page 47).

Principle of operation

If the local emergency stop is activated on a UE410-GU (falling edge on I3 and/or I4, depending on the program set), this module sets its safety output Q1 to low. The signals O_P and O_N remain high, i. e. the local emergency stop only acts on the safety output on the UE410-GU on which the local emergency stop was triggered.

Once the cause of the local emergency stop has been rectified (inputs I3 and I4 are high again, e. g. protective field clear), the safety output Q1 on the module switches to high again after a successful reset.

Reset

A local emergency stop can be reset either manually or automatically depending on the program set:

- Automatic reset: Once the local cut-off path is closed again (e. g. protective field clear), then the safety output Q1 on the module also switches to high again.
- Manual reset: Once the local cut-off path is closed again (e. g. protective field clear), output Q2 starts to flash at 1 Hz. If the reset button is then operated, the safety output Q1 on the module switches to high again.

The following conditions are to be noted for the manual reset:

- Only the falling edge is evaluated.
- The minimum actuation time for the reset button is ≥ 50 ms.
- The maximum actuation time for the reset button is ≤ 5 s.

If one of these criteria is not met, the emergency stop is not reset.

3.4.5 Inputs

Connection of the emergency stop pushbutton for the global emergency stop (I1 and I2)

A two-pole equivalent safety switch must be connected to the inputs I1 and I2 as the emergency stop pushbutton for the global emergency stop. The emergency stop pushbutton is tested via the connection of X1–I1 and X2–I2.

Connection of the sensors for the local emergency stop (I3 and I4)

The sensors for the local emergency stop are connected to the inputs I3 and I4 (see "UE410-GU programs", page 47). The sensors are tested via the connection of X1–I3 and X2–I4.

Connection of the external device monitoring (EDM) (I5)

The external device monitoring (EDM) is connected to I5.

Before each enable it is checked whether I5 is high. If this condition is not met, the safety output Q1 is not set to high.

Connection of the reset button (I6)

The reset button must be connected to input I6.

Notes

NOTE

- The reset button acts both as a reset button for the global emergency stop and for the local emergency stop, if a program with manual reset is set for the local emergency stop (program 2, 4, 6 or 8) (see "UE410-GU programs", page 47).
- If a program with automatic reset is set for the local emergency stop, then the reset button only acts on a global emergency stop, i. e. if a global emergency stop has been triggered on the module and the module has the status Reset required.

3.4.6 Outputs

NOTE

Lay the single-channel connection in a protected area!

To achieve SIL3 or category 4, you must lay the single-channel connection Q1 to K1 / K2 such that cross-circuits to other electrical signals can be excluded, e.g. by laying in protected areas such as in a control cabinet or in separate plastic-sheathed cables.

DANGER

Safety-relevant devices must be suitable for safety-relevant signal requirements!

Serious injury may occur due to breakdown of safety outputs or loss of required safety functions.

- Do not connect loads that exceed the rated value of the safety outputs.
- Wire the Flexi Classic system so that 24 V DC signals cannot contact the safety outputs.
- Connect the GND wires of the voltage supply to earth so that the devices do not switch on when the safety output line is applied to frame potential.
- All UE410-GU modules that are on a common global emergency stop cut-off path must be connected to the same GND connection.
- Use appropriate components or devices in accordance with regulations and standards.

3.4.7 Connection of one UE410-8DI switch

A UE410-8DI acts on the cut-off path A/B on a UE410-GU as follows:

- Input A (I1-I4) ➜ QA acts on the global cut-off path.
- Input B (I5-I8) ➜ QB acts on the local cut-off path.

NOTE

An OR function or a bypass function that acts on the global cut-off path of the UE410-GU (switch setting 7 or 8, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

3.4.8 Power-up delay and response time of the UE410-GU

Power-up delay

The power-up delay of the UE410-GU is calculated as follows:

Power-up delay = local power-up delay + (N–1) × global power-up delay

where:

Local power-up delay	=	power-up delay for the module on which the emergency stop was triggered and reset
Global power-up delay	=	power-up delay of the other modules in the system
N	=	number of the UE410-GU modules in the system

You will find the values for the power-up delay on the data sheet in "UE410-GU module", page 100.

Response times

DANGER

Extended response time of the overall system on the usage of several UE410-GU modules!

In a system consisting of several UE410-GU modules connected together, the power-up delay and the response time are increased depending on the number of UE410-GU modules connected together. Take this aspect into account on planning your system. Otherwise the operator of the system will be in danger.

The response time of the UE410-GU is calculated as follows:

Response time = local response time + (N–1) × global response time

where:

Local response time	=	response time of the module on which the emergency stop was triggered
Global response time	=	Response time of the other modules in the system
N	=	number of the UE410-GU modules in the system

You will find the values for the response time on the data sheet in "UE410-GU module", page 100.

3.4.9 Diagnostics and troubleshooting for the UE410-GU

If a system with a global emergency stop function comprising several UE410-GU modules is either entirely or partially at the standstill, then you can determine which module has triggered the emergency stop as follows:

- Based on the LED indicators on any UE410-GU module in the system check whether the emergency stop has been triggered by this module or the direction of the module that has triggered the global or local emergency stop, see table 15.

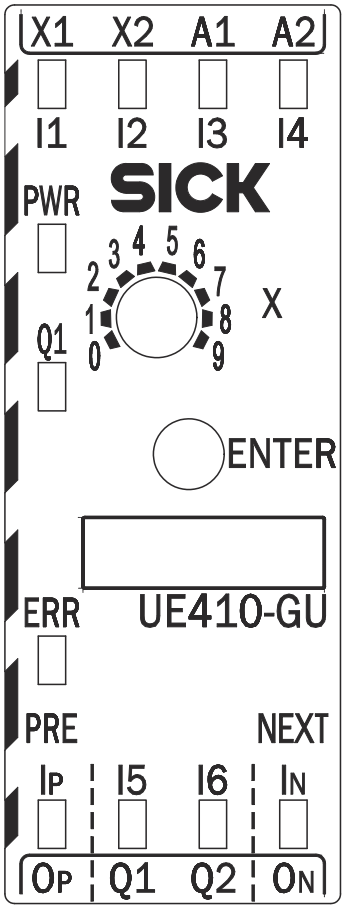


Figure 10: Diagnostic displays on UE410-GU

- Also pay attention to the lamp on output Q2 (“Global emergency stop status”, “Reset required”) on the related UE410-GU.

Table 15: Diagnostics on UE410-GU

Q1	I1/I2	I3/I4	I_P	I_N	Lamp Q2	Cause
○	●	○	●	●	○	A local emergency stop has been triggered on this station.
○	●	X	○	X	●	A previous station has triggered a global emergency stop.

Q1	I1/I2	I3/I4	I_P	I_N	Lamp Q2	Cause
○	●	X	X	○	●	A next station has triggered a global emergency stop.
○	○	X	X	X	☼●	A global emergency stop has been triggered on this station.
○	●	●	●	●	☼	Reset is required on this station.
●	●	●	●	●	○	The safety output on the module is active and the system enabled.

● The LED or lamp is illuminated constantly.
☼● The LED or lamp is flashing (1 Hz).
☼☼● The LED or lamp is flashing (2 Hz).
○ The LED or lamp is off.
X Any

NOTE
A combination of several causes may occur, e. g. if a local emergency stop and a global emergency stop have been triggered.

LED I5 and I6 indications

In normal operation with safety output Q1 active the LEDs I5 and I6 are ○ **Off**.

Table 16: Significance of the diagnostics LEDs I5 and I6 on the UE410-GU

LED	Meaning
I5 illuminates ● **Green**	The safety output Q1 is shut down, the external actuators have dropped out. Otherwise check the wiring.
I5 flashes ☼ **Green**	EDM error. Check the wiring. If necessary, replace the actuator.
I6 illuminates ● **Green**	The reset button is pressed. Otherwise check the wiring.
I6 flashes ☼ **Green**	The reset button was pressed too long. Check the wiring if necessary.

Also note the description of the LED indicators on the UE410-GU in "Operating elements and status indicators", page 24 as well as "Troubleshooting", page 92.

3.5 UE410-SD main module

The UE410-SD is a main module for use in the Safeguard Detector safety system (see operating instructions 8026274). The UE410-SD main module can only fulfill safety-related tasks as part of the safety system.

UE410-SD is used as a standalone module.

3.5.1 Status indicators

Table 17: Status indicators of the UE410-SD

Display		Description
PWR	Off	No supply voltage
	Green	Supply voltage is on
Q1	Off	Safety outputs Q1/Q2 are ow
	Green	Safety outputs Q1/Q2 are high
RES REQ	Flashing green (1 Hz)	Reset required after interruption
	Flashing green (2 Hz)	Reset required after sequence error or discrepancy error

Display		Description
ERR	Flashing red	Error, see table 40, page 93
	Red	Error, see table 40, page 93
I1	Green	Operating mode with sensor pair A
	Off	Operating mode with sensor pair A and sensor pair B
I2	Green	Output Q3 is configured for the connection of a higher-level control (high)
	Off	Output Q3 is configured for connection of a signal lamp (low)
I3	No function	
I4	Flashing green	Reset pushbutton fault
	Green	Reset pushbutton and EDM closed
I5 / I6	Green	Sensor pair A active (object detected)
	Off	Sensor pair A switched off
	Flashing green in push-pull	Sequence error or discrepancy error at sensor pair A
I7 / I8	Green	Sensor pair B active (object detected)
	Off	Sensor pair B switched off
	Flashing green in push-pull	Sequence error or discrepancy error at sensor pair B

3.5.2 Terminal assignment

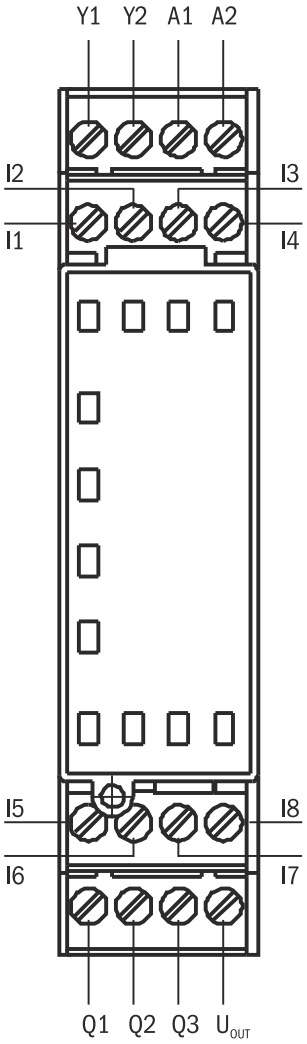


Figure 11: Terminals of the UE410-SD

Table 18: Terminals of the UE410-SD

Assignment	Description
I1	**Selection of the operating mode** • U_B to I1: Only sensor pair A active • Open: Sensor pair A and sensor pair B active
I2	**Configuration for output Q3** • U_B to I2: Higher-level control at Q3 • Open: **Reset required** indicator light at Q3
I3	No function
I4	Connection for reset pushbutton
A1 (+ U_B)	UE410-SD voltage supply
A2 (GND)	
Y1	Application diagnostic output for sensor pair A
Y2	Application diagnostic output for sensor pair B
Q1 / Q2	Safety outputs (OSSD)
Q3	Connection for **reset required** indicator light or connection to a higher-level control

Assignment	Description
U_{OUT}	Voltage supply of sensors
I5 / I6	Connection of sensor pair A
I7 / I8	Connection of sensor pair B

3.5.3 Wiring the inputs

Connecting the sensors

The sensors must be connected in a voltage-free state (U_V = 0 V).

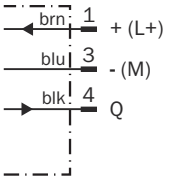


Figure 12: Connection diagram of Safeguard Detector photoelectric proximity sensor

PNP: load => M

- Sensor pair A must be connected to inputs I5/I6.
- Sensor pair B must be connected to inputs I7/I8.

Preventing cross-circuits using separate sensor cabling

A cross-circuit between the cables of the sensor to the SICK safety evaluation module may not be detected by the SICK safety evaluation module in some circumstances and must therefore be prevented by suitable measures when laying or selecting cables.

Selection of the operating mode

- Operating mode with one sensor pair: If only sensor pair A (I5/I6) is to be used, then I1 must be connected to U_B. LED I1 lights up continuously in this case.
- Operating mode with two sensor pairs: If both sensor pair A (I5/I6) as well as sensor pair B (I7/I8) are to be used, I1 may not be connected. LED I1 is continuously off in this case.

Connecting the reset pushbutton

The reset pushbutton must be connected to input I4.

Connecting the external device monitoring (EDM)

The external device monitoring (EDM) is connected in series to the reset pushbutton at I4.

3.5.4 Wiring the outputs

DANGER
Safety-oriented devices must be suitable for safety-related signals!

A functional interruption of safety outputs leads to the loss of the safety functions, meaning there is the risk of serious injury.

- Do not connect any loads that exceed the nominal values of the safety outputs.
- Wire the UE410-SD so that 24 V DC signals cannot contact the safety outputs.
- Connect the GND lines of the voltage supply to ground so that the devices do not switch on if the safety output line is at ground potential.
- The UE410-SD, the sensors and the connected protective devices must be connected to the same GND connection.
- Use suitable components and devices that meet all applicable regulations and standards.

NOTE
In order to detect errors in safety outputs Q1/Q2, the outputs are tested periodically.

3.6 UE410-XU module

The UE410-XU module is an input/output extension or a subsystem with 4 safe inputs and outputs. It has the **identical** functionality to the UE410-MU main module, however without the system save using the ENTER pushbutton.

The UE410-XU cannot be used as a stand-alone device and always requires a UE410-MU main module.

3.6.1 Operating elements and status indicators

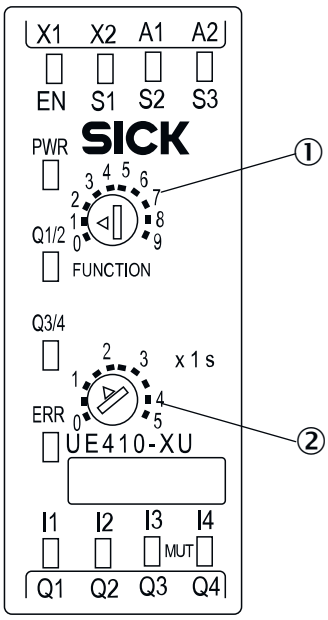


Figure 13: UE410-XU controls and status indicators

① Program switch

② Switch for switch-off delay (not for UE410-xxxTO)

Indicators, controls and terminal assignments are the same as on the UE410-MU main module (see (table 9–table 11).

3.7 UE410-MU/UE410-XU programs

The modules have 9 settable programs each that can be set via a rotary switch.

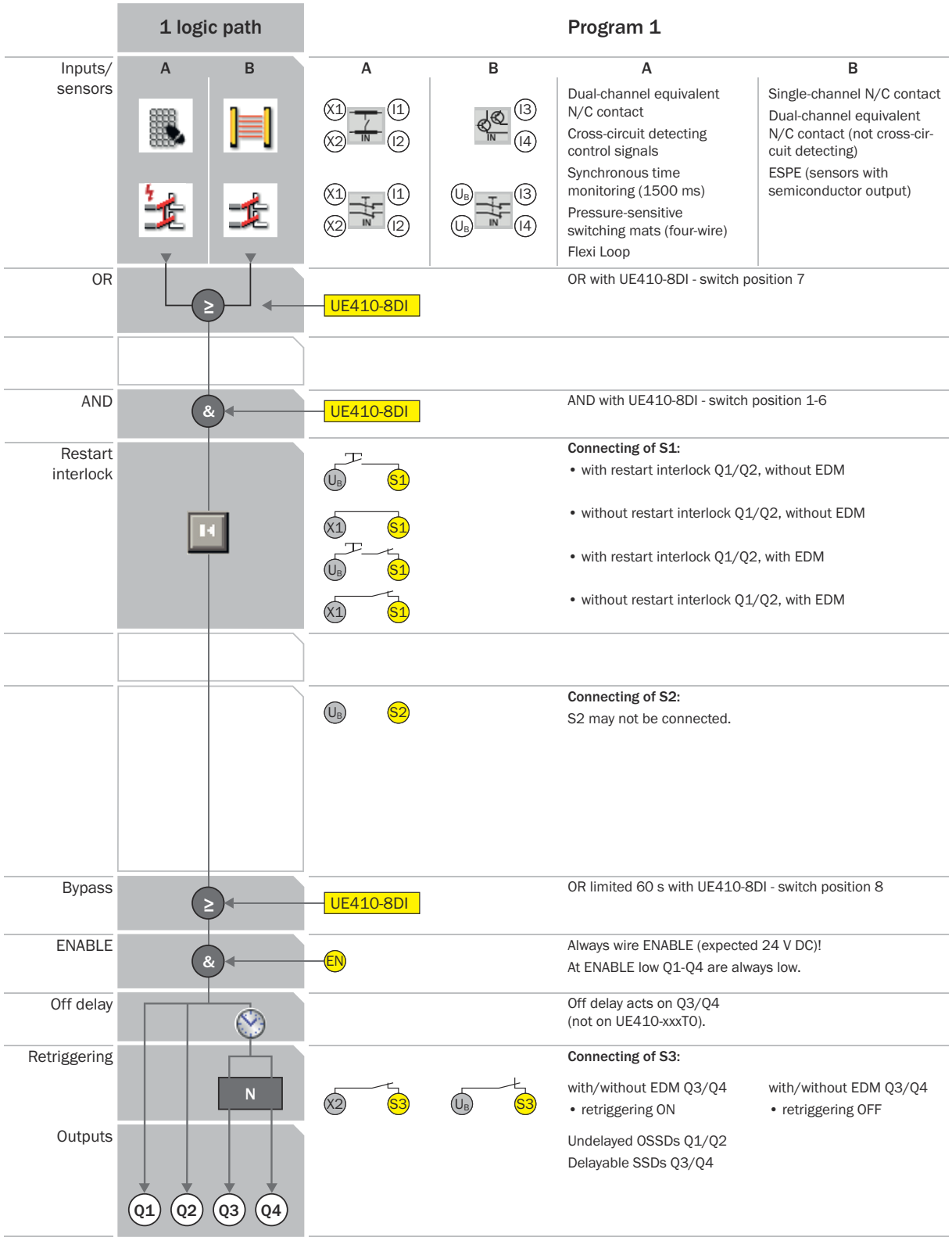
Up to two applications acting independently or two applications that are dependent on each other (A and B) can be controlled. These can act independently or dependent on each other, depending on the program (see figure 3 till figure 6).

The program selection determines the type of safety sensor equipment to be connected **and** logic instructions.

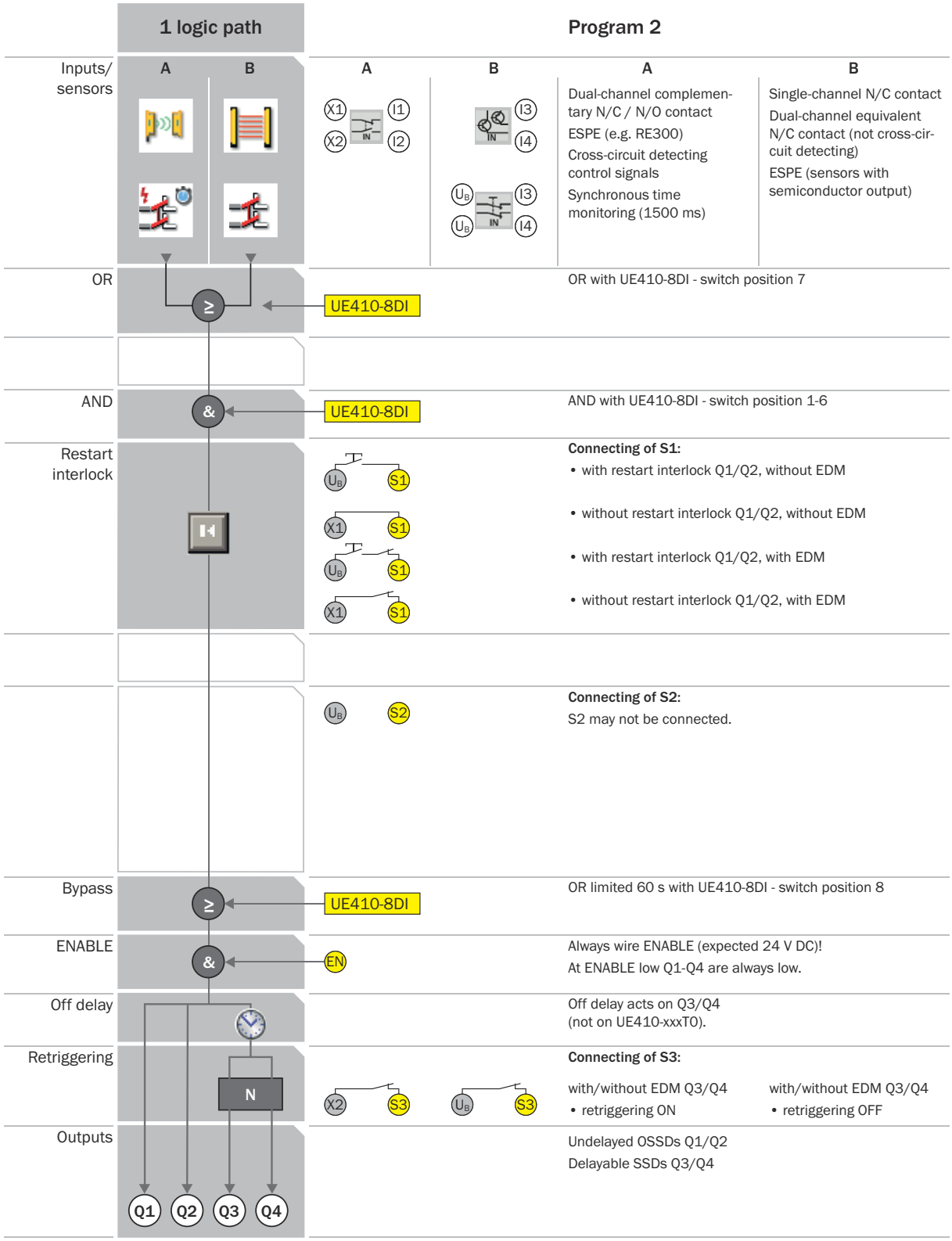
Table 19: UE410MU/UE410-XU programs

Program	Description
0	Module inactive
1-2	Input control circuit A is linked by means of OR logic to input control circuit B and acts on all the safety outputs Q1-Q4.
3.1–3.2	• Input control circuit A acts on the safety outputs Q1, Q2, Q4. • Input control circuit B is muting input and controls the muting lamp via Q3.
4	Input control circuit AB acts on all the safety outputs AB (two-hand IIIC).
5–7	• Input control circuit A acts on both safety outputs Q1/Q2 and Q3/Q4. • Input control circuit B acts only on the safety output Q3/Q4.
8	• Input control circuit A acts only on the safety output Q1/Q2. • Input control circuit B acts only on the safety output Q3/Q4.
9	• Input control circuit A acts on both safety outputs Q1/Q2 and Q3/Q4. • Input control circuit B acts only on the safety output Q3/Q4.

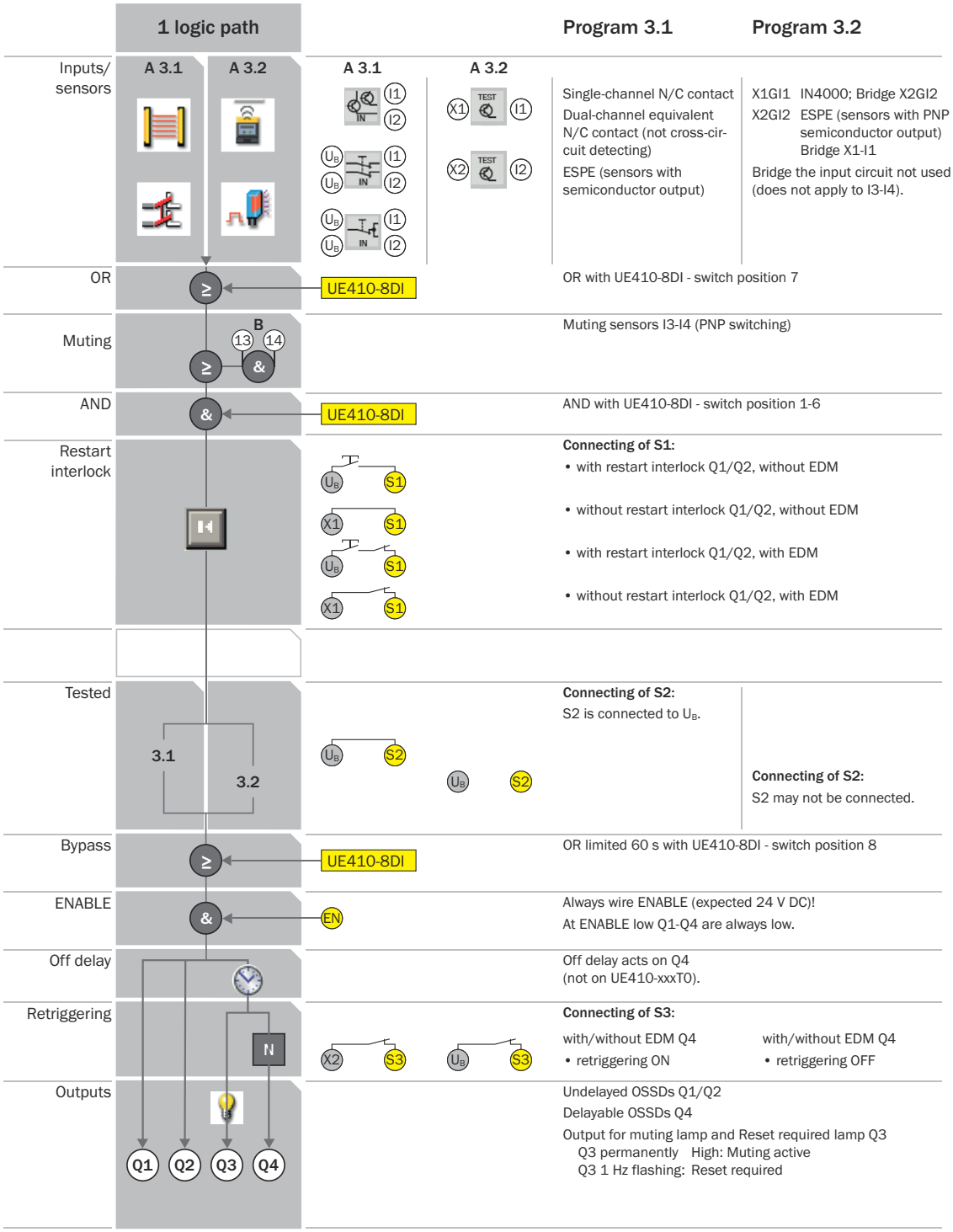
3.7.1 Program 1



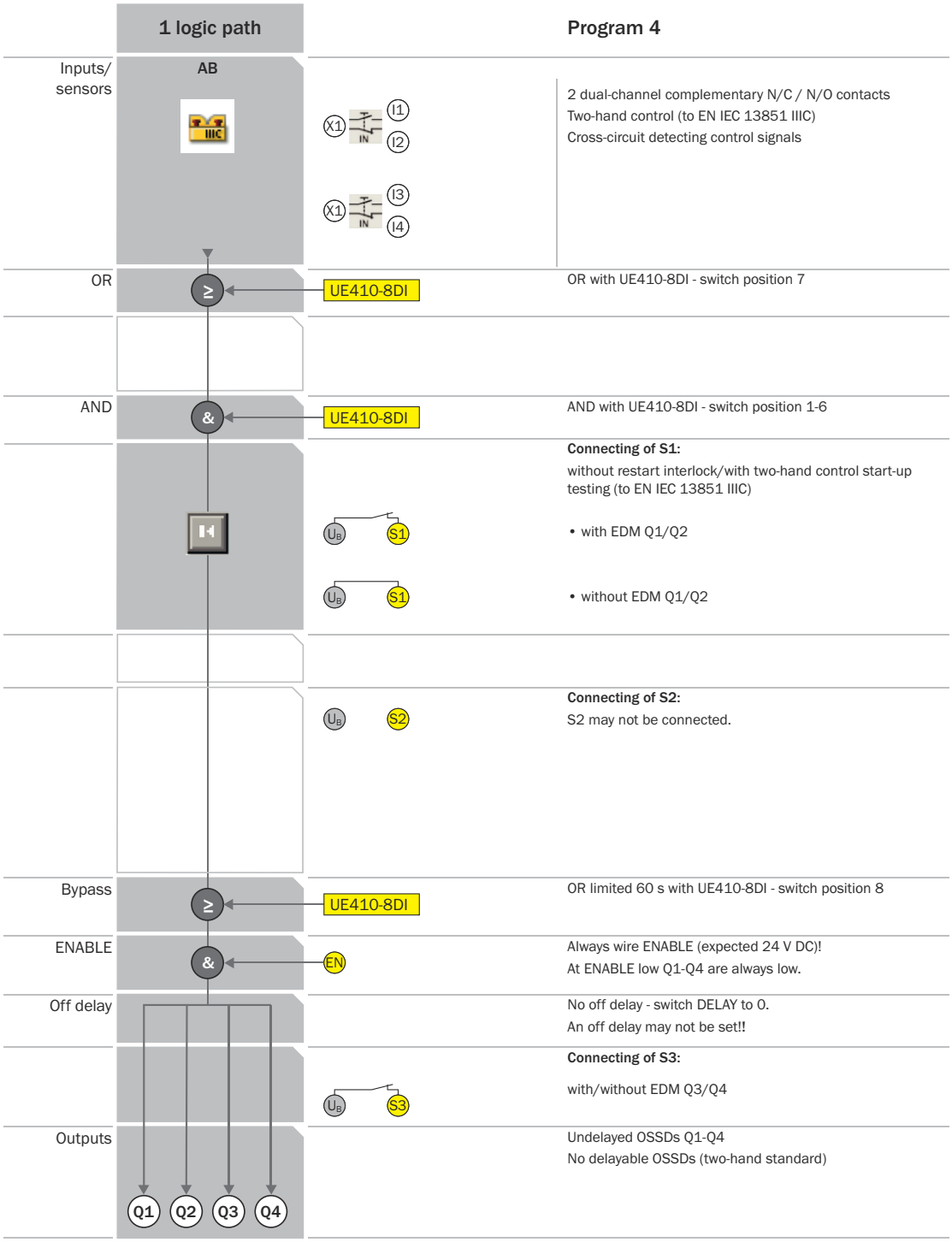
3.7.2 Program 2



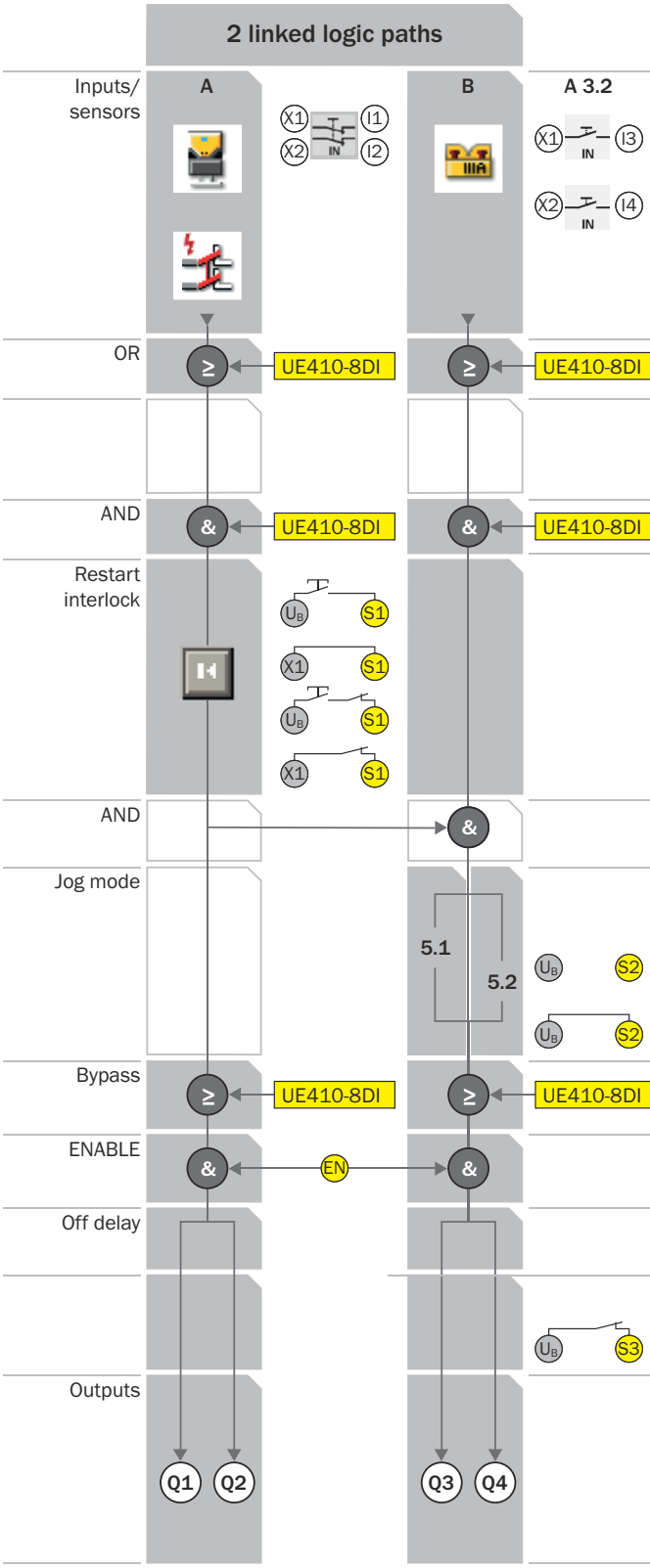
3.7.3 Programs 3.1 and 3.2



3.7.4 Program 4

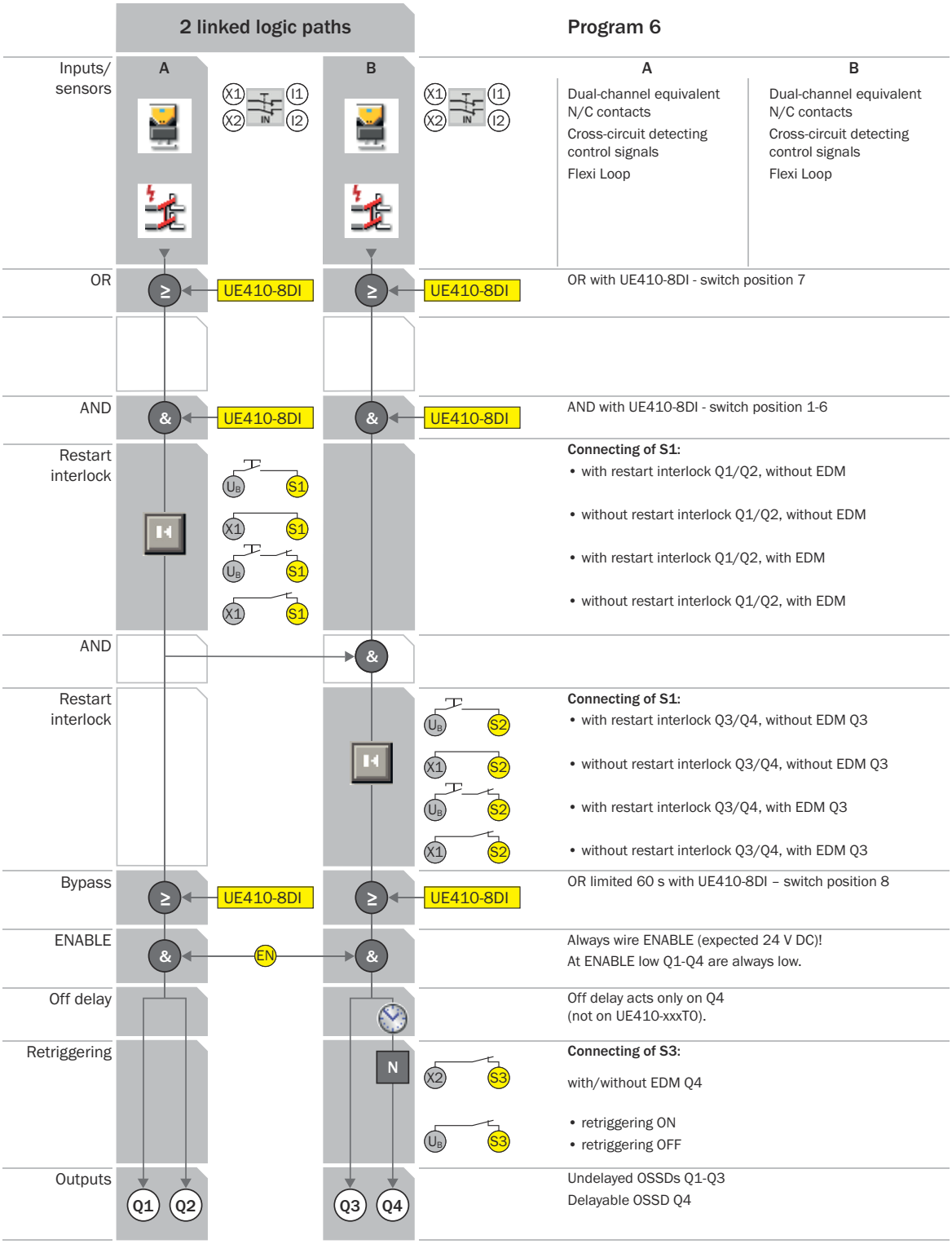


3.7.5 Programs 5.1 and 5.2

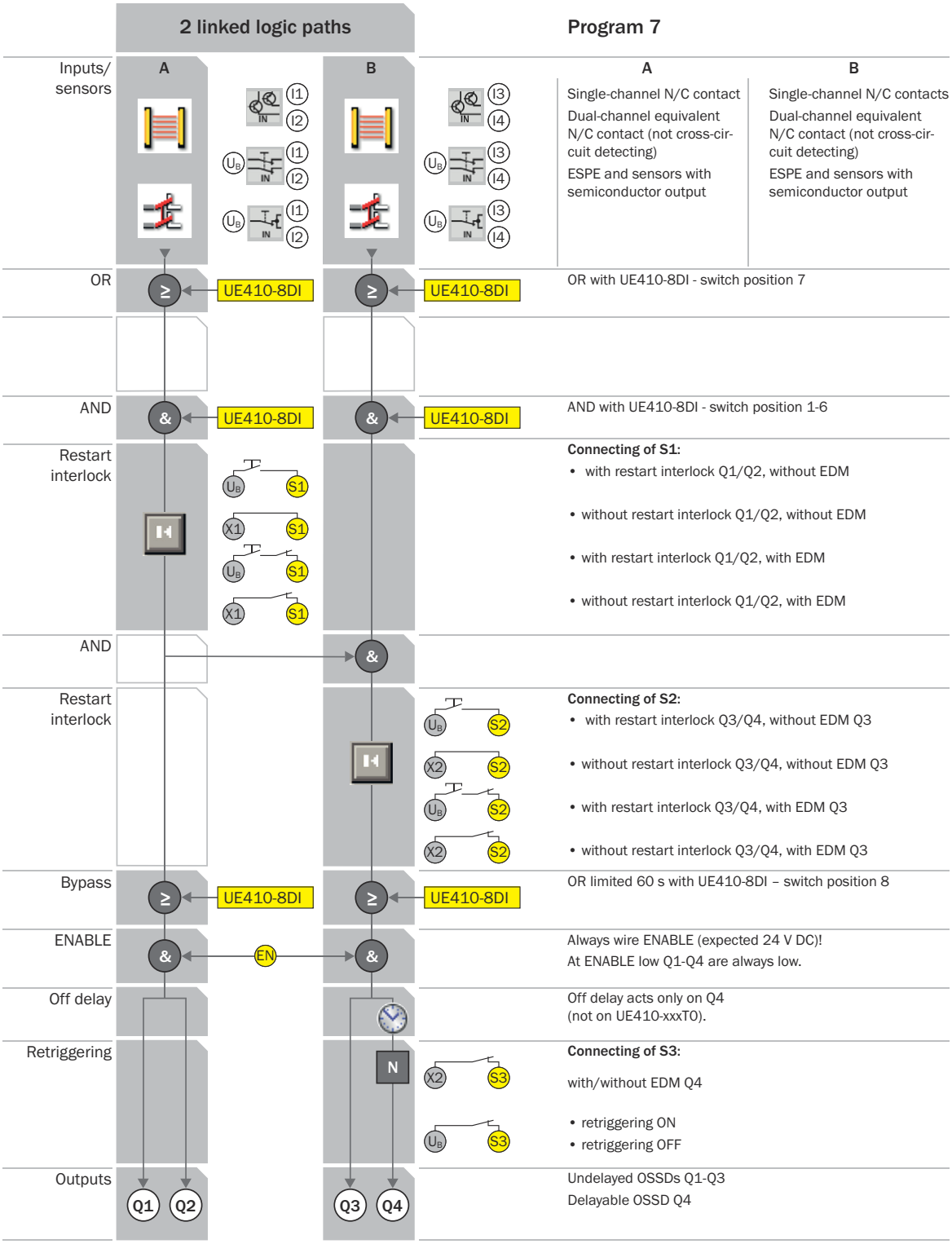


	Program 5.1	Program 5.2
Inputs/ sensors	Dual-channel equivalent N/C contact Flexi Loop	2 single-channel N/C contacts Two-hand control (to EN IEC 13851 IIIA) with or without jog mode Cross-circuit detecting control signals
OR	OR with UE410-8DI - switch position 7	
AND	AND with UE410-8DI - switch position 1-6	
Restart interlock	**Connecting of S1:** • with restart interlock Q1/Q2, without EDM • without restart interlock Q1/Q2, without EDM • with restart interlock Q1/Q2, with EDM • without restart interlock Q1/Q2, with EDM	
AND		
Jog mode	**Connecting of S2:** without restart interlock + with start-up testing (two-hand standard) Acts only on Q3/Q4. Switch off path B: Two-hand control unit (to EN IEC 13851 IIIA) with jog mode Jog mode max. 5 s (Q3/Q4 remain switched on for only 5 s) Two-hand control unit (to EN IEC 13851 IIIA) without jog mode	
Bypass	OR limited 60 s with UE410-8DI - switch position 8	
ENABLE	Always wire ENABLE (expected 24 V DC)! At ENABLE low Q1-Q4 are always low.	
Off delay	No off delay — switch DELAY to 0. **An off delay may not be set!**	
	Connecting of S3: with/without EDM for Q3/Q4	
Outputs	Undelayed OSSDs Q1-Q2 No delayable OSSDs (two-hand standard)	

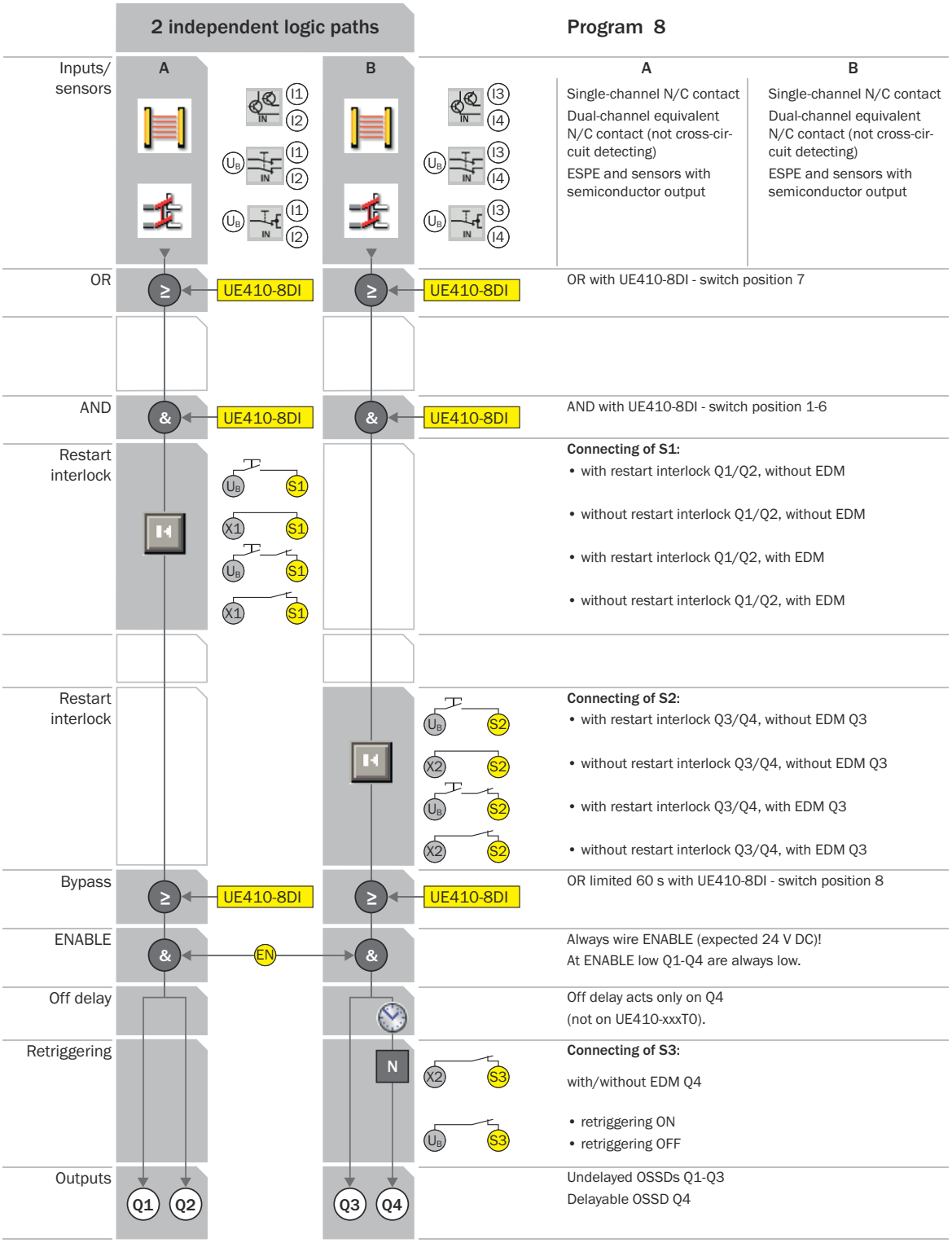
3.7.6 Program 6



3.7.7 Program 7

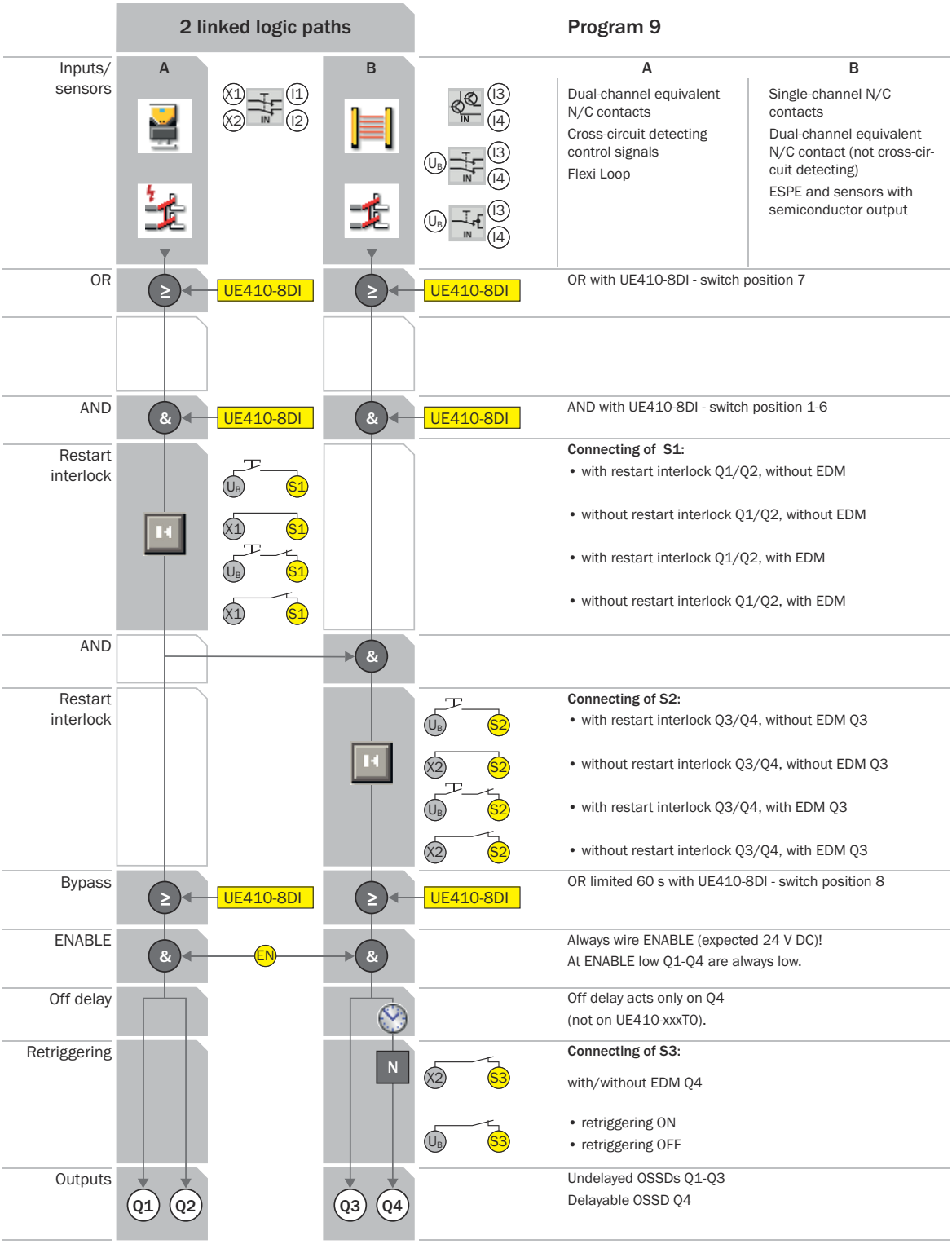


3.7.8 Program 8



	A	B
Inputs/ sensors	Single-channel N/C contact Dual-channel equivalent N/C contact (not cross-circuit detecting) ESPE and sensors with semiconductor output	Single-channel N/C contact Dual-channel equivalent N/C contact (not cross-circuit detecting) ESPE and sensors with semiconductor output
OR	OR with UE410-8DI - switch position 7	
AND	AND with UE410-8DI - switch position 1-6	
Restart interlock	**Connecting of S1:** • with restart interlock Q1/Q2, without EDM • without restart interlock Q1/Q2, without EDM • with restart interlock Q1/Q2, with EDM • without restart interlock Q1/Q2, with EDM	
Restart interlock	**Connecting of S2:** • with restart interlock Q3/Q4, without EDM Q3 • without restart interlock Q3/Q4, without EDM Q3 • with restart interlock Q3/Q4, with EDM Q3 • without restart interlock Q3/Q4, with EDM Q3	
Bypass	OR limited 60 s with UE410-8DI - switch position 8	
ENABLE	Always wire ENABLE (expected 24 V DC)! At ENABLE low Q1-Q4 are always low.	
Off delay	Off delay acts only on Q4 (not on UE410-xxxT0).	
Retriggering	**Connecting of S3:** with/without EDM Q4 • retriggering ON • retriggering OFF	
Outputs	Undelayed OSSDs Q1-Q3 Delayable OSSD Q4	

3.7.9 Program 9



3.7.10 Connection of sensors to the UE410-MU/UE410-XU

NOTE

- The allocation of the outputs X1 to X2 to the inputs I1 to I4 depends on the selected input circuit function.
- The functions of logic paths A and B can be set independently of each other.

DANGER

Unused inputs must be jumpered as per the status shown!

► Connect the sensors (type depending on the switch setting) accordingly. table 20

Table 20: Connection of sensors to the UE410-MU/UE410-XU

Program	Inputs of logic path A				Inputs of logic path B		
0	Module inactive						
1	Dual-channel equivalent N/C contact Cross-circuit detecting Synchronization time monitoring 1,500 ms			X1I1 X2I2	Dual-channel non-isolated semiconductors		U_B I3 U_B I4
					Dual-channel N/C contact, three-wire		U_B I3 U_B I4
	Four-wire Cross-circuit detecting (e. g. cross-circuit detecting pressure sensitive mats)			X1I1 X2I2	Single channel NC contact		U_B I3 U_B I4
2	Dual-channel complementary N/C contact Cross-circuit detecting Synchronization time monitoring 1,500 ms			X1I1 X2I2	Dual-channel non-isolated semiconductors		U_B I3 U_B I4
					Dual-channel N/C contact, three-wire		U_B I3 U_B I4
	Dual-channel complementary N/C contact Cross-circuit detecting Synchronization time monitoring 1,500 ms			X1I1 X2I2	Single-channel N/C contact		U_B I3 U_B I4
3	3.1	Single-channel N/C contact		U_B I1 U_B I2	Muting 2 single-channel N/C contacts or dual-channel non-isolated semiconductor		U_B I3 U_B I4
		Dual-channel N/C contact, three-wire		U_B I1 U_B I2			
		Dual-channel non-isolated semiconductors		U_B I1 U_B I2			
	3.2	Single-channel N/C contacts/ ESPE (sensors with semiconductor output)		X2I2 (bridge X1-I1)			

Program	Inputs of logic path A				Inputs of logic path B		
	3.2	Single-channel N/C contacts/ IN4000 (inductive switch with semiconductor output)		X1I1 (bridge X2-I2)			
4	Two-hand pushbutton (X1-I1 N/O contact; X1-I2 N/C contact)			X1I1 X1I2	Two-hand pushbutton (X1-I3 N/O contact; X2-I4 N/C contact)		X2I3 X2I4
5	Dual-channel equivalent N/C contact Cross-circuit detecting			X1I1 X2I2	2 single-channel N/O contacts, cross-circuit detecting		X1I3 X2I4
6	Dual-channel equivalent N/C contact Cross-circuit detecting			X1I1 X2I2	Dual-channel equivalent N/C contact Cross-circuit detecting		X1I3 X2I4
7	Dual-channel non-isolated semiconductors			U_B I1 U_B I2	Dual-channel non-isolated semiconductors		U_B I3 U_B I4
	Dual-channel N/C contact, three-wire			U_B I1 U_B I2	Dual-channel N/C contact, three-wire		U_B I3 U_B I4
	Single-channel N/C contact			U_B I1 U_B I2	Single-channel N/C contact		U_B I3 U_B I4
8	Dual-channel non-isolated semiconductors			U_B I1 U_B I2	Dual-channel non-isolated semiconductors		U_B I3 U_B I4
	Dual-channel N/C contact, three-wire			U_B I1 U_B I2	Dual-channel N/C contact, three-wire		U_B I3 U_B I4
	Single-channel N/C contact			U_B I1 U_B I2	Single-channel N/C contact		U_B I3 U_B I4
9	Dual-channel equivalent N/C contact Cross-circuit detecting			X1I1 X2I2	Dual-channel non-isolated semiconductors		U_B I3 U_B I4
					Dual-channel N/C contact, three-wire		U_B I3 U_B I4
					Single-channel N/C contact		U_B I3 U_B I4

3.8 UE410-GU programs

The UE410-GU has 9 programs that are set using the program switch.

The global emergency stop function with manual reset is active in all programs. Depending on the program set, a local emergency stop function can also be configured with which it is possible to choose between manual reset and automatic reset.

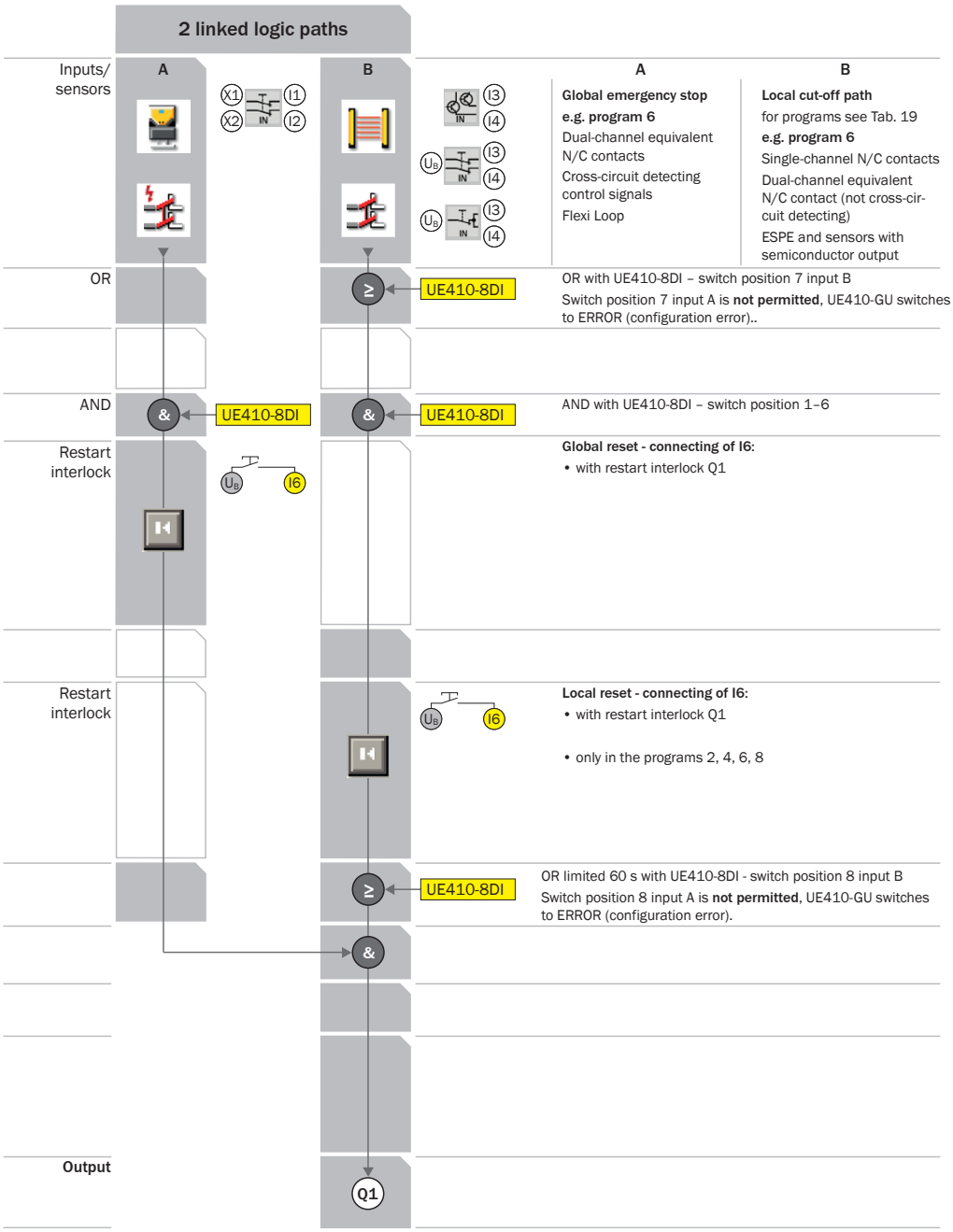
The selection of the program defines the type of safety sensor to be connected and the principle of operation of the local reset. The operator logic is identical for all programs.

Table 21: UE410-GU programs

Program	Function I1/I2 (global emergency stop)	Function I3/I4 (local emergency stop)	Monitoring	Function I6 (reset of the local emergency stop)[5]
1	Equivalent switch, cross-circuit detecting 	–	–	–
2		Equivalent switch, cross-circuit detecting 	I3-X1 I4-X2	Manual
3				Automatic
4		Dual-channel N/C / N/O contact, complementary, cross-circuit detecting 	I3-X1 I4-X2	Manual
5				Automatic
6		OSSD or untested safety switch 	I3-Ux[6] I4-Ux	Manual
7				Automatic
8		Single-channel N/C contact, cross-circuit detection, e.g. • Emergency stop pushbutton • Interlock safety switch • Testable sensors (e. g., L41) 	I3-n. c.[7] I4-X2	Manual
9				Automatic

NOTE
Switch setting 0 is not permitted.

5) A reset button for the global emergency stop must always be connected to I6. This button also acts as the reset button for manually resetting the local emergency stop if necessary.
6) Ux = independent 24 V supply that must be connected to the same GND terminal as the UE410-GU voltage supply.
7) Not connected, i. e. I3 must be not connected.


2 linked logic paths
Inputs/ sensors
A
B
X1
X2
I1
I2
I3
I4
OR
AND
UE410-8DI
Restart interlock
I6
Output
Q1
A
Global emergency stop
e.g. program 6
Dual-channel equivalent N/C contacts
Cross-circuit detecting control signals
Flexi Loop
B
Local cut-off path
for programs see Tab. 19
e.g. program 6
Single-channel N/C contacts
Dual-channel equivalent N/C contact (not cross-circuit detecting)
ESPE and sensors with semiconductor output
OR with UE410-8DI – switch position 7 input B
Switch position 7 input A is not permitted, UE410-GU switches to ERROR (configuration error)..
AND with UE410-8DI – switch position 1–6
Global reset - connecting of I6:
• with restart interlock Q1
Local reset - connecting of I6:
• with restart interlock Q1
• only in the programs 2, 4, 6, 8
OR limited 60 s with UE410-8DI - switch position 8 input B
Switch position 8 input A is not permitted, UE410-GU switches to ERROR (configuration error).

3.9 UE410-8DI input exptension module

The UE410-8DI module is an input expansion module with 8 safety inputs.

A UE410-8DI is used to add additional inputs either to a UE410-MU, UE410-GU or UE410-XU. The simultaneous use of up to UE410-8DI per UE410-MU, UE410-GU or UE410-XU is possible.

A UE410-8DI input extension module acts exclusively on the next UE410-MU, UE410-GU or UE410-XU module on the left in the module structure. It has two separate input groups each with 4 inputs for connecting safe signal detectors and sensors. The UE410-8DI has a separate switch for each input group (input A and B). The 9 switch settings on the rotary switch determine the type of safety component which can be connected and with which logic (OR, AND or Bypass) it will act on the UE410-MU, UE410-GU or UE410-XU.

The input group A of a UE410-8DI acts on the logic path A of a connected UE410MU, UE410-GU or UE410-XU.

The input group B of a UE410-8DI acts on the logic path B of a connected UE410MU, UE410-GU or UE410-XU.

Each input group consists of two input pairs. For example, for input A it is I1 / I2 and I3 / I4. Two inputs are AND-linked and form an input pair. This does not apply to switch setting 1.

Table 22: UE410-8DI switch settings

Switch setting	Description
0	Selected input (A/B) is inactive — input signals are ignored.
1	The connected single-channel sensor equipment is **AND**-linked to the respective logic path of the UE410-MU/UE410-GU/UE410-XU modules. Unused inputs must be bridged according to the logical “1” state (e.g. X4I4, U_B I4).
2–6	The connected dual-channel sensor equipment is **AND**-linked to the respective logic path of the UE410-MU/UE410-GU/UE410-XU modules. Unused inputs must be bridged according to the logical “1” state (e.g. X4I4, U_B I4).
7	The connected dual-channel sensor equipment is **OR**-linked to the respective logic path of the UE410-MU/UE410-GU/UE410-XU modules.[8)]
8	The connected dual-channel sensor equipment is **Bypass**-linked to the respective safety outputs of the UE410-MU/UE410-GU/UE410-XU modules (time-limited OR function).[9)]
9	Reciprocal assignment of input A/input B in order to link all 8 inputs on a logic path.

For more information, see "Grouping of subsystems", page 75.

3.9.1 AND link

The switch settings 1 to 6 of the UE410-8DI add inputs to the UE410-MU/UE410-GU/UE410-XU modules and link them with AND logic.

If the input conditions I1-I4 and I5-I8 are logical “1”, the AND function is active and the LED Q_A or Q_B is illuminated.

8) An OR function that acts on the global cut-off path on the UE410-GU (switch setting 7, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

9) A bypass function that acts on the global cut-off path on the UE410-GU (switch setting 8, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

Table 23: UE410-8DI switch settings

Switch setting	Application		Electrical wiring
0	• For unused inputs		–
1		• Emergency stop pushbutton • Interlock safety switch • Testable sensors	Single-channel N/C contact
2		• Emergency stop pushbutton • Interlock safety switch • Switching mat (pressure-sensitive) • Flexi Loop	Dual-channel N/C contact, equivalent, cross-circuit detection
3		• Emergency stop pushbutton • Interlock safety switch • Flexi Loop	Dual-channel N/C contact, equivalent, cross-circuit detection Synchronization time monitoring 1,500 ms
4		• Interlock safety switch	Dual-channel N/C / N/O contact, complementary, cross-circuit detecting
5		• Interlock safety switch • RE300	Dual-channel N/C / N/O contact, complementary, cross-circuit detecting Synchronization time monitoring 1,500 ms
6	  	• Emergency stop pushbutton • Interlock safety switch • ESPE (e. g. C4000)	Single-channel N/C contact Dualchannel N/C contact, equivalent Dualchannel semiconductor output

3.9.2 OR link

The switch setting 7 of the UE410-8DI adds inputs to the UE410-MU/UE410-XU modules and links these with OR logic.

All input pairs are AND-linked internally. For example, only if I1 and I2 are high is the OR signal from this pair active. If the input conditions I1/I2 or I3/I4 are logical “1”, the OR function is active and the LED Q_A or Q_B is illuminated.

OR function on the UE410-GU via UE410-8DI

On the UE410-GU the OR function is only available via the UE410-8DI input extension module (switch setting 7) and only on the local cut-off path, i. e. via input B.

NOTE

An OR function that acts on the global cut-off path on the UE410-GU (switch setting 7, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

Table 24: OR link UE410-8DI

Switch setting	Application		Electrical wiring
7		• Interlock safety switch • ESPE (e. g. C4000)	Single-channel N/C contact
			Dualchannel N/C contact, equivalent
			Dualchannel semiconductor output

3.9.3 Bypass

The switch setting 8 of the UE410-8DI jumpers the outputs of the UE410-MU/UE410-XU modules for the maximum duration of 60 s. The bypass is only active if I1 and I2 or I5 and I6 are logical “1”. The input pairs I3/I4 and I7/I8 do not have to be wired, they have no function.

Bypass function on the UE410-GU via UE410-8DI

On the UE410-GU, the bypass function is only available via the UE410-8DI input extension module (switch setting 8) and only on the local cut-off path, i.e. via input B.

NOTE

A bypass function that acts on the global cut-off path on the UE410-GU (switch setting 8, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

Table 25: Bypass UE410-8DI

Switch setting	Application		Electrical wiring
8		• Key-operated pushbutton • Enabling switch	Dual-channel N/C contact, equivalent, cross-circuit detection

DANGER

Bypass jumpers the safety device!

It should only be possible to generate the bypass signal by means of a dual-channel key switch (normally open contacts). The bypass should only be activated through a conscious act of the operator and with a view of the hazardous area.

3.9.4 Reciprocal assignment — Mirror mode

Switch setting 9:

The functionality and logical link of input B is assigned to the logic of input A. Input group A then has 8 inputs.

Or

The functionality and logical link of input A is assigned to the logic of input B. Input group B then has 8 inputs.

NOTE
Function 9 may only be selected for one of the two input groups respectively. Otherwise a device error ERROR is generated and the ERR LED flashes.

3.9.5 Connection of sensors to the UE410-8DI

DANGER
A UE410-8DI has two test pulse generators. This means that short-circuits between odd (X1) and evenly (X2) numbered outputs will be detected. Short-circuits between two odd (i.e. X1 and X3) or two evenly (i.e. X2 and X4) numbered outputs will not be detected. Please heed this when wiring the safety sensors.

NOTE
- The assignment of outputs X1 to X8 to inputs I1 to I8 depends on the selected rotary switch setting.
- The functions of logic paths A and B can be set independently of each other.

DANGER
When AND logic is used, unused inputs must be bridged according to the logical “1” state (e.g. X4-I4, U_B I4)!

► Connect the sensors (type depending on the switch setting) in accordance with table 26.

Table 26: Connection of sensors to the UE410-8DI

Switch setting			Input A				Input B			
0	All the inputs of Group A or B are not used	N. c.	Terminals not connected				Terminals not connected			
1	AND 4 × single-channel with testing		X1I1	X2I2	X3I3	X4I4	X5I5	X6I6	X7I7	X8I8
	AND 4 × single-channel with testable sensors (ESPE)		X1I1	X2I2	X3I3	X4I4	X5I5	X6I6	X7I7	X8I8
2	AND 2 × dual-channel, cross-circuit detection		X1I1 X2I2		X3I3 X4I4		X5I5 X6I6		X7I7 X8I8	
	AND 2 × dual-channel, cross-circuit detection		X1I1 X2I2		X3I3 X4I4		X5I5 X6I6		X7I7 X8I8	
3	AND 2 × dual-channel, cross-circuit detection, synchronous time monitoring 1,500 ms		X1I1 X2I2		X3I3 X4I4		X5I5 X6I6		X7I7 X8I8	
4	AND 2 × dual-channel, cross-circuit detection		X1I1 X2I2		X3I3 X4I4		X5I5 X6I6		X7I7 X8I8	

Switch setting			Input A		Input B	
5	AND 2 × dual-channel, cross-circuit detection, synchronous time monitoring 1,500 ms		X1I1 X2I2	X3I3 X4I4	X5I5 X6I6	X7I7 X8I8
6	AND 2 × dual-channel, semiconductor		$OSSD1_{Sensor}$-I1 $OSSD2_{Sensor}$-I2	$OSSD1_{Sensor}$-I3 $OSSD2_{Sensor}$-I4	$OSSD1_{Sensor}$-I5 $OSSD2_{Sensor}$-I6	$OSSD1_{Sensor}$-I7 $OSSD2_{Sensor}$-I8
	AND 2 × dual-channel, three-wire		$+U_B$ I1 $+U_B$ I2	$+U_B$ I3 $+U_B$ I4	$+U_B$ I5 $+U_B$ I6	$+U_B$ I7 $+U_B$ I8
	AND 2 × single-channel		$+U_B$ I1 $+U_B$ I2	$+U_B$ I3 $+U_B$ I4	$+U_B$ I5 $+U_B$ I6	$+U_B$ I7 $+U_B$ I8
7	OR 2 × dual-channel, semiconductor		$OSSD1_{Sensor}$-I1 $OSSD2_{Sensor}$-I2	$OSSD1_{Sensor}$-I3 $OSSD2_{Sensor}$-I4	$OSSD1_{Sensor}$-I5 $OSSD2_{Sensor}$-I6	$OSSD1_{Sensor}$-I7 $OSSD2_{Sensor}$-I8
	OR 2 × dual-channel, three-wire		$+U_B$ I1 $+U_B$ I2	$+U_B$ I3 $+U_B$ I4	$+U_B$ I5 $+U_B$ I6	$+U_B$ I7 $+U_B$ I8
	OR 2 × single-channel		$+U_B$ I1 $+U_B$ I2	$+U_B$ I3 $+U_B$ I4	$+U_B$ I5 $+U_B$ I6	$+U_B$ I7 $+U_B$ I8
8	Bypass 1 × dual-channel, cross-circuit detection		X1I1 X2I2	I3 n.c. I4 n.c.	X5I5 X6I6	I7 n.c. I8 n.c.
9	Input supplement	–	Function as for input B		Function as for input A	
When AND logic is used, unused inputs must be bridged according to the logical “1” state (e.g. X4I4, U_B I4)!						

3.9.6 Operating elements and status indicators

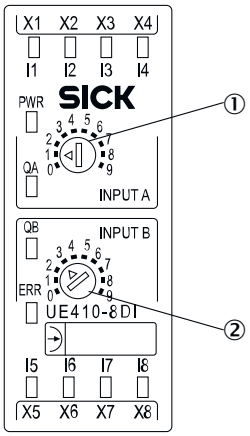


Figure 14: UE410-8DI controls and status indicators

① Function switch for input A

② Function switch or input B

Table 27: UE410-8DI LED indications

Display	Description
PWR (green)	Supply voltage via safety bus is present
I1-I8 (green)	Logical “1” is applied at the corresponding input.
I1, I2 flash in phase	Cross-circuit between I1, I2
I3, I4 flash in phase	Cross-circuit between I3, I4
I5, I6 flash in phase	Cross-circuit between I5, I6 or modules with different revision code, see "Replacement of a module", page 92
I7, I8 flash in phase	Cross-circuit between I7, I8 or modules with different revision code, see "Replacement of a module", page 92
I1, I2 flash out of phase	Sequence error at I1, I2
I3, I4 flash out of phase	Sequence error at I3, I4
I5, I6 flash out of phase	Sequence error at I5, I6
I7, I8 flash out of phase	Sequence error at I7, I8
I1 or I2 flashing	Synchronous time (1,500 ms) exceeded
I3 or I4 flashing	Synchronous time (1,500 ms) exceeded
I5 or I6 flashing	Synchronous time (1,500 ms) exceeded
I7 or I8 flashing	Synchronous time (1,500 ms) exceeded
QA (green)	Input conditions input A of inputs I1 to I4 are fulfilled.
QB (green)	Input conditions input B of inputs I5 to I8 are fulfilled.
ERR (red flashing)	Erroneous operational status on this module, see "Trouble-shooting", page 92
ERR (red)	Erroneous operational status on the whole system (the error is on another module), see "Troubleshooting", page 92

Table 28: UE410-8DI operating elements

Control element	Function
INPUT A	10-step rotary switches for setting an input circuit function (input group A or B)
INPUT B	

3.9.7 Inputs and outputs

Table 29: Connection terminals of UE4108-DI

Pin assignment	Description
I1–I4	Inputs for the connection of signal detectors or sensors (input A)
X1–X4	Test outputs: cross-circuit detecting control signals for controlling sensors of the module (input A)
I5–I8	Inputs for the connection of signal detectors or sensors (input B)
X5–X8	Test outputs: cross-circuit detecting control signals for controlling sensors of the module (input B)

For more information, see "Grouping of subsystems", page 75.

3.10 UE410-2RO/UE410-4RO output modules

The UE410-2RO/UE410-4RO output modules make dual-channel contact-based outputs with positively guided relay contacts available.

The output modules may only be operated in a system combination with a UE410-MU/XU.

A maximum of four UE410-4RO or eight UE410-2RO can be connected to a Flexi Classic system.

The slot of an output module in the Flexi Classic system is on the end of the safety assembly.

3.10.1 Output module UE410-2RO

The UE410-2RO has one control input (B1). This input controls two internal relays and forms a redundant cut-off path comprising:

- two “safe enabling current paths” (13/14, 23/24), dual-channel and volt-free,
- one “safe enabling current path” (Y14), dual-channel and not volt-free,
- one “external device monitoring feedback circuit: (Y1 / Y2), dual-channel and volt-free.

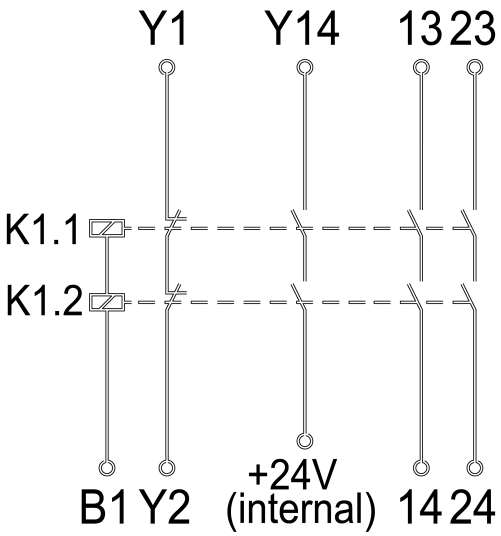


Figure 15: Internal structure of UE410-2RO

3.10.2 Output module UE410-4RO

The UE410-4RO has two control inputs (B1, B2). These inputs control two-by-two internal relays that form two independent redundant cut-off paths.

Control input (B1) operates two internal relays and forms one redundant cut-off path comprising:

- two “safe enabling current paths” (13/14, 23/24), dual-channel and volt-free,
- one “safe enabling current path” (Y14), dual-channel and not volt-free,
- one “external device monitoring feedback circuit: (Y1 / Y2), dual-channel and volt-free.

Control input (B2) operates two internal relays and forms one redundant cut-off path comprising:

- two “safe enabling current paths” (33/34, 43/44), dual-channel and volt-free,
- one “safe enabling current path” (Y24), dual-channel and not volt-free,
- one “external device monitoring feedback circuit: (Y3 / Y4), dual-channel and volt-free.

The UE410-4RO therefore has twice the functionality of an UE410-2RO.

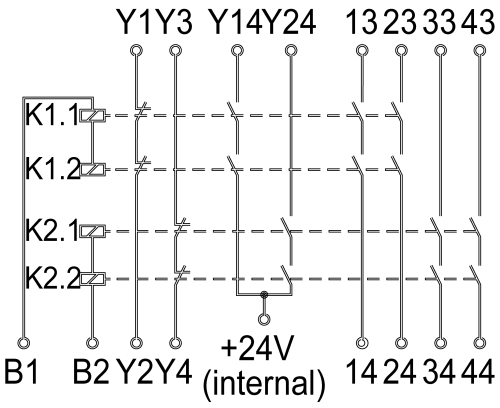


Figure 16: Internal structure of UE410-4RO

3.10.3 Operating elements and status indicators

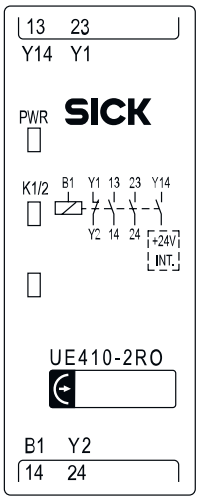


Figure 17: Operating elements and status indicators of UE4102-RO

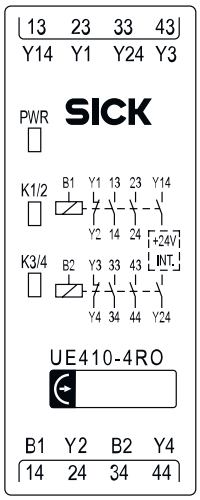


Figure 18: Operating elements and status indicators of UE410-4RO

Table 30: UE4102-RO/UE4104RO indicators

Display	Description
PWR (green)	Supply voltage via safety bus is present
K1/2 (green)	Relay K1/K2 — safety contacts closed
K3/4 (green)	Relay K3/K4 — safety contacts closed

3.10.4 UE410-2RO inputs and outputs

Table 31: Connection terminals of UE410-2RO

Pin assignment	Description
B1	Wiring relay K1/K2
13/14 and 23/24	Safety contacts for switch-off circuit K1/K2
Y1/Y2	Feedback circuit external device monitoring (EDM), N/C contact
Y14	N/O safety contact K1/K2, current-limited, see "Technical data", page 96

3.10.5 UE410-4RO inputs and outputs

Table 32: Connection terminals of UE410-4RO

Pin assignment	Description
B1	Wiring relay K1/K2
B2	Wiring relay K3/K4
13/14 and 23/24	Safety contacts for switch-off circuit outputs K1/K2
33/34 and 43/44	Safety contacts for switch-off circuit outputs K3/K4
Y1/Y2	Feedback EDM K1/K2, N/C contact
Y3/Y4	Feedback EDM K3/K4, N/C contact
Y14	N/O safety contact K1/K2, current-limited, see "Technical data", page 96
Y24	N/O safety contact K3/K4, current-limited, see "Technical data", page 96

4 Special applications and functions

This chapter describes the special applications and functions that can be implemented with a Flexi Classic system.

These are the connection and configuration of the safety sensors and the settings at the Flexi Classic system:

- RE300 magnetic safety switch
- IN4000 inductive safety switch
- Connection of testable safety single-beam sensors
- Two-hand operation/inching mode
- OR function
- Muting function
- Bypass function
- Wiring of S1, S2, S3
  - Restart interlock
  - External device monitoring (EDM)
- Retriggering
- Grouping of subsystems
- ENABLE input

4.1 RE300 magnetic safety switch

RE300 magnetic safety sensors can be connected directly to the inputs of the UE410MU/UE410GU/UE410-XU as well as UE410-8DI units. Up to eight RE300 can be connected in series.

The necessary test signals for the RE300 switch are only generated in program 2 on the UE410-MU/UE410-XU and in switch setting 5 on the UE410-8DI. They comply with the requirements for an application up to PL e according to ISO 13849.

An RE300 can only be connected to the local cut-off path on I3 and I4 on the UE410-GU in program 4 or 5. The necessary test signals (X1 / X2) for the RE300 magnetic safety switch meet the requirements for applications up to PL e as per ISO 13849.

DANGER
Pay attention to the safety notes for the RE300 switch.

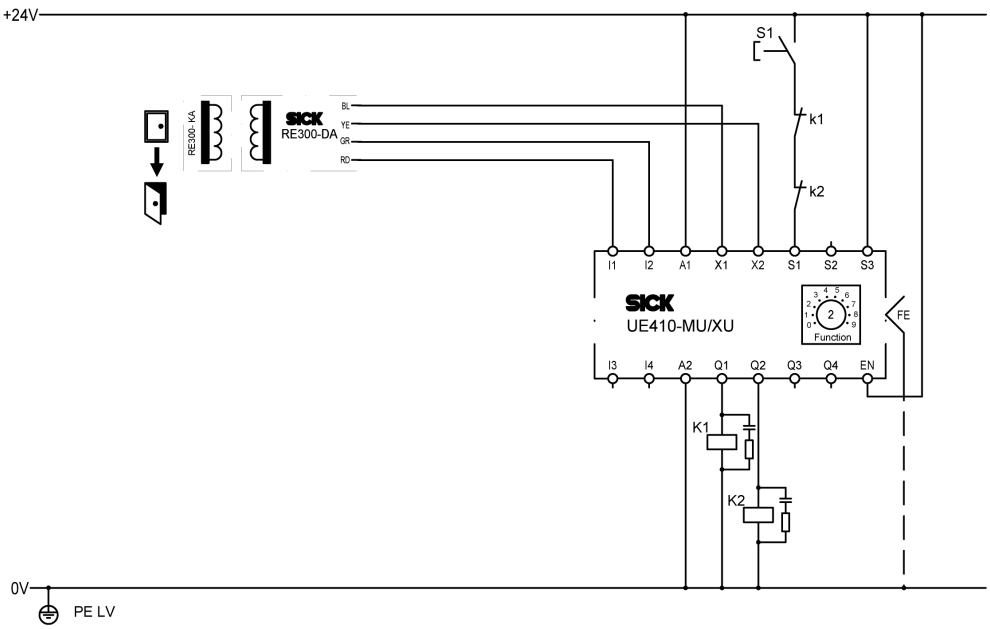


Figure 19: Connection of an RE300 to the UE410-MU/XU

NOTE

- If RE300 sensors are cascaded, these have to be tested/activated regularly (for example opening and closing of the protective doors connected to the sensors).
- Cascading of several RE300 sensors is limited by the line resistance (refer to the operating instructions of the RE300 for further information).
- If RE300 sensors (N/C/N/O contacts) are connected, the unused input pairs at the UE410-8DI must be appropriately wired to simulate a logical “1” input. The corresponding odd-numbered inputs/test outputs have to be bridged (for example I1-X1), the even-numbered inputs/test outputs are not connected (for example I2-X2).

4.2 IN4000 inductive safety switch

IN4000 inductive safety sensors can be connected directly to the inputs of the UE410MU/UE410-XU units. The required test signals for the sensors are generated in the program 3.2 of the UE410MU/UE410-XU.

Up to nine safety sensors can be cascaded per input.

NOTE

Inductive safety switches IN4000 cannot be connected to a UE410-GU.

Connection

A safety sensor/cascade is connected to the input I1 and test output X1. More information is available in the IN4000 operating instructions.

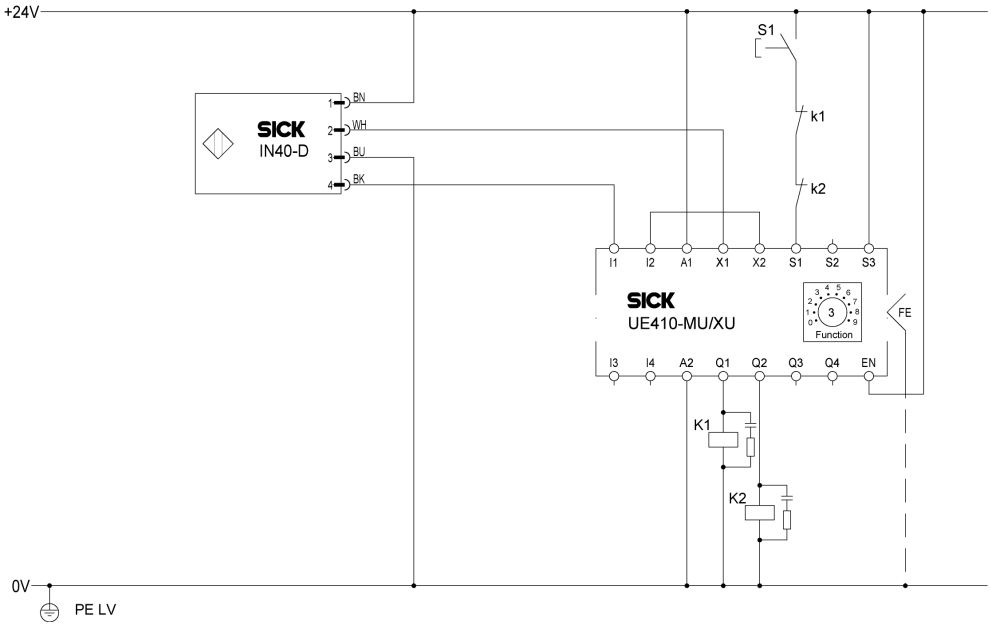


Figure 20: Connection of one IN4000 switch

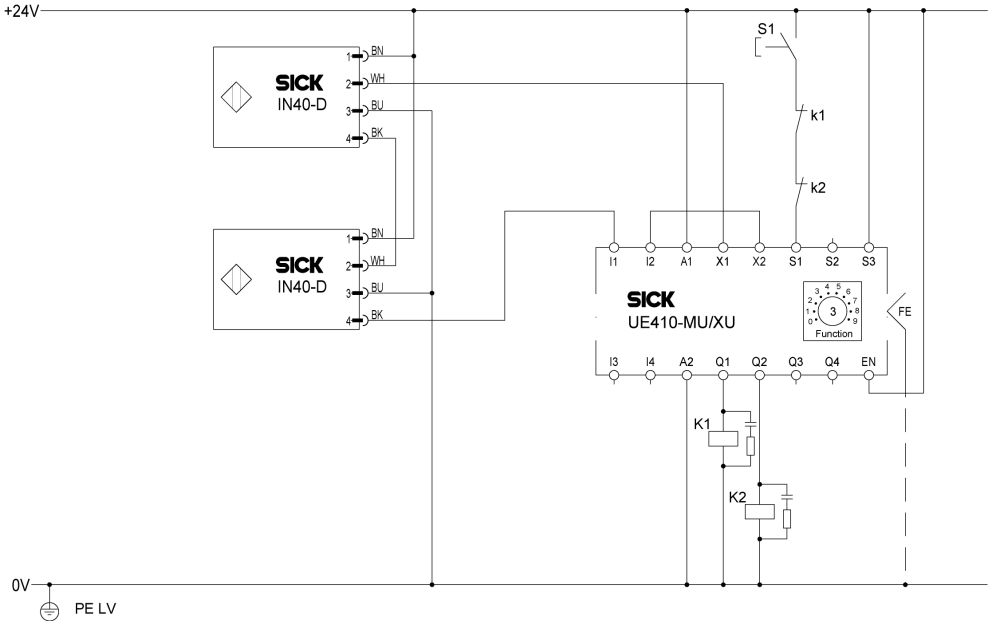


Figure 21: Connection two IN4000 switches

NOTE

Input I2 and test output X2 have to be bridged. The S2 terminal must not be connected. A selection of IN4000 safety switches can be found at "Accessories/Spare parts", page 116.

4.3 Testable single-beam photoelectric safety switches

Testable single-beam photoelectric safety switches can be connected directly to the inputs of the UE410-MU/UE410-GU/UE410-XU as well as UE410-8DI units.

NOTE

- For category 2 testable photoelectric sensors (e.g. L21), the response time of the respective program applies.
- For category 4 testable photoelectric sensors (e.g. L41), the response time is calculated from the response time of the program plus the test period of the program.
- You can find the response times of the programs in "Technical data", page 96.

The required test signals at X2 for the sensors are generated in program 3.2 of the UE410MU/UE410-XU.

The required test signals are generated on X2 in programs 8 and 9 on the UE410-GU.

In switch setting 1 of the UE410-8DI the required test signals are generated at outputs X1 to X8.

Up to 4 testable single-beam sensors can be cascaded per input. I.e., using one input (I2) at each of the modules UE410-MU/UE410-GU/UE410-XU respectively, and using inputs I1 to I8 at the UE410-8DI.

A selection of single-beam photoelectric switches is available in "Accessories/Spare parts", page 116.

DANGER

Ensure protected laying of the connecting cables!

If cascades are used, protected separate laying of the connecting cables must be ensured.

Connection to UE410-MU/UE410-XU

A testable single-beam photoelectric safety switch/cascade uses the input I2 and test output X2.

Connection to UE410-GU

A testable single-beam photoelectric safety switch/cascade uses the input I4 and test output X2.

Connection to UE410-8DI

A testable single-beam photoelectric safety switch/cascade uses the inputs and test outputs that belong together (e. g. I1/X1 to I8/X8).

NOTE

- UE410-MU/UE410-XU:
  Input I1 and test output X1 must be bridged. The S2 terminal must not be connected.
- UE410-8DI:
  The unused inputs have to be bridged with the corresponding test outputs (for example the free inputs I2 / X2–I8 / X8).

Ensuring the protective function when a Flexi Classic system with single-beam photoelectric safety switches is used

- Safety single-beam sensors may only be used as access protection in accordance with ISO 13855. Usage as finger and hand protection is not permissible.
- Interference beams (for example, direct/indirect sun irradiation, remote controls) are to be prevented since they can reduce the availability of safety single-beam sensors.
- The number of beams of the sender and receiver as well as the distance between the beams must agree.

Mutual interference of single-beam photoelectric safety switches

- If several pairs of single-beam photoelectric safety switches are used, it is imperative that the aperture angle of the sensors is observed to avoid the possibility of mutual interference.
- If the senders are only mounted on one side, the light beams may not overlap on the receiver side, i.e. the light beam of one sender may not reach two receivers.
- If the senders and receivers are mounted alternately, ensure that the light beam of sender S1 cannot be received by receiver R3 and that the light beam of sender S3 cannot be received by receiver R1.

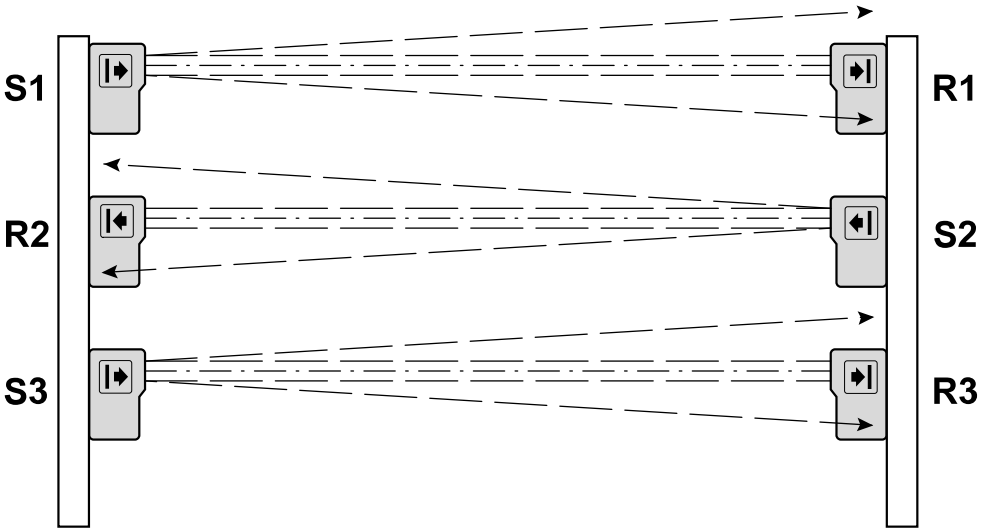


Figure 22: Mounting to avoid mutual optical influence

Mutual optical influence between cascades must be excluded.

Reflective surfaces that are present within the sending and receiving beam paths, placed or mounted there can cause reflection and therefore non-detection of an object or a person. All reflective surfaces and objects (for example material bins) must therefore be located at a minimum distance (a) rotational-symmetrically around the optical axis between the sender and receiver.

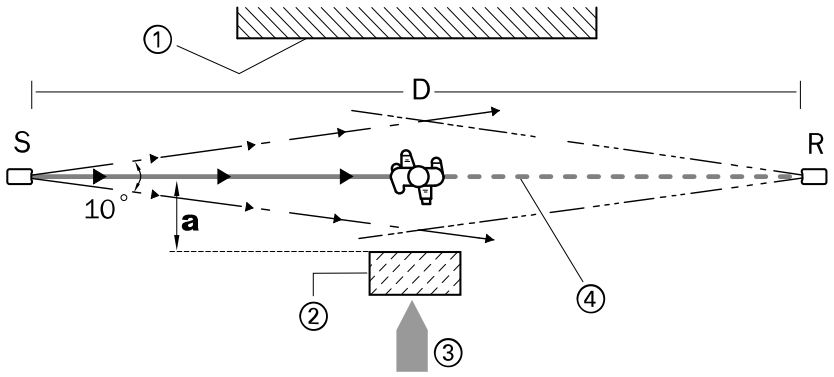


Figure 23: Minimum distance (a) to reflective surfaces, correct mounting and alignment

S Sender
R Receiver
D Distance sender-receiver
a Minimum distance from reflective surfaces
1 Limit of the hazardous area
2 Reflective surface
3 Entry direction to the hazardous area
4 Optical axis

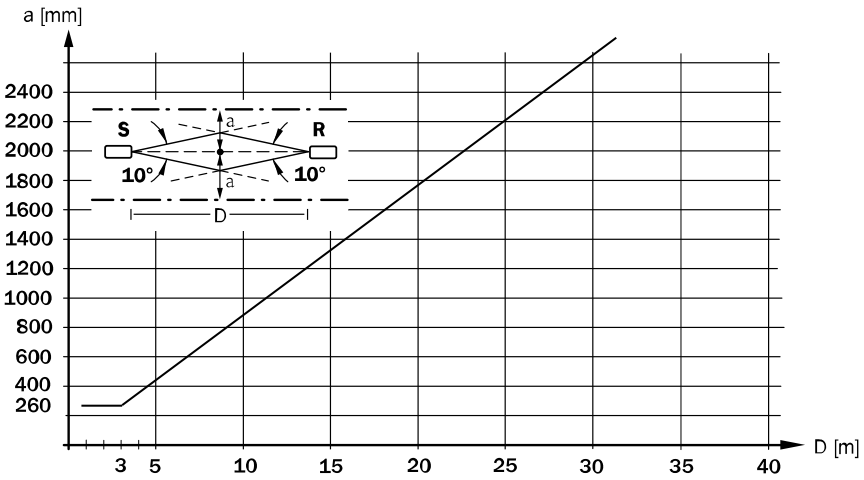


Figure 24: Minimum distance (a) as a factor of the distance D for testable single-beam photoelectric safety switches

The minimum distance (a) to reflective surfaces for single-beam photoelectric safety switches with a field of view of 10° is calculated as follows:

- If the distance D = 3 m, the minimum distance a = 260 mm.
- If the distance D > 3 m, the minimum distance (a) is calculated using the following equation:
  a (mm) = 88.2 × D × 10^3 (m)

Example:

Distance D between the sender and receiver amounts to 28 m.

With the corresponding value entered:

a (mm) = 88.2 × 28 m × 10^3 = 2,469.6 mm

The minimum distance (a) to the reflective surface has to amount to 2,469.6 mm in this example.

4.4 Two-hand operation/inching mode

The two-hand operation function in accordance with type IIIC can be set in program 4 of the UE410-MU/UE410-XU:

- Two pairs of complementary inputs (N/O / N/C contact pairs of both two-hand pushbuttons) are monitored.
- A valid input signal is only generated if the ON state (H/L level) exists at both inputs within a period of 0.5 s (synchronous change, both two-hand pushbuttons pressed) and if both were in the OFF state (L/H level) beforehand.

In Program 5 at the main module UE410-MU, the logic path B can monitor normal two-hand operation (synchronous pressing of two pushbuttons within 0.5 s, program 5.1), or two-hand operation in inching mode (program 5.2), for example for traversing movements. Two-hand operation in inching mode allows feeding or setting-up procedures.

The two-hand operation function in accordance with type IIIA can be set in program 5.1 of the UE410-MU/UE410-XU:

- Two equivalent inputs (N/O contacts of both two-hand pushbuttons) are monitored.
- A valid input signal is only generated if the ON state (H level) exists at both inputs within a period of 0.5 s (synchronous change, both two-hand pushbuttons pressed) and if both were in the OFF state (L level) beforehand.

The inching operation function can be set in program 5.2 of the UE410-MU/XU:

- The evaluation in inching mode corresponds to two-hand operation IIIA with the difference that the ON signal is limited to a duration of 5 s.

In the case of two-hand operation/inching mode an output signal is only generated as long as both actuating parts are pressed. In inching mode, the power-up delay for the safety outputs (Q3/Q4) is limited to 5 s.

When the two actuating parts are released, the time is reset. Renewed activation of the two actuation parts is possible.

In order to activate jog mode, terminal S2 remains not connected. For two-hand applications, S2 is bridged with the supply voltage $+U_B$.

NOTE
It is not impossible to implement two-hand applications using a UE410-GU.

4.5 OR function

NOTE
The OR function can be implemented at the UE410-MU/UE410-XU modules (switch settings 1 and 2) or by an input expansion module UE410-8DI (switch setting 7).

DANGER
Switch the machine to a safe state when using the OR function!
As long as the OR function is active, the outputs of the main module do **not** switch off. You must ensure that while the OR function is being used, for example for setup mode, other protective measures, e.g., the safe setup mode of the machine, are activated so that there is no danger to persons or parts of the system while the OR function is being used.

A logic path A/B can be jumpered by using an OR signal. Thus, for example, a safety function can be jumpered in setup mode by means of an enabling switch. An OR link of two safety functions is also possible.

The OR function does not have a time limit.

OR function with input extension module

All the programs of the main module offer the possibility of linking signals of the OR function at the UE410-8DI input extension modules to the input signals of the UE410MU/ UE410XU by means of a logical OR (also refer to "OR link", page 51).

OR function on the UE410-MU/UE410-XU

The OR function can be implemented in the programs 1 and 2. I1/I2 is linked to I3/I4 OR.

OR function on the UE410-GU via UE410-8DI

On the UE410-GU the OR function is only available via the UE410-8DI input expansion module (switch setting 7) and only on the local cut-off path, i.e. via input B.

NOTE
An OR function that acts on the global cut-off path on the UE410-GU (switch setting 7, input A on the UE410-8DI) is not permitted and will result in a configuration error (ERROR).

4.6 Muting function

Muting overrides the protective effect of a safety device temporarily. This means that material can be transported to or from a machine or system without the working process having to be interrupted.

In the case of muting additional sensor signals are used to differentiate between humans and material. To this purpose an evaluation unit (e. g. the Flexi Classic modular safety controller) evaluates the signals from external sensors logically and, if the muting condition is valid, mutes the protective device so that the material to be transported can pass the protective device. As soon as anything except the material enters the hazardous area, the working process is interrupted.

NOTE
It is not possible to implement muting applications using the UE410-GU.

DANGER
Pay attention to the following safety notes!

- Muting is only allowed to be activated during the period when the material to be transported (e. g. on a pallet) blocks the access to the hazardous area.
- Muting must be triggered by at least two independently wired signals (e. g. from muting sensors) and must not depend entirely on software signals (for instance from a PLC).
- Muting must be removed immediately as soon as the material to be transported no longer blocks the access to the dangerous movement so that the protective device is once more effective.
- The material to be transported must be detected over its entire length, i. e. there must be no interruption in the muting output signals.
- Always position the sensors so that the minimum distance to the protective device is observed!
- Prevent the unintentional triggering of muting by a person by mounting the sensors appropriately!

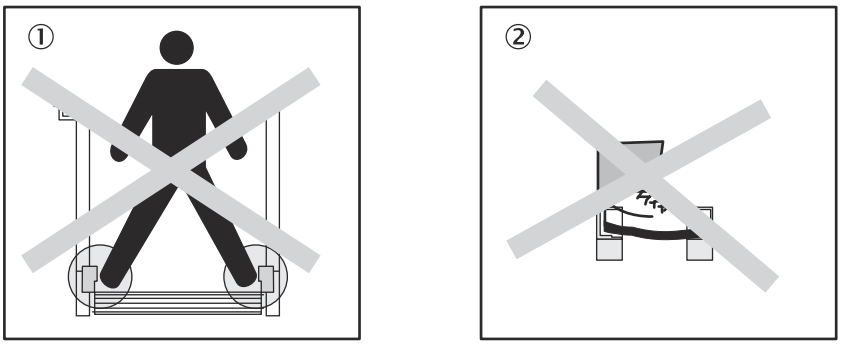


Figure 25: Safety requirements when mounting the muting sensors

① It must not be possible to activate sensors that are located opposite one another at the same time.

② It must not be possible to activate sensors that are located next to one another at the same time.

DANGER

Always mount the muting lamp where it can be clearly seen!

The muting lamp must be clearly visible from all sides of the hazardous area and for the system operator.

4.6.1 Muting with two sensors

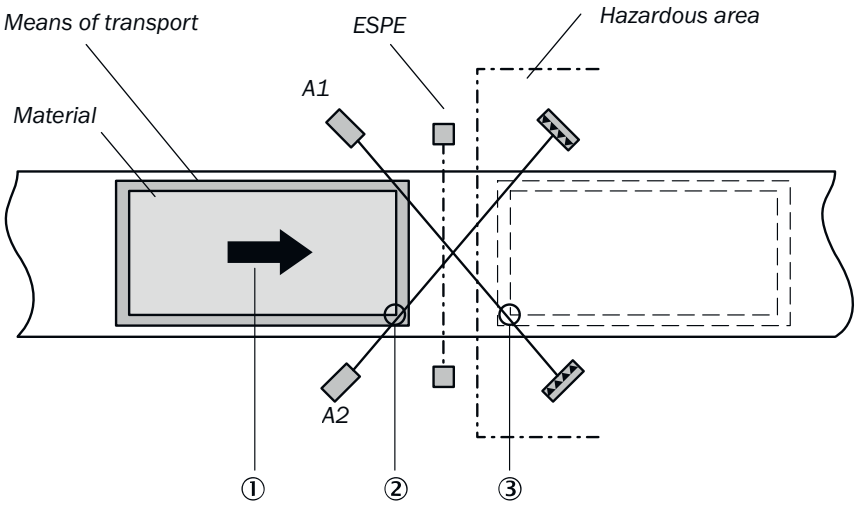


Figure 26: Schematic diagram

In the example, the material moves from left to right on a conveyor belt ①. As soon as the muting sensors A1 and A2 are activated ②, the protection provided by the ESPE protective device is muted and the material can move into the hazardous area. As soon as the muting sensors are clear again ③, the protection provided by the protective device is re-activated.

4.6.2 Muting cycle

The muting cycle is the sequence defined for all the processes that run during muting. The cycle starts when the first muting sensor is activated. The cycle ends when the last muting sensor returns to its initial status (e. g. clear light path for optical sensors). Only then is it possible to activate muting again.

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

4.6.3 Muting sensors

Muting sensors detect material and supply the necessary signals as required by an evaluation unit (e. g. the Flexi Classic modular safety controller.) If the muting conditions are met, the evaluation unit can mute the protective device based on the sensor signals.

Sensor signals can be generated by the following external sensors:

- Optical sensors
- Inductive sensors
- Mechanical switches
- Controller signals

SICK muting sensors

An overview of the SICK muting sensors is available in "SICK muting sensors", page 72.

4.7 Placement of muting sensors

DANGER
Pay attention to the following notes on the placement of the muting sensors!

- ► Always arrange the muting sensors so that only the material is detected, and not the transportation equipment (pallet or vehicle).
- ► Always position the muting sensors such that material can pass unhindered, but people are reliably detected.

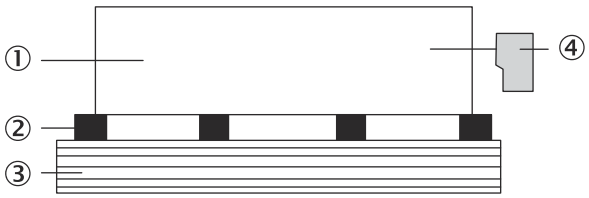


Figure 27: Detection of material during muting

① Transported material
② Transportation equipment
③ Transport level
④ Muting sensor

- ► Always position the muting sensors such that, on the detection of the material ①, a minimum distance to the light beams on the ESPE ② is maintained.

NOTE
The minimum distance provides the processing time necessary until muting is activated.

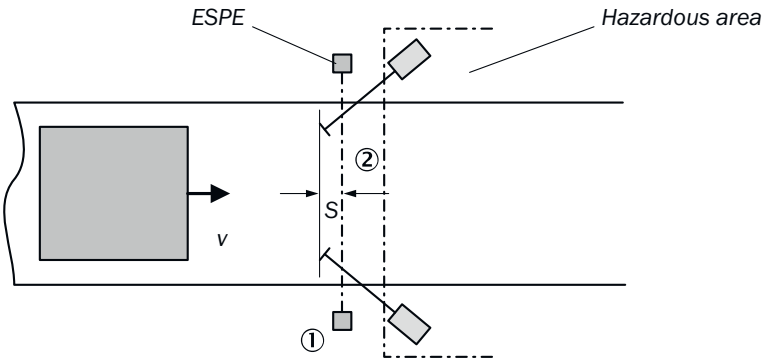


Figure 28: Minimum distance, material detection to the ESPE on muting

How to calculate the minimum distance:

$S \geq v \times 61\ ms$

where...

S = minimum distance (mm)

v = velocity of the material (e. g. of the conveyor belt) (m/s)

► Use optical sensors with background suppression. These detect material only up to a specific distance. Objects that are further away than the material to be detected are not detected.

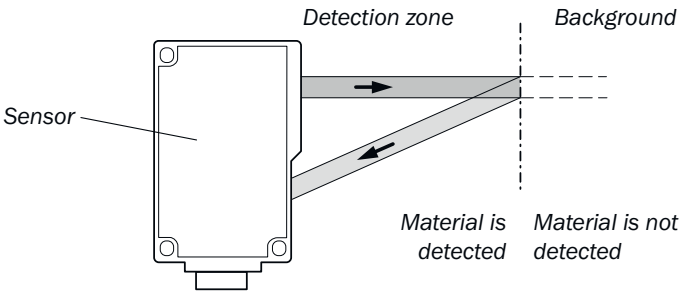


Figure 29: Functionality of sensors with background suppression

4.7.1 Muting with two sensors (a sensor pair), crossed placement

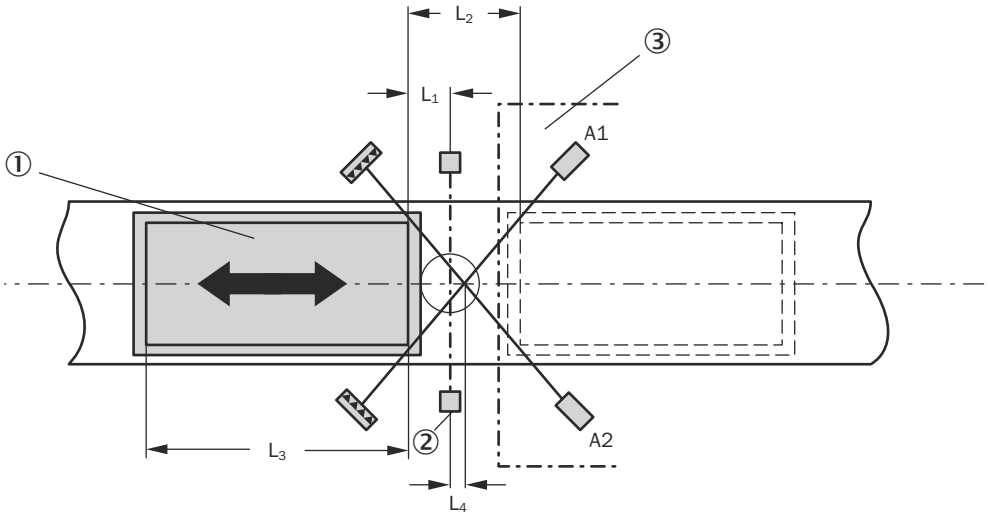


Figure 30: Muting with two sensors, crossed placement

① Transported material
② ESPE (e.g., safety light curtain)
③ Hazardous area

In the example, the material moves from left to right or, alternatively, from right to left. As soon as the muting sensors A1 and A2 are activated, the protection provided by the protective device (ESPE) is muted.

The following prerequisites must be met:

Table 33: Conditions for muting with two sensors, crossed placement

Condition	Description
A1 & A2	Muting applies for as long as this condition remains fulfilled.

How to calculate the distance:

$L_1 \geq v \times 61$ ms

where...

L_1 = Minimum distance between the light beams of the ESPE and the detection by the muting sensors (mm)

v = velocity of the material (e.g., of the conveyor belt) (m/s)

NOTE

- The material can flow in both directions.
- In order for materials to be conveyed in both directions, place the intersection of the muting sensors ① exactly on the course of the light beams of the ESPE. In order for material to be conveyed in one direction only, place the intersection behind the light beams of the ESPE seen from the conveyor direction.
- This placement is suitable for through-beam photoelectric switches and photoelectric reflex switches.

4.7.2 4-sensor muting, sequential layout

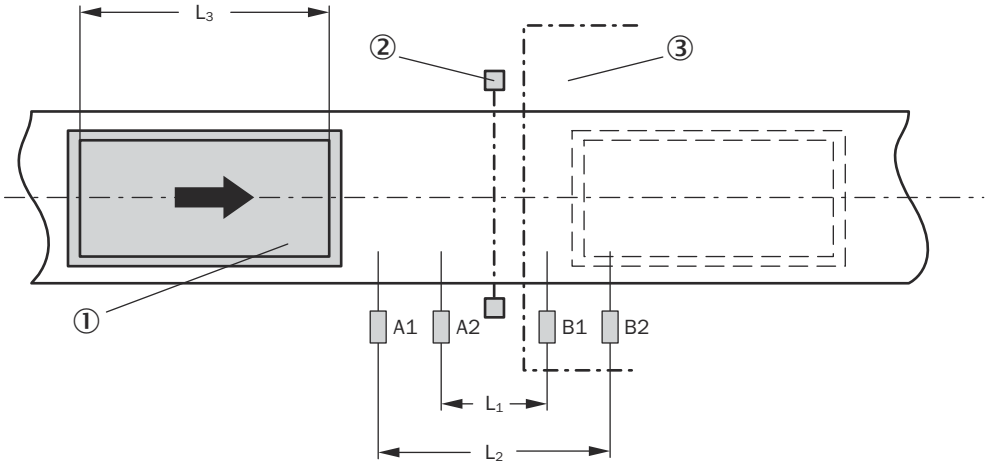


Figure 31: Simulated muting with 4 sensors

① Transported material
② ESPE (e.g., safety light curtain)
③ Hazardous area

In the example, the material moves from left to right. As soon as the muting sensors A1 & A2 are activated, the protection provided by the protective device (ESPE) is muted. The protection remains muted until one of the sensors in the muting sensor pair B1 & B2 is clear again.

4.7.3 Muting with UE410-MU/UE410-XU

A simple muting function can be implemented at the UE410-MU/UE410-XU modules (programs 3.1 and 3.2) by using inputs I3 and I4 for the muting sensors. Inputs I3 and I4 are AND-linked to each other and mute the safety sensor equipment connected to I1/I2.

A muting lamp can be connected to output Q3.

Features of the muting function for UE410-MU/UE410-XU:

- The outputs on the muting sensors must be “0” on powering up the Flexi Classic, otherwise a sequence error will be generated and the system will generate ERROR.
- Muting duration indefinite
- Switching behavior of the muting sensors is not limited in time.
- Direction independent muting
- Inputs I3/I4 for muting sensors can be “1” simultaneously.
- The muting lamp is not current monitored and has two functions:
  - Muting lamp ON continuously, then muting is active,
  - Muting lamp flashes at 1 Hz, then the Reset required is active.

Muting with 4 sensors:

DANGER

- With this 4-sensor muting two muting sensors each are connected to one input of the UE410-MU/UE410-XU. Take into account that the muting sensors A1/B2 and A2/B1 are combined respectively.
- Only “high-side”-switching sensors may be used for 4-sensor muting. Thereby it has to be ensured that a “high” always overwrites a “low”. This type of muting may only be used after thorough risk analysis/error analysis.

4.8 SICK muting sensors

Table 34: Selection of the optical SICK muting sensors

Sensor	Type	Output signal switching device Q
Photoelectric proximity sensor	WT24-2	Light switching
	WT273	
	WT260	
Photoelectric retro-reflective sensor	WL23-2	Dark switching
	WL27-3	
	WL260	
	WL12-3	
	WL14-2	
	WL183	
Through-beam photoelectric sensor	WS/WE24-2	Dark switching
	WS/WE27-3	
	WS260/WE260	

NOTE

For the selection and settings for the SICK optical muting sensors in muting applications, the following applies:

- The outputs must be PNP switching.
- Other product family are possible.

4.9 Bypass

The bypass function bypasses the logic paths A/B in the UE410-MU/UE410-XU or the logic path B in the UE410-GU and forces their safety outputs to logical “1” for 60 s. The bypass function can be implemented via a UE410-8DI input extension module (switch setting 8).

The bypass signal is limited to a duration of 60 s. After the period has expired, bypass operation can be activated again after deactivation.

NOTE

- On the UE410-GU the bypass function can only be implemented on the local cut-off path via input B.
- A bypass function on the UE410-GU that acts on the global cut-off path (input A) is not permitted and will result in a configuration error (ERROR).

DANGER

Ensure that there is no danger during bypass operation!

As long as the bypass function is active, the safety outputs of the UE410-MU/UE410-GU/ UE410-XU modules are activated. You have to ensure that there is no danger to persons or parts of the machine or system during bypass operation.

The bypass function may only be activated by a key-operated switch with an automatic reset and two levels or by two input signals that are independent of each other, e. g. two position switches.

DANGER
Check the connected key-operated pushbutton for bypass regularly!

- ► Using organizational measures, ensure that the key-operated pushbutton for bypass is actuated once after a certain interval. This is necessary so that the Flexi Classic can identify an error status of the key-operated pushbutton for bypass or an error condition in its connection cable that occurs up until then. The interval is to be defined to suit the specific case dependent on the application.
- ► Constantly check in the operating mode in which you have configured the bypass active whether the bypass function can be activated and deactivated.

DANGER

- It must be possible to view the entire hazardous point when pressing the key-operated pushbutton for bypass.
- It may not be possible to actuate the key-operated pushbutton for bypass in the hazardous area.
- The safety controller ends the bypass automatically when an error occurs.

4.10 Wiring S1, S2, S3

Three control inputs S1, S2, and S3 are available for the configuration of the control circuit functions (restart interlock, retriggering, EDM) at the UE410-MU/UE410-XU modules.

NOTE
No control inputs are available on the UE410-GU.

4.10.1 Operation with restart interlock

In the case of operation with a restart interlock the reset button is connected to the respective input (S1/S2). The required starting condition for canceling the restart interlock is only fulfilled, when the reset button is pressed and released again and the feedback circuit is closed.

4.10.2 Operation without restart interlock

The outputs are activated as soon as the input conditions of the safety sensors have the value of logical “1”. A reset button is not required.

4.10.3 Operation with external device monitoring (EDM)

The static EDM monitors whether the controlled contactors have dropped out during resetting. The EDM is included in the feedback circuits S1, S2 and S3 in accordance with the set program.

Table 35: EDM by means of S1

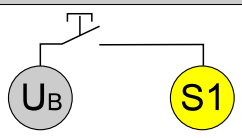
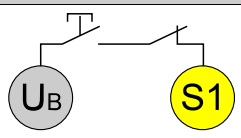
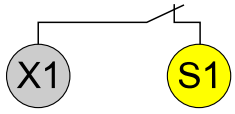
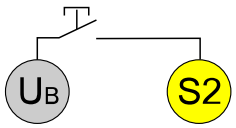
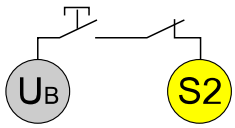
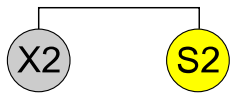
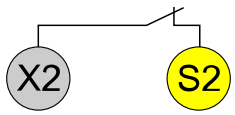
Wiring	S1	
	Without EDM	With EDM
Manual reset (with restart interlock)		
Automatic reset (without restart interlock)		

Table 36: EDM by means of S2

Wiring	S2	
	Without EDM	With EDM
Manual reset (with restart interlock)		
Automatic reset (without restart interlock)		

4.11 Retriggering of the delayed OSSDs

The behavior of the switch-off delay (not on UE410-xxxT0) can be influenced by means of retriggering. Retriggering is specified by connecting terminal S3 to the supply voltage $+U_B$ or the module-specific cycle output X2.

NOTE
Retriggering is not possible on the UE410-GU.

Example: Retriggering ON

During automatic operation a protective door is opened and the off delay is started for the corresponding releases. If the door is closed again before the delay time has expired, the releases do not switch off and the machine continues to run without interruption.

Example: Retriggering OFF

During manual operation the emergency stop pushbutton is activated and the off delay is started for the corresponding releases. If the emergency stop pushbutton is reset again before the delay time has expired and the reset button is pressed, the releases are nevertheless deactivated. Renewed releasing via the reset button is not possible until the delay time has expired.

Table 37: Retriggering time response

Retrigger-ing	Procedure
ON	If the safe input state (all input conditions are valid) of the input circuits is attained again before the time has expired, the delayed output circuits do not change and the delay time is reset.
OFF	The delayed output circuits open after the delay time has expired irrespective of the status of the input circuits. In the case of an automatic start and a safe input status before the delay time has expired, the delayed OSSDs are deactivated for 400 ms, and are then re-activated

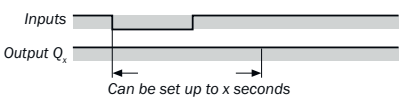


Figure 32: Retriggering ON, with/without restart interlock

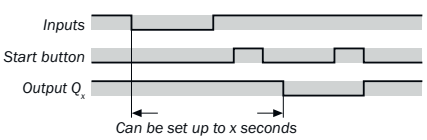


Figure 33: Retriggering OFF, with restart interlock

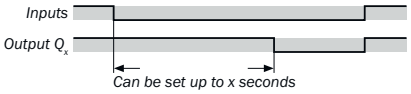


Figure 34: Retriggering OFF, without restart interlock

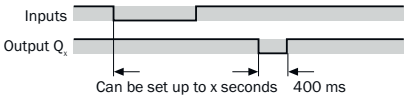
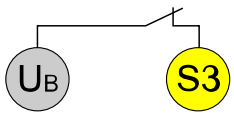
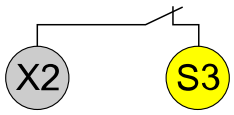


Figure 35: Retriggering OFF, without restart interlock

Table 38: EDM by means of S3

Wiring	S3	
	Without EDM	With EDM
Without retriggering		
With retriggering		

NOTE

- S1 and S3 must always be wired.
- S2 must be wired depending on the program.

NOTE

All later changes at the wiring of S1, S2 and S3 will cause a lock-out (ERR).

- During the configuration phase (when the voltage is activated) of the manual reset with the reset button, the corresponding S-input must be open or be wired to a high-resistance output, for example of a PLC (high or low potential causes an incorrect configuration).
- In order to monitor external contactors that may be connected to the safe outputs Q1 to Q4, the N/C contacts of the respective contactors or output extensions have to be connected in series with the corresponding control inputs.

4.12 Grouping of subsystems

NOTE

In case of single-channel wiring of a safety output (Q1–Q4) to a signal input (EN), it is possible to achieve category 4 in accordance with ISO 13849 or SIL3 in accordance with IEC 62061.

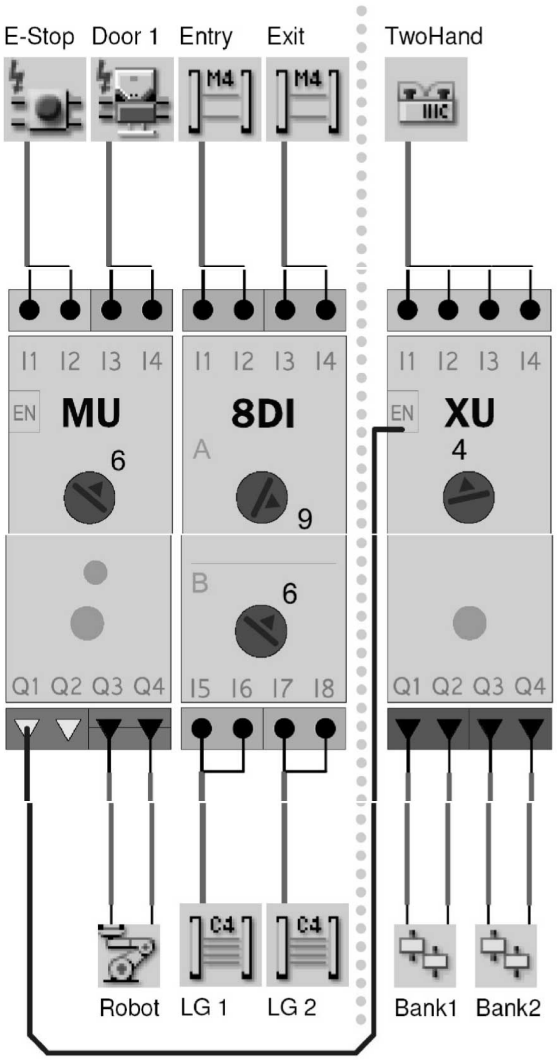


Figure 36: Cascading of safety circuits

DANGER
Exclude cross-circuits by means of appropriate wiring!

- If several modules are used (> 1), cross-circuits on test pulse outputs (X1-Xn) can not always be detected.
- If two modules are used (UE410-MU or UE410-GU and a UE410- XU), cross-circuits on safety outputs (Q1-Q4) can not always be detected.

► If several modules are used, the possibility of cross-circuits has to be excluded by means of appropriate wiring measures (protected installation, plastic-sheathed cable etc.).

4.13 ENABLE input

For all UE410-MU and UE410-XU devices with a type label entry from E1: In case of single-channel wiring of a safety output (Q1–Q4) to a signal input (EN), it is possible to achieve category 4 in accordance with ISO 13849 or SIL3 in accordance with IEC 61508.

NOTE
The ENABLE input is not available on the UE410-GU.

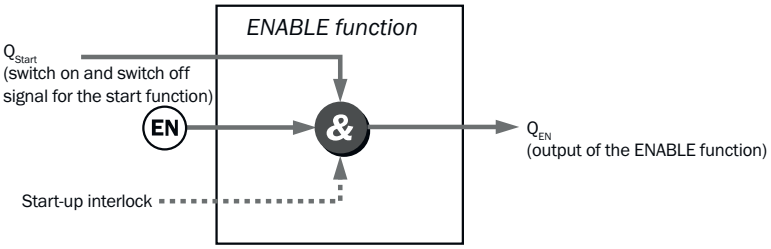


Figure 37: ENABLE input

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

NOTE
Unused ENABLE inputs must be connected to the supply voltage $+U_B$.

When the ENABLE input goes low (0 V DC), the OSSDs (Q1-Q4) always go low and at the same time no signal such as a reset or muting is detected until ENABLE is high again.

Switching OFF and switching ON ENABLE does not require a renewed reset on the related modules, the OSSDs (Q1-Q4) go high.

If a time delay has been set on Q3/Q4, the delay starts after the ENABLE input goes low.

5 Mounting

5.1 Mounting the modules

Prerequisites

- The Flexi Classic system is only suitable for mounting in a control cabinet rated to at least protection class IP 54.
- In a Flexi Classic system, the main module UE410-MU is positioned at the far left and one of the optional gateways, e.g., UE410-PRO, at the far right.
- The connection between the modules is effected by means of the plug connector integrated in the housing.
- Mounting in accordance with EN 50274
- The modules are located in a 22.5 mm wide housing for 35 mm standard rails as per EN 60715 (DIN mounting rail).

Approach

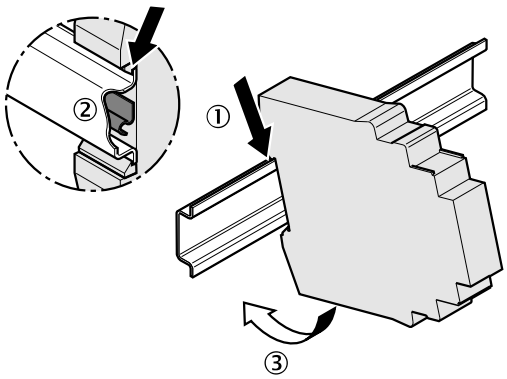


Figure 38: Hanging the module into the DIN mounting rail

- ► Hang the device on the mounting rail (①).
- ► Ensure that the earthing spring contact (②) is positioned correctly.
- ► The earthing spring contact of the module must contact the DIN mounting rail making good electrical contact. Latch the module onto the DIN mounting rail by pressing it lightly in the direction of the arrow (③).

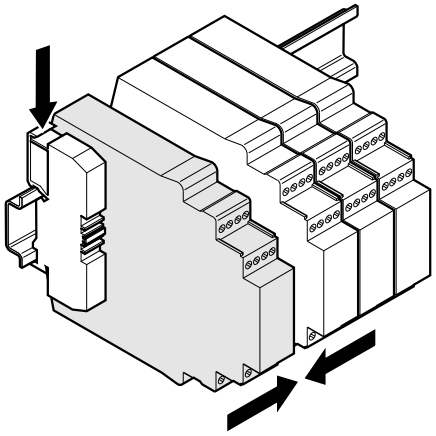


Figure 39: Installing the end clips

- ► If there are several modules, slide the modules together individually in the direction of the arrow until the side plug connection latches in.
- ► Install end clips on the right and left.

5.2 Removing the modules

Approach

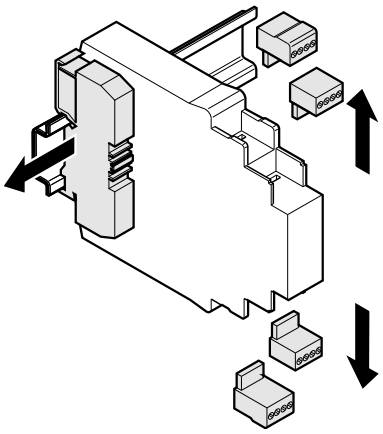


Figure 40: Removing the plug-in terminals

► Remove the plug-in terminals with wiring and the end clips.

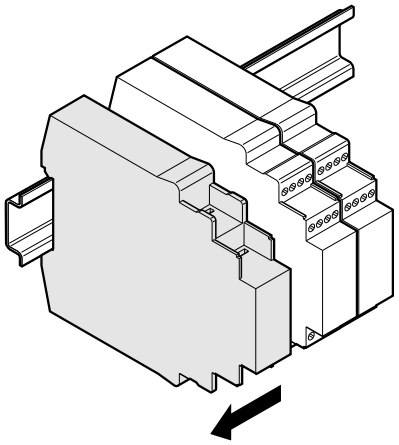


Figure 41: Disconnect plug connector

► If there are several modules, slide the modules away from each other individually in the direction of the arrow until the side plug connector is separated.

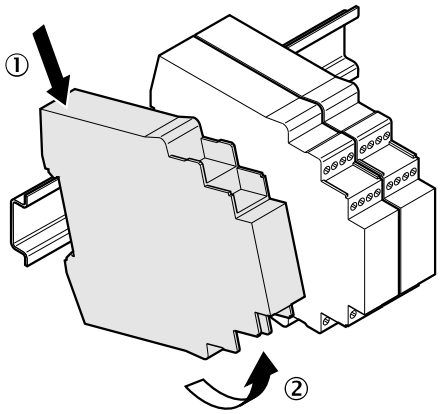


Figure 42: Removing the module from the DIN mounting rail

► Press the module downwards (①) and remove it from the DIN mounting rail in the direction of the arrow while keeping it pressed down (②).

5.3 Removing the anti-manipulation cover

Overview

To prevent tampering on the Flexi Classic, SICK provides an anti-manipulation cover.

Approach

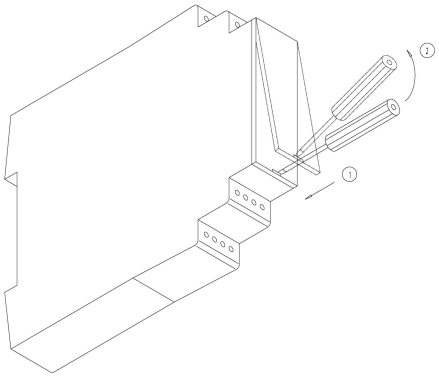


Figure 43: Anti-manipulation cover

- ► Insert a screwdriver in the opening (①).
- ► The anti-manipulation cover fastening is released by upward movements. The anti-manipulation can be removed (②).
- ► The cover is closed by engaging it.

Further topics

- "Anti-manipulation cover", page 118

6 Electrical installation

6.1 Electrical installation

Important information

DANGER
Note when wiring!

An UE410-8DI has two test pulse generators. This means that short-circuits between X1 (odd) and X2 (even) numbered outputs will be detected. Short circuits between X1, X3, X5, X7 (odd) or X2, X4, X6, X8 (even) will not be detected (see also "Grouping of subsystems", page 75).

Prerequisites

- Mounting is completed.
- Dangerous condition of the machine is and remains off during the electrical installation.
- The mounting rail is connected to the functional earth.
- The Flexi Classic safety controller fulfills the EMC requirements in accordance with the basic specification EN 61000-6-2 for industrial use and EN 61131-2 for control systems.
- The Flexi-Classic modules conform to Class A, Group 1, in accordance with EN 55011. Group 1 encompasses all ISM devices in which intentionally generated and/or used conductor-bound RF energy that is required for the inner function of the device itself occurs.
- You must connect the Flexi Classic to the same voltage supply as the connected protective devices.
- To meet the requirements of the relevant product standards (e.g. IEC 61496-1), the external voltage supply for the devices (SELV) must, among other aspects, be able to bridge a power failure lasting 20 ms. Suitable power supply units are available as accessories from SICK.
- When several power supply units are used, all mass connections (GND) must be connected to each other.
- All UE410-GU modules that are on a common global emergency stop cut-off path must be connected to the same GND connection.
- The voltage supply as well as all signals connected have to fulfill the regulations for extra-low voltages with safe separation (SELV, PELV) in accordance with EN 60664 and EN 50178 (equipment of electrical power installation with electronic devices) or NEC Class 2 according to UL 1310.
- External protective elements must be used when installing the device in overvoltage category III environments. The required level of protection as per EN 62305-1 can be achieved using an external suppressor. The protective elements used (SPD – surge protective devices) must meet the requirements in accordance with EN 61643-11.
- The wires of a connected reset button must be in separate plastic-sheathed cables.
- All connected devices and the reset pushbutton comply with the required category in accordance with ISO 13849-1 and SIL in accordance with IEC 62061 (e.g. shielded single sheathed cables, separate installation).
- All connected controls switches and downstream controllers as well as the wiring and routing comply with the required category in accordance with ISO 13849 and SIL in accordance with IEC 62061 (e.g. shielded single sheathed cables, separate installation).

- To protect the safety outputs and increase the service life, the external loads must be equipped with, for example, varistors or RC circuits. It should be noted that the response times may be extended depending on the type of suppressor.
- Single-channel safety outputs and the external device monitoring (EDM) and ENABLE (EN) must be wired within the control cabinet.
- External errors (e.g., cross-circuits) between two modules within a Flexi Classic system are to be avoided through the use of appropriate countermeasures (separating effected wires, single plastic-sheathed cable etc.). For more information see "Grouping of subsystems", page 75.
- Mount the reset control switch outside the hazardous area so that it cannot be actuated by a person who is inside the hazardous area. The operator must have full visual command of the hazardous area when actuating the control switch.

7 Application and connection diagrams

NOTE

By taking into account all the necessary boundary conditions and their evaluation in a Failure Mode and Effects Analysis (FMEA), applications up to a maximum of SIL3 (IEC 61 508) can be achieved.

7.1 L21 on the UE410-MU/XU

Program 3.2 with restart interlock and EDM

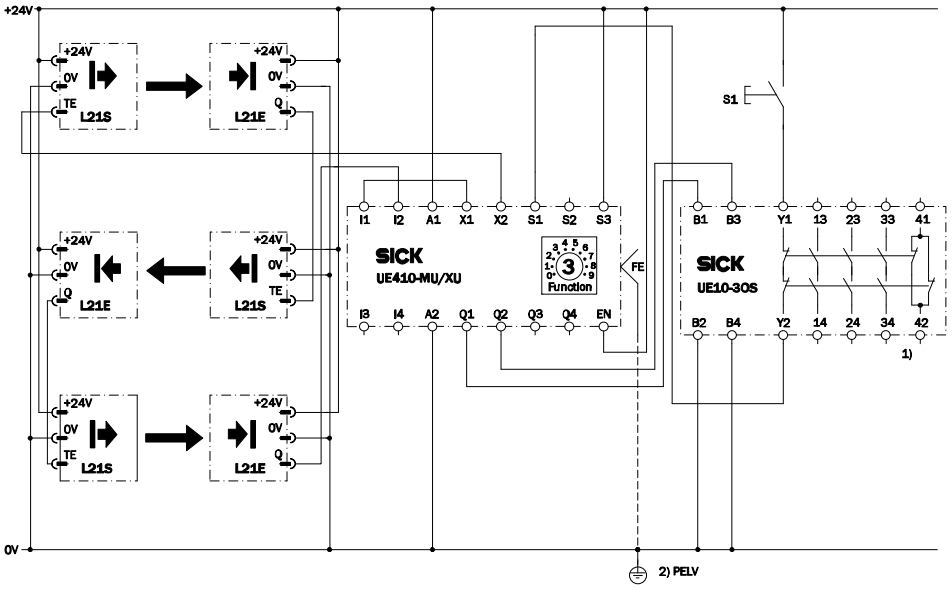


Figure 44: Connection of three L21 to the UE410-MU/XU

7.2 Emergency stop on the UE410-MU/XU

Program 1 with restart interlock and EDM

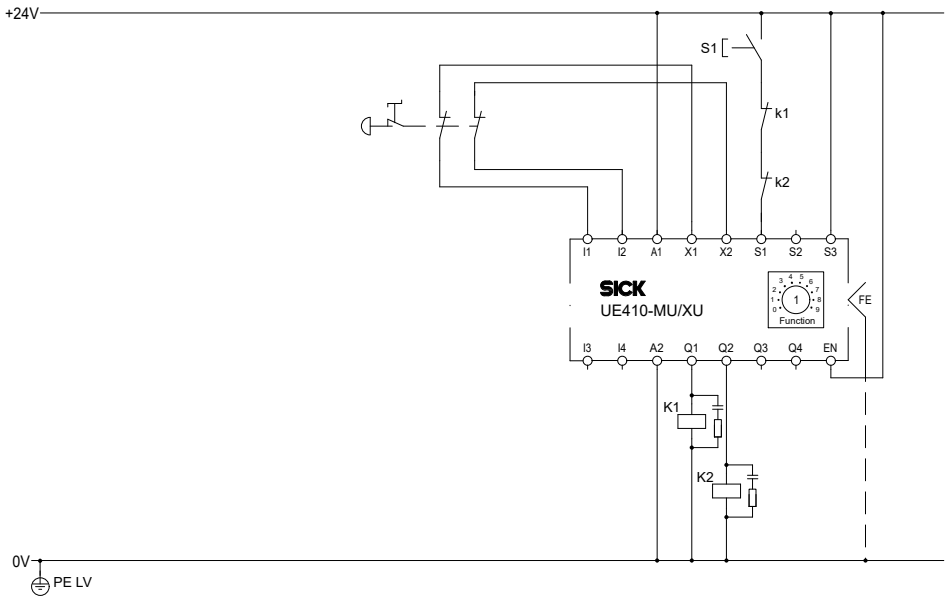


Figure 45: Connection of an emergency stop to the UE410-MU/XU

7.3 RE300 on the UE410-MU/XU

Program 2 with restart interlock and EDM

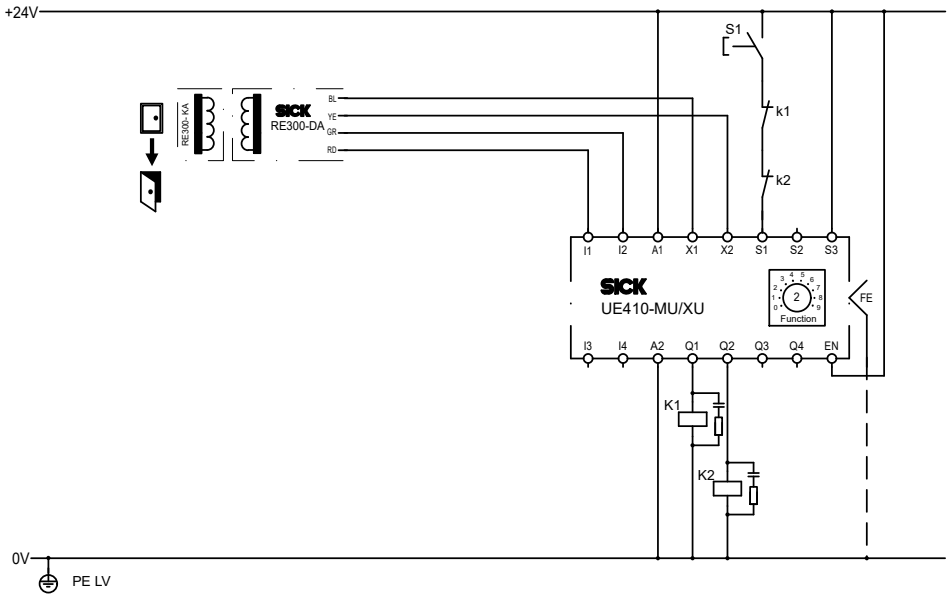


Figure 46: Connection of an RE300 to the UE410-MU/XU

7.4 Two-hand IIIC on the UE410-MU/XU

Program 4 without restart interlock and with EDM

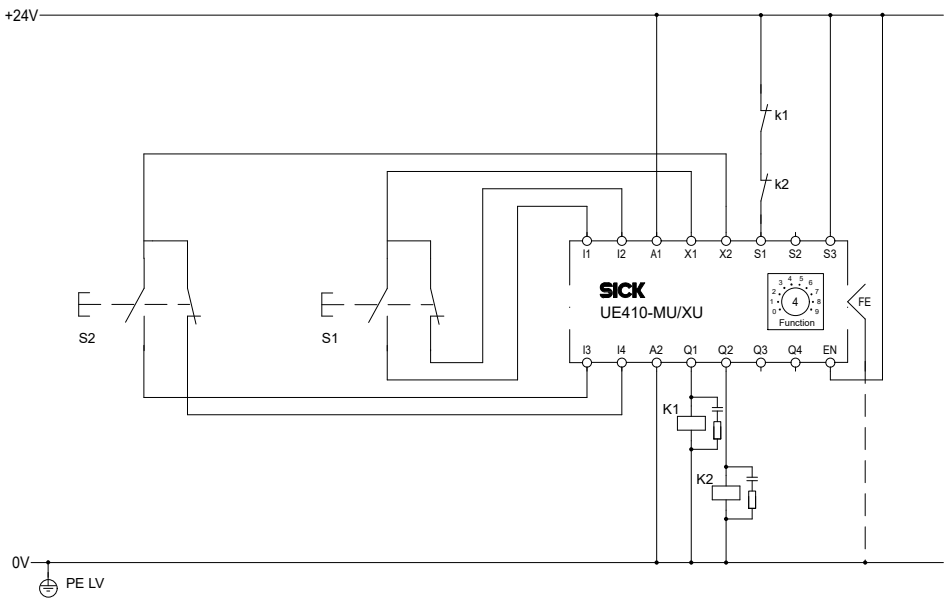


Figure 47: Connection of a two-hand switch IIIC to the UE410-MU/XU

7.5 C2000 and emergency stop on the UE410-MU/XU, two hazardous areas

Program 7 with restart interlock and EDM

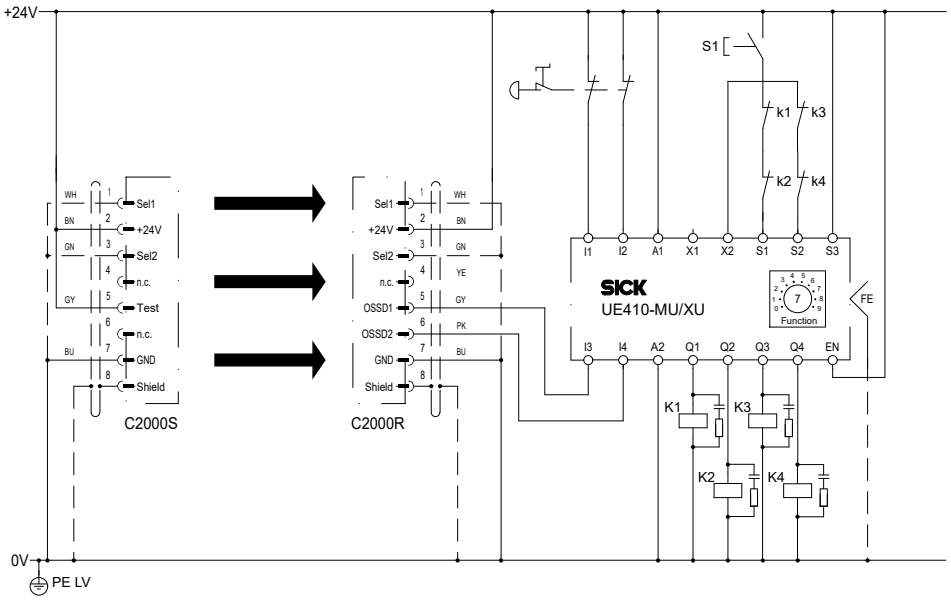
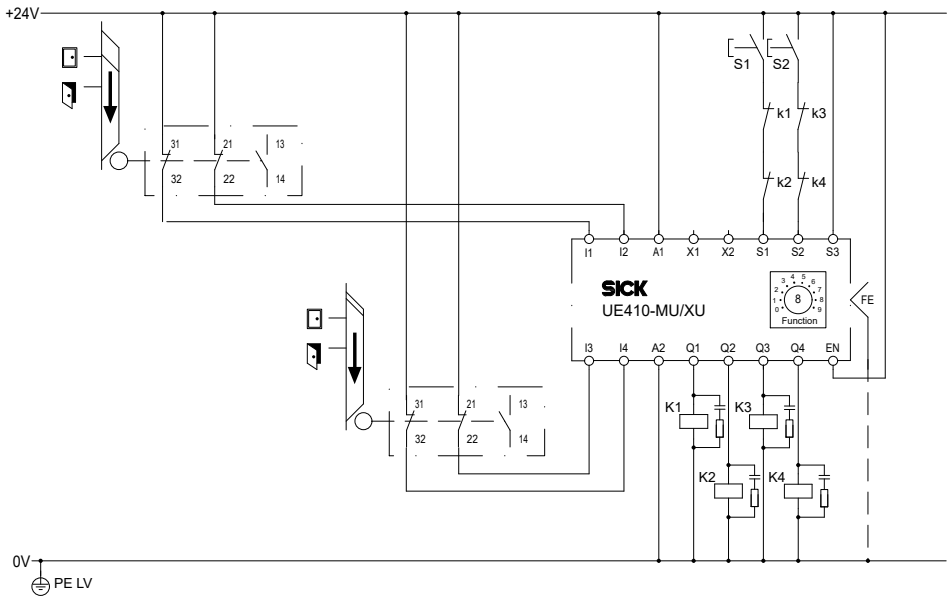


Figure 48: Connection of a C2000 and emergency stop to the UE410-MU/XU

7.6 i11 on the UE410-MU/XU, two independent hazardous areas

Program 8 with restart interlock and EDM



7.7 IN4000 on the UE410-MU/XU

Program 3.2 with restart interlock and EDM

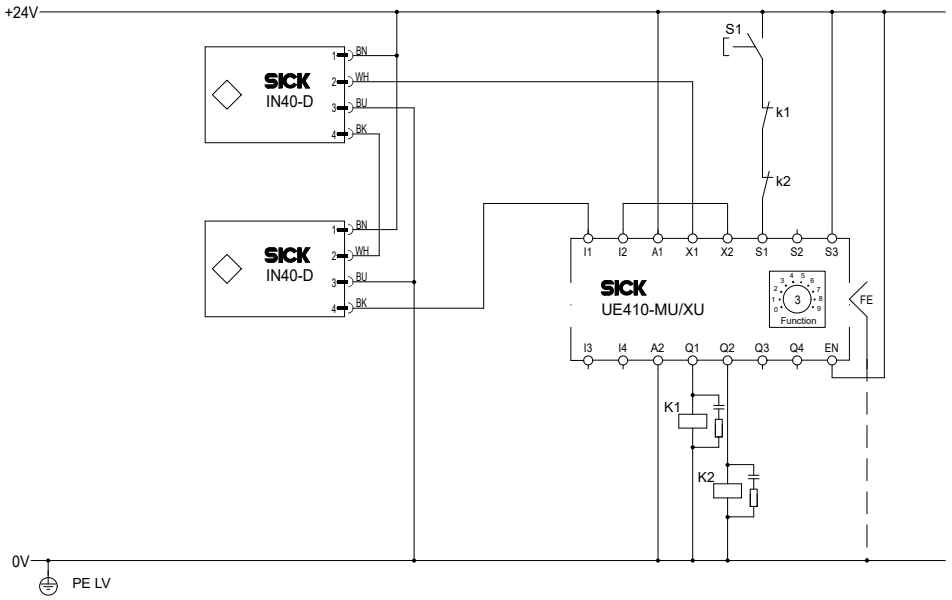


Figure 49: Connection of two IN4000 switches to the UE410-MU/XU

7.8 C4000 on the UE410-MU/XU, 2-sensor muting

Program 3.1 with restart interlock and EDM

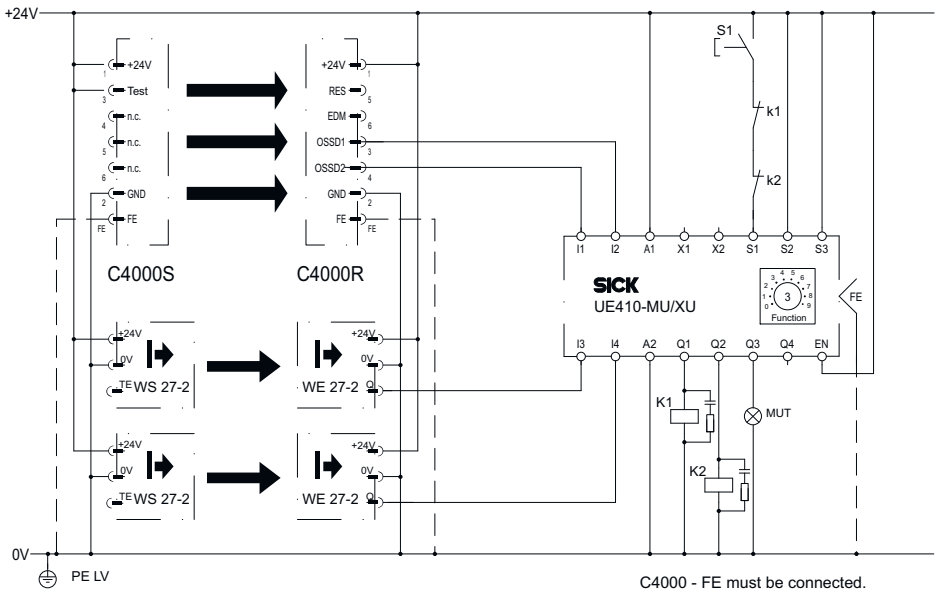


Figure 50: Connection of a C4000 to the UE410-MU/XU, 2-sensor muting

7.9 Global emergency stop with two UE410-GU

Program 1 (global emergency stop only)

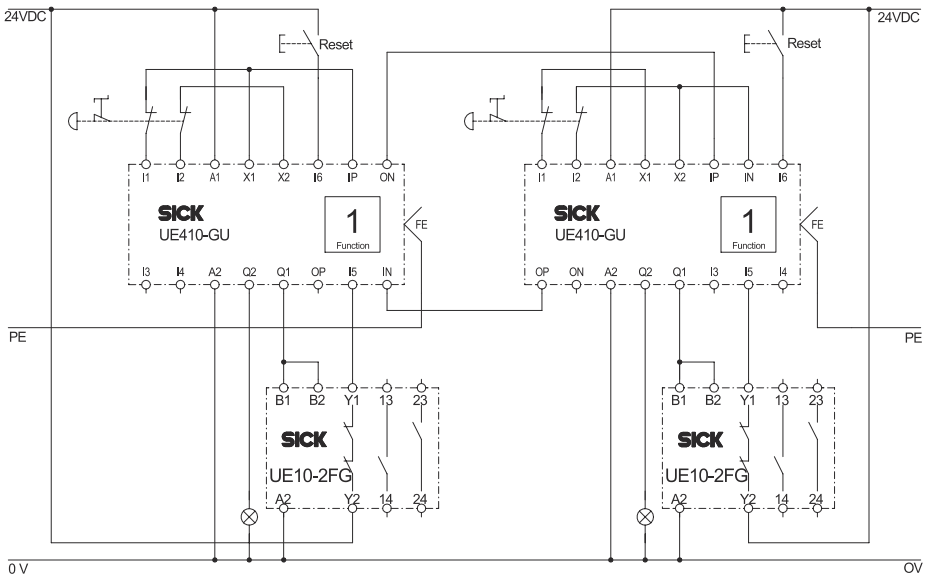


Figure 51: Global emergency stop with two UE410-GU

8 Configuration

8.1 Accepting the system configuration

Important information

DANGER
Loss of the safety function due to incorrect configuration!

The configuration of safety applications must be carried out with the greatest accuracy and must match the status and the condition of the machine or system to be monitored.

- ► Check whether the configured safety application monitors the machine or system as planned and whether the safety of a configured application is ensured at all times. This must be ensured in every operating mode and secondary application. The results of this check must be documented!
- ► In each case, observe the instructions for commissioning and daily checking in the operating instructions of the protective devices integrated into the safety application!
- ► Note the warnings and descriptions of operation of protective devices connected to the safety controller! If in doubt, please contact the respective manufacturer of the protective device!

DANGER
Check the configuration for the protective device after each change!

If you change the configuration, you must check the effectiveness of the protective device. Observe the test notes in the operating instructions of the connected protective device.

Prerequisites

- Screwdriver required

Approach

- ► Switch off the voltage supply (terminals A1, A2) at all main modules.
- ► Use a screwdriver to set the desired switch settings (programs and functions) at the rotary switches on all modules of the system.
- ► Switch on the voltage supply of all the modules while keeping the ENTER pushbutton of the UE410-MU or UE410-GU main module pressed.

NOTE
Do not press any of the connected reset buttons while this state is present!

- ► When the ERR indicator begins to flash, release the ENTER button within 3 seconds.
- ✓ The selected operating mode is stored as a non-volatile setting and is active.

NOTE
If the ENTER button is pressed for more than 3 seconds, the entire system switches to the error state. The ERR display flashes.

NOTE
All subsequent changes to the wiring at S1, S2, S3 will cause a lock-out (ERR).

Further topics

- "Fault indicators", page 93

9 Commissioning

9.1 Changing the Telnet password

Overview

The following devices with serial numbers ≤ 2311xxxx contain a Telnet server:

- UE410-EN1
- UE410-EN3
- UE410-EN4

The Telnet password for accessing the Telnet server is blank by default. For better security, change the Telnet password before commissioning.

Allowed password length: 15 characters

Approach

1. Open the Windows command prompt.
2. Enter the following commands with appropriate values:
```
$ telnet <Gateway-IP-Address>
Password: <old password> [Enter]
passwd <utmost secure password> [Enter]
quit [Enter]
```
3. Use the following commands to test whether the new password has been saved.
```
$ telnet <Gateway-IP-Address>
Password: <new password> [Enter]
```

9.2 Final acceptance of the application

Prerequisites

- Before commissioning, make sure that there are no persons in the hazardous area.
- Only appropriately trained personnel are allowed to carry out final acceptance.

Approach

- ► Check whether the connection of the components to the connections complies with the required safety parameters.
- ► Check the devices connected to the safety controller according to the test notes in the associated operating instructions.
- ► Clearly mark all connecting cables and plug connectors on the safety controller to avoid mix-ups.
- ► Perform a complete validation of the safety function (e.g. error simulation). Note the response times.
- ► Fully document the configuration for the system and individual devices, plus the results of the safety inspection.

9.3 Checks before initial commissioning

Overview

Before commissioning the machine, you must check whether the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

Prerequisites

- Before initial commissioning, ensure that the system/machine is inspected by qualified safety personnel, documented, and approved.
- Before commissioning, make sure that there are no persons in the hazardous area.
- Secure the hazardous area to prevent entry (e.g. by setting up warning signs, attaching barriers, and so on).

Checks before initial commissioning

Check the protective device as described below and in accordance with the applicable standards and regulations.

- ► Check the effectiveness of the safety function on the machine in all operating modes and functions in which the machine can be set.
- ► Ensure that all operators have been instructed by the qualified safety personnel of the machine user before they start working on a machine protected by an safety controller. Instruction is the responsibility of the machine user.

9.4 Regular thorough check of the protective device by qualified safety personnel

- ► Check the system following the inspection intervals specified in the national rules and regulations. If any changes are made to the machine or someone tampers with the protective device after initial commissioning, this will ensure that any such issues are detected.
- ► Each safety application must be checked at an interval specified by you. The effectiveness of the protective devices must be tested by qualified personnel.
- ► If any modifications have been made to the machine or the protective device, or if the safety controller has been changed or repaired, the system must be checked again as specified in the checklist in the annex.

10 Troubleshooting

10.1 Response to faults

Important information

WARNING
Cease operation if the cause of the malfunction has not been clearly identified!
Immediately put the machine out of operation if you cannot clearly identify the error and if you cannot safely remedy the problem.

► After eliminating an error, perform a full functional test.

The ERROR operational status

With certain malfunctions or an error configuration, the Flexi Classic enters the safe status. The ERR LEDs of the safety controller modules show the corresponding errors. To place the device back in operation:

► Fix the cause of the error as indicated by the ERR LED.
► Switch the voltage supply of the Flexi Classic off and on again.

10.2 Replacement of a module

Replacing modules

If in an existing Flexi Classic system a module is replaced, the following has to be observed:

UE410-MU and UE410-GU

Each time a device is replaced, it is necessary to accept the system configuration again.

UE410-XU

If in an existing Flexi Classic system a module is replaced by another module with a different revision code (e.g., C-XX to E-XX), then it is necessary to accept the system configuration again. This is not necessary if the revision code remains the same.

UE410-8DI

If in an existing Flexi Classic system a module is replaced by another module with a different revision code (e.g., C-XX to E-XX), then it is necessary to accept the system configuration again. This is not necessary if the revision code remains the same.

Additionally from revision code D-XX or higher you must pay attention to the wiring: If the devices were wired as described in these operating instructions (see "Connection of sensors to the UE410-8DI", page 53), no change is necessary. If the devices were wired e.g. via external distributor modules (X1 and X2 to I1 to I8), then a module exchange from revision code ≤ C-XX to ≥ D-XX requires that connection I5 be exchanged with I6, and I7 with I8.

Further topics

- "Accepting the system configuration", page 88

10.3 Fault indicators

Important information

NOTE
S3 and ENABLE must always be wired on the UE410-MU/XU. Otherwise the outputs Q1-Q4 cannot be enabled.

UE410-MU and UE410-GU

Table 39: Error indications of the ERR LED

Display	Error	Troubleshooting
●	Sequential error on modules that did not detect the error initially	► Eliminate the error at the respective module.
2 x ☼	Error at the module configuration	► Repeat the configuration.
3 x ☼	Rotary switch manipulated	► Turn the rotary switch back to the original position. ► Carry out a power-up or repeat teaching-in.
4 x ☼	Change to the configuration in the electrically unpowered status • on the rotary switch or • to S1-S3 (UE410-MU/XU only)	► Reset configuration to original status or ► Re-connect module to original position or ► Carry out a power-up and accept the configuration again.
	Slot list comparison found difference or differing module revisions.	
5 x ☼	Voltage supply defective	► Check voltage supply
6 x ☼	Self-monitoring, internal error, etc.	► Check cabling and rotary switch setting.

○ LED off. ☼ LED flashes. ● LED illuminates.

UE-410-SD

Table 40: Error displays of the Error-LED ERR

Display	Error	Troubleshooting
2 × ☼	Internal error	► Check the wiring ► Carry out a power-up ► Replacing the device
3 × ☼		
4 × ☼		
5 × ☼	Faulty voltage supply	► Check voltage supply
6 × ☼	Self-monitoring, internal error etc.	► Check the wiring ► Carry out a power-up ► Replace the device

○ LED off. ☼ LED flashes. ● LED illuminates.

10.4 Anti-manipulation measures

Table 41: Anti-manipulation measures

Reaction of the system	Cause	Rectification of the error
• **Immediate deactivation of all outputs** • **System changes to "System error" status.** • **Red ERR LED of the respective module flashes.** • **Green PWR LED flashes.** • **All other ERR LEDs to steady red** • **Message via diagnosis module**	Changeover of a rotary switch	► Return the switch back to the old position (adjustment indicator if voltage remains activated: flashing PWR LED changes to steady green). ► Restart the system by switching the voltage off and on again.
• **De-activation of the outputs of the system/ subsystem during the next cycle** • **Red ERR LED of the respective module flashes.** • **Message via diagnosis module**	UE410-MU/XU only: Change in the control circuit configuration (inputs S1, S2, S3)	► Reset the old configuration at S1, S2, S3. ► Restart the system by switching the voltage off and on again.
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	You can read out the last (correct) configuration using one of the Flexi Classic Gateways. ► Check the configuration visually at regular intervals.
• **Outputs of the system cannot be activated.** • **Red ERR LED of the main module (UE410MU) flashes.** • **All other ERR LEDs to steady red**	Changeover of a rotary switch	► 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.
• **Outputs of the system/subsystem cannot be activated.** • **Red ERR LED of the main module (UE410MU) flashes.** • **All other ERR LEDs to steady red**	UE410-MU/XU only: Change in the control circuit configuration (inputs S1, S2, S3)	► Reset the old configuration at S1, S2, S3. ► Restart the system by switching the voltage off and on again.

11 Decommissioning

11.1 Disposal

Approach

► Always dispose of unusable devices in accordance with national waste disposal regulations.

Complementary information

SICK will be glad to help you dispose of these devices on request.

12 Technical data

12.1 Regular testing

The Flexi Classic system must be tested regularly.

DANGER
To meet the safety-related parameters of SIL 3 (see "Technical data", page 96) according to IEC 62061, the following proof testing must be performed at least every 365 days:

- The supply voltage of the Flexi Classic system must be switched off.
- The supply voltage of the Flexi Classic system must be switched on.
- All safety functions of the connected safety sensors must be verified.

12.2 Data sheet

12.2.1 UE410-MU/UE410-XU modules

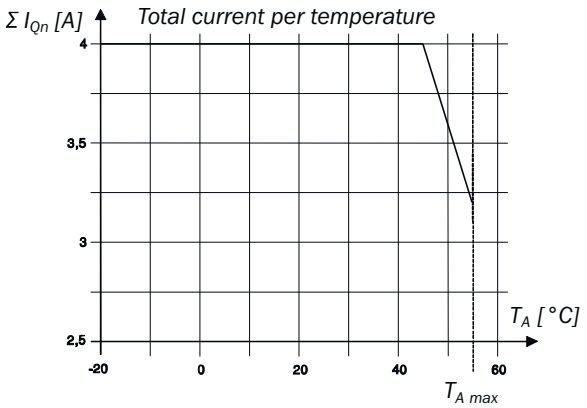
Table 42: Data sheet UE410-MU/UE410-XU

	Minimum	Typical	Maximum
Supply circuit (A1, A2)			
Supply voltage U_B	19.2 V DC	24 V DC	30 V DC
Type of supply voltage	PELV or SELV The current of the power supply unit used for the main module must be limited externally to max. 6 A - either by the power supply unit itself or using a fuse.		
Residual ripple U_{ss}	–	–	3 V
Power consumption	–	–	3 W
Power-up delay	–	–	60 s
Short-circuit protection	4 A gG with tripping characteristic B or C		
Input circuit (I1-I4, EN, S1-S3)			
Number of inputs:	–	–	8
Input voltage HIGH	13 V DC	–	30 V DC
Input voltage LOW	–5 V DC	–	5 V DC
Input current HIGH	2.4 mA	3 mA	3.8 mA
Input current LOW	–2.5 mA	–	2.1 mA
Input capacitance	9 nF	10 nF	11 nF
Minimum cut-off time[10)] (I1/I2) program 3.1, 7, 8	7 ms	–	–
Minimum switch-off time) (I1/I2) program 1, 2, 4, 5, 6, 9	20 ms	–	–
Minimum switch-off time) (I1/I2) pressure sensitive mat	20 ms	–	–
Minimum switch-off time) (I3/I4) program 1, 2, 7, 8, 9	7 ms	–	–
Minimum switch-off time) (I3/I4) program 4, 5, 6	20 ms	–	–
Minimum switch-off time) (X1I1/X2-I2) program 3.2	70 ms/20 ms	–	–

10) Time without sensor; the data from the connected sensors also applies.

	Minimum	Typical	Maximum
Minimum switch-off time (EN)	7 ms	–	–
Maximum break time of the input signal without switching of the outputs (Q1-Q4)	–	–	1 ms
Power-up delay	70 ms	–	–
Synchronous time monitoring program 1, 2	–	1,500 ms	–
Synchronous time monitoring program 4 and 5	–	500 ms	–
Muting ON program 3[11)]	–	–	61 ms
Muting OFF program 3	–	61 ms	165 ms[12)]
Muting gap suppression program 3[13)]	95 ms	–	100 ms
Reset time	–	–	124 ms
Teach-in time of ENTER pushbutton UE410-MU (during power-up)	–	–	3 s
Duration of actuation of the reset button (only S1, S2)	50 ms	–	5 s
Control outputs (X1, X2)			
Number of outputs	–	–	2
Type of output	PNP semiconductors, short-circuit protected, cross-circuit detecting[14)]		
Output voltage	16 V DC	–	30 V DC
Output current[15)]	–	–	120 mA
Test period (X1, X2) program 1, 2, 4, 5, 6, 9	–	–	40 ms
Test period (X1, X2) program 3.2	–	–	X1 = 384 ms X2 = 40 ms
Load capacity	–	–	1,000 nF
Conductor resistance	–	–	100 Ω
Output circuit (Q1, Q2, Q3, Q4)			
Number of outputs	–	4	–
Type of output	PNP semiconductor, short-circuit protected, cross-circuit monitored)		
Switching voltage	18.4 V DC	–	30 V DC
Switching current			
I_{Qn}, $T_U \leq 45$ °C	–	–	2.0 A
I_{Qn}, $T_U \leq 55$ °C	–	–	1.6 A
Total current I_{sum}			
ΣI_{Qn}, $T_U \leq 45$ °C	–	–	4 A
ΣI_{Qn}, $T_U \leq 55$ °C	–	–	3.2 A

11) Time between muting condition valid (I3/I4 high) and muting possible.
12) Max. switch-off time at muting error.
13) One muting input (I3 or I4) may be LOW for the specified time.
14) Cross-circuit detecting only within a module.
15) The total output current for a Flexi Classic system is limited. The current for supplying all sensors that are connected to the UE410-MU/XU (X1/X2) and UE410-8DI (X1-X8) must be I < 600 mA and the current on a Flexi Classic gateway must be I < 100 mA. If this total current is insufficient, please contact the SICK hotline.

	Minimum	Typical	Maximum
	 *Figure 52: Load diagram for the Q1 to Q4 outputs of the UE410MU/UE410-XU modules*		
Test pulse width	500 µs	640 µs	700 µs
Test pulse frequency	12.5 Hz	–	32 Hz
Inductive switch-off energy $E = 0.5 \times L \times I^2$	–	–	370 mJ
Load capacity	–	–	500 nF
Cable length (single, Ø 1.5 mm^2)	–	–	100 m
Response time (I1/I2)[16] Program 3.1, 7, 8	–	–	13 ms
Response time (I1/I2)) program 1, 2, 4, 5, 6, 9	–	–	29 ms
Response time (I1/I2)) program 1 pressure sensitive mat	–	–	38 ms
Response time of all programs with tested ESPE Cat. 4 (e.g. L41)	–	–	56 ms
Response time (I3/I4)) program 1, 2, 7, 8, 9	–	–	13 ms
Response time (I3/I4)) program 4, 5	–	–	29 ms
Response time (I1X1, I2X2)) program 3.2	–	–	79 ms/29 ms
Response time[17] on connection of Flexi Loop	–	–	56 ms
Response time (EN)[18]	–	–	13 ms
Delay time (adjustable)	0 / 0.5 / 1 /1.5 / 2 / 2.5 / 3 / 3.5 / 4 / 5 s		
	0 / 5 / 10 / 15 / 20 / 25 / 30 / 35 / 40 / 50 s		
	0 / 0.5 / 1 / 1.5 / 2 / 2.5 / 3 / 3.5 / 4 / 5 min		
General system data			
Weight	–	0.18 kg	–
Electrical Safety	Class III		
Immunity to interference	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Operating data			

16) Time without sensor; the data from the connected sensors also applies.
17) Response time not including Flexi Loop and not including sensor. Also take into account the response times of Flexi Loop and the sensors connected.
18) Cascading subsystems.

	Minimum	Typical	Maximum
Ambient operating temperature (UL/CSA: ambient temperature)	–25 °C	–	55 °C
Storage temperature	–25 °C	–	+70 °C
Air humidity	≤ 95%, non-condensing		
Climatic conditions	EN 61131-2		
Mechanical strength			
Vibration	EN 61131-2		
Vibration resistance	5–500 Hz / 5 grms (EN 60068-2-64)		
Terminal and connection data			
Single-wire or fine-wire	1 × 0.14 mm² to 2.5 mm² or 2 × 0.14 mm² to 0.75 mm²		
Fine stranded with ferrule in accordance with EN 46228	1 × 0.25 mm² to 2.5 mm² or 2 × 0.25 mm² to 0.5 mm²		
Stripping length	–	–	8 mm
Tightening torque	–	–	0.6 Nm
For UL 508 and CSA applications			
UE410-xx**3**..., UE410-xxx**3**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
– Tightening torque	5-7 lb·in		
UE410-xx**4**..., UE410-xxx**4**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
Safety-related parameters All these data are based on an ambient temperature of +40 °C. For detailed information on the safety configuration of your machine/system, please consult your SICK subsidiary.			
Safety integrity level (IEC 61508) Safety integrity level (IEC 62061)	SIL 3		
Category (ISO 13849)	Category 4		
Performance level (ISO 13849)	PL e		
T_M (mission time, ISO 13849)	20 years		
PFD	3.9×10^{-6}		
PFH_D (mean probability of a dangerous failure per hour)	2.5×10^{-9}		
SFF	96%		
DC	99%		

Table 43: PFD and PFH_D values for UE410-MU/UE410-XU

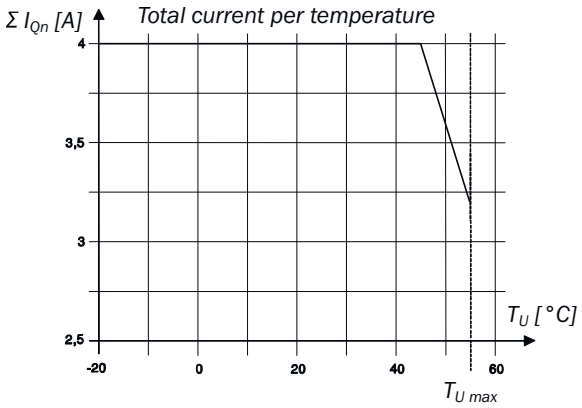
	Single-channel input, single-channel output	Single-channel input, dual-channel output	Dual-channel input, single-channel output	Dual-channel input, dual-channel output
PFD (Ø)	**2.2 × 10–5**	**5.2 × 10–6**	**2.1 × 10–5**	**3.9 × 10–6**
% of SIL 3	2.2%	0.5%	2.1%	0.4%
PFH_D (1 / h)	**6.0 × 10–9**	**2.5 × 10–9**	**6.0 × 10–9**	**2.5 × 10–9**
% of SIL 3	6.0%	2.5%	6.0%	2.5%

12.2.2 UE410-GU module

Table 44: UE410-GU data sheet

	Minimum	Typical	Maximum
Supply circuit (A1, A2)			
Supply voltage U_B	19.2 V DC	24 V DC	30 V DC
Type of supply voltage	PELV or SELV The current from the power supply unit that supplies the main module must be limited externally to max. 6 A — either by the power supply unit itself or by a fuse.		
Residual ripple U_{ss}	–	–	3 V
Power consumption	–	–	3 W
Power-up delay	–	–	60 s
Short-circuit protection	4 A gG with tripping characteristic B or C		
Input circuit (I1-I4, I_P, I5, I6, I_N)			
Number of inputs:	–	–	8
Input voltage HIGH	13 V DC	–	30 V DC
Input voltage LOW	–5 V DC	–	5 V DC
Input current HIGH	2.4 mA	3 mA	3.8 mA
Input current LOW	–2.5 mA	–	2.1 mA
Input capacitance	9 nF	10 nF	11 nF
Minimum cut-off time[19] (I1/I2)	20 ms	–	–
Minimum switch-off time) (I3/I4) program 6, 7	7 ms	–	–
Minimum switch-off time) (I3/I4) program 2, 3, 4, 5, 8, 9	20 ms	–	–
Maximum interruption time for the input signal without switching the output (Q1)	–	–	1 ms
Local power-up delay (I1-I4)	–	–	70 ms
Local reset time	–	–	124 ms
Teach-in time of ENTER pushbutton (during power-up)	–	–	3 s
Duration of actuation of the reset button (I6)	50 ms	–	5 s
Control outputs (X1, X2)			
Number of outputs	–	–	2
Type of output	PNP semiconductors, short-circuit protected, cross-circuit detecting[20]		
Output voltage	16 V DC	–	30 V DC
Output current[21]	–	–	120 mA
Test period (X1, X2)	–	–	40 ms
Load capacity	–	–	1,000 nF
Conductor resistance	–	–	100 Ω

19) Time without sensor; the data from the connected sensors also applies.
20) Cross-circuit detecting only within a module.
21) The total output current for a Flexi Classic system is limited. The current for supplying all sensors that are connected to the UE410-GU/XU (X1/X2) and UE410-8DI (X1-X8) must be I < 600 mA and the current on a Flexi Classic gateway must be I < 100 mA. If this total current is insufficient, please contact the SICK hotline.

	Minimum	Typical	Maximum
Output circuit (Q1, Q2)			
Number of outputs	–	2	–
Type of output	PNP semiconductor, short-circuit protected, cross-circuit monitored)		
Switching voltage	18.4 V DC	–	30 V DC
Switching current			
I_{Qn}, $T_U \leq 45$ °C	–	–	2.0 A
I_{Qn}, $T_U \leq 55$ °C	–	–	1.6 A
Total current I_{sum}			
ΣI_{Qn}, $T_U \leq 45$ °C	–	–	4 A
ΣI_{Qn}, $T_U \leq 55$ °C	–	–	3.2 A
	 *Figure 53: Load diagram for the Q1 and Q2 outputs of the UE410GU modules*		
Test pulse width	500 µs	640 µs	700 µs
Test pulse frequency	12.5 Hz	–	32 Hz
Inductive switch-off energy $E = 0.5 \times L \times I^2$	–	–	370 mJ
Load capacity	–	–	500 nF
Cable length (single, Ø 1.5 mm^2)	–	–	100 m
Local response time cut-off path (I1/I2)[22]	–	–	29 ms
Local response time cut-off path (I3/I4)) program 2, 3, 4 and 5	–	–	29 ms
Local response time cut-off path (I3/I4)) program 6, 7	–	–	13 ms
Local response time cut-off path (I4)) program 8, 9 with tested ESPE Cat. 4 (e.g. L41)	–	–	56 ms
Local response time[23] on connection of Flexi Loop	–	–	56 ms
Global emergency stop circuit (O_P-I_N, O_N-I_P)			
Cable length O_X to I_X	–	–	100 m

22) Time without sensor; the data from the connected sensors also applies.
23) Response time not including Flexi Loop and not including sensor. Also take into account the response times of Flexi Loop and the sensors connected.

	Minimum	Typical	Maximum
Cable length all stations, global emergency stop function[24]	–	–	1,000 m
Number of stations, global emergency stop function	–	–	32
Global response time I_X to O_X	–	–	40 ms
Global power-up delay I_X	–	80 ms	120 ms
General system data			
Weight	–	0.18 kg	–
Electrical Safety	Class III		
Immunity to interference	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Operating data			
Ambient operating temperature (UL/CSA: ambient temperature)	–25 °C	–	55 °C
Storage temperature	–25 °C	–	+70 °C
Air humidity	≤ 95%, non-condensing		
Climatic conditions	EN 61131-2		
Mechanical strength			
Vibration	EN 61131-2		
Vibration resistance	5–500 Hz / 5 grms (EN 60068-2-64)		
Terminal and connection data			
Single-wire or fine-wire	1 × 0.14 mm² to 2.5 mm² or 2 × 0.14 mm² to 0.75 mm²		
Fine stranded with ferrule in accordance with EN 46228	1 × 0.25 mm² to 2.5 mm² or 2 × 0.25 mm² to 0.5 mm²		
Stripping length	–	–	8 mm
Maximum tightening torque	–	–	0.6 Nm
For UL 508 and CSA applications			
UE410-xx**3**..., UE410-xxx**3**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
– Tightening torque	5-7 lb·in		
UE410-xx**4**..., UE410-xxx**4**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
Safety-related parameters All these data are based on an ambient temperature of +40 °C. For detailed information on the safety configuration of your machine/system, please consult your SICK subsidiary.			
Safety integrity level (IEC 61508) Safety integrity level (IEC 62061)	SIL 3		
Category (ISO 13849)	Category 4		
Performance level (ISO 13849)	PL e		
T_M (mission time, ISO 13849)	20 years		
PFD	2.1×10^{-5}		

24) The input voltage levels (I1-I6, I_P,I_N) must be met.

	Minimum	Typical	Maximum
PFH_D (mean probability of a dangerous failure per hour)	6.0×10^{-9}		
SFF	96%		
DC	99%		

Table 45: PFD and PFH_D values for UE410-GU

	Single-channel input, single-channel output	Dual-channel input, single-channel output
PFD (Ø)	**2.2 × 10–5**	**2.1 × 10–5**
% of SIL 3	2.2%	2.1%
PFH_D (1 / h)	**6.0 × 10–9**	**6.0 × 10–9**
% of SIL 3	6.0%	6.0%

12.2.3 Data sheet UE410-SD

Table 46: Supply circuit (A1, A2)

	Minimum	Typical	Maximum
Supply voltage U_B	19.2 V DC	+24 V DC	30 V DC
Type of supply voltage	PELV or SELV The current for the voltage supply must be limited externally to max. 6 A – either by the voltage supply itself or using a fuse.		
Residual ripple U_{ss}	–	–	3 V
Power consumption	–	–	3 W
Switch-on time after power-up	–	–	10 s
Short-circuit protection	4 A gG with trigger characteristics B or C		

Table 47: Input circuit I1–I8

	Minimum	Typical	Maximum
Number of inputs:	–	–	8
Input voltage HIGH	13 V DC	–	30 V DC
Input voltage LOW	–5 V DC	–	5 V DC
Input current HIGH	2.4 mA	3 mA	3.8 mA
Input current LOW	–2.5 mA	–	2.1 mA
Input capacitance	9 nF	10 nF	11 nF
Minimum power-up delay I5/I6 and I7/I8	200 ms	–	–
Reset time	–	–	124 ms
Discrepancy time	–	–	3000 ms
Delete discrepancy error	–	–	350 ms
Actuating duration of the reset pushbutton (I4)	50 ms	–	5 s

Table 48: Control outputs (Y1, Y2)

	Minimum	Typical	Maximum
Number of outputs	–	–	2
Type of output	PNP semiconductor, short-circuit protected, cross-circuit detection [1)]		

	Minimum	Typical	Maximum
Output voltage	16 V DC	–	30 V DC
Output current	–	–	120 mA
Load capacity	–	–	1.000 nF
Conductor resistance	–	–	100 Ω

1) Cross-circuit detection only within a module.

Table 49: Output circuit (Q1, Q2, Q3, U_{OUT})

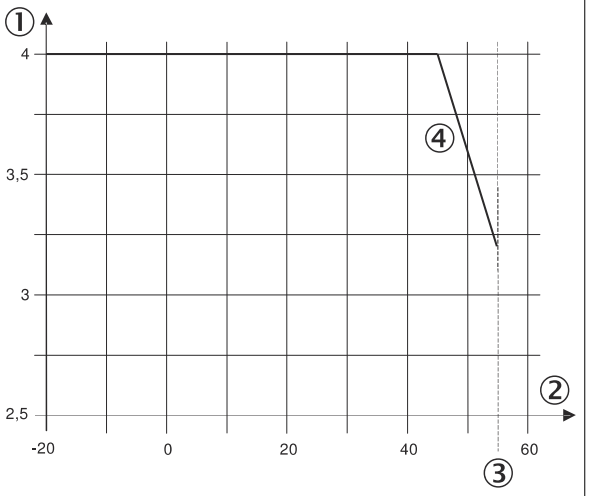
	Minimum	Typical	Maximum
Number of outputs	–	2	–
Type of output	PNP semiconductor, short-circuit protected, cross-circuit monitored 1)		
Switching voltage	18.4 V DC	–	30 V DC
Switching current			
I_{Qn}, $T_U \leq 45$ °C	–	–	2.0 A
I_{Qn}, $T_U \leq 55$ °C	–	–	1.6 A
Sum current I_{sum}			
ΣI_{Qn}, $T_U \leq 45$ °C	–	–	4.0 A
ΣI_{Qn}, $T_U \leq 55$ °C	–	–	3.2 A
			
Test pulse width	500 µs	640 µs	700 µs
Test pulse frequency Q1, Q2	12.5 Hz	–	32 Hz
Test impulse frequency Q3, U_{OUT}	–	–	5 Hz
Inductive switch-off energy $E = 0.5 \times L \times I^2$	–	–	370 mJ
Load capacity	–	–	500 nF
Length of cable (single, Ø 1.5 mm^2)	–	–	100 m

Figure 54: Load chart Q1, Q2, Q3 and U_{OUT} of UE410-SD

① ΣI_{Qn} [A]
② T_U [°C]
③ $T_{U\,max}$
④ Sum current over temperature

	Minimum	Typical	Maximum
Response time	See “Safeguard Detector” operating instructions (8026274)		

1) Cross-circuit detection only within a module.

Table 50: General system data

	Minimum	Typical	Maximum
Weight	–	0.18 kg	–
Electrical Safety	Class III		
Immunity to interference	EN 61000-6-2		
Emitted interference	EN 61000-6-4		

Table 51: Operating data

	Minimum	Typical	Maximum
Ambient operating temperature (UL/CSA: ambient temperature)	–25 °C	–	55 °C
Storage temperature	–25 °C	–	+70 °C
Air humidity	≤ 95%, non-condensing		
Climatic conditions	EN 61131-2		

Table 52: Mechanical strength

	Minimum	Typical	Maximum
Vibration	EN 61131-2		
Vibration resistance	5–500 Hz/5 grms (EN 60068-2-64)		

Table 53: Terminal and connection data

	Minimum	Typical	Maximum
Single-wire or fine-stranded	1 × 0.14 mm² to 2.5 mm² or 2 × 0.14 mm² to 0.75 mm²		
Fine-stranded with ferrule in accordance with EN 46288 (1x)	1 × 0.25 mm² to 2.5 mm² or 2 × 0.25 mm² to 0.5 mm²		
Stripping length	–	–	8 mm
Tightening torque	–	–	0.6 Nm
For UL-508 and CSA applications			
UE410-SD3xx			
Connection cross-section	AWG 30–12 (use only 60/75 °C copper wire)		
Tightening torque	5–7 lb•in		
UE410-SD4xx			
Connection cross-section	AWG 30–12 (use only 60/75 °C copper wire)		

12.2.4 Input extension module UE410-8DI

Table 54: UE410-8DI data sheet

	Minimum	Typical	Maximum
Supply circuits (via UE410-MU or UE410-GU)			
Power consumption	–	–	3 W
Input circuit (I1-I8)			
Number of inputs:	–	–	8

	Minimum	Typical	Maximum
Input voltage HIGH	13 V DC	–	30 V DC
Input voltage LOW	–5 V DC	–	5 V DC
Input current HIGH	2.4 mA	3 mA	3.8 mA
Input current LOW	–2.5 mA	–	2.1 mA
Input capacitance	9 nF	10 nF	11 nF
Minimum cut-off time	See response times		
Break time of the input signal without switching of the outputs	–	–	1 ms
Monitoring of synchronization, switch setting 3, 5	–	1,500 ms	–
Power-up delay	70 ms	–	–
Reset time	–	–	120 ms
Output circuit (X1-X8)			
Number of outputs	–	–	8
Type of output	PNP semiconductors, short-circuit protected, cross-circuit detecting[25)]		
Output voltage	16 V DC	–	30 V DC
Output current[26)]	–	–	30 mA
Test period	–	–	40 ms
Load capacity	–	–	1,000 nF
Cable resistance	–	–	100 Ω
Response time UE410-8DI on safety outputs UE410-MU/UE410-XU (Q1-Q4)			
Response time switch setting 6, 7[27)]	–	–	17 ms
Response time switch setting 1, 2, 3, 4, 5, 8)	–	–	34 ms
Response time switch setting 2 pressure sensitive mats)	–	–	42 ms
Response time of all programs with tested ESPE Cat. 4 (e.g. L41)	–	–	60 ms
Response time[28)] on connection of Flexi Loop	–	–	60 ms
General system data			
Weight	–	0.15 kg	–
Electrical Safety	Class III		
Immunity to interference	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Operating data			
Ambient operating temperature (UL/CSA: ambient temperature)	–25 °C	–	55 °C
Storage temperature	–25 °C	–	+70 °C
Air humidity	≤ 95%, non-condensing		

25) Cross circuit detecting only within a module.

26) The total output current for a Flexi Classic system is limited. The current for supplying all sensors that are connected to the UE410-MU/XU (X1/X2) and UE410-8DI (X1-X8) must be I < 600 mA and the current on a Flexi Classic gateway must be I < 100 mA. If this total current is insufficient, please contact the SICK hotline.

27) Time without sensor; the data from the connected sensors also applies.

28) Response time not including Flexi Loop and not including sensor. Also take into account the response times of Flexi Loop and the sensors connected.

	Minimum	Typical	Maximum
Climatic conditions	EN 61131-2		
Mechanical strength			
Vibration	EN 61131-2		
Vibration resistance	5–500 Hz / 5 grms (EN 60068-2-64)		
Terminal and connection data			
Single-wire or fine-wire	1 × 0.14 mm^2 to 2.5 mm^2 or 2 × 0.14 mm^2 to 0.75 mm^2		
Fine stranded with ferrule in accordance with EN 46228	1 × 0.25 mm^2 to 2.5 mm^2 or 2 × 0.25 mm^2 to 0.5 mm^2		
Stripping length	–	–	8 mm
Maximum tightening torque	–	–	0.6 Nm
For UL 508 and CSA applications			
UE410-xx**3**..., UE410-xxx**3**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
– Tightening torque	5-7 lb·in		
UE410-xx**4**..., UE410-xxx**4**...			
– Connection cross-section	AWG 30–12 (only use 60/75 °C copper flexible wire)		
Safety-related parameters All these data are based on an ambient temperature of +40 °C. For detailed information on the safety configuration of your machine/system, please consult your SICK subsidiary.			
Safety integrity level (IEC 61508) Safety integrity level (IEC 62061)	SIL3		
Category (ISO 13849)	Category 4		
Performance level (ISO 13849)	PL e		
T_M (mission time, ISO 13849)	20 years		
PFD	5.8×10^{-6}		
PFH_D (mean probability of a dangerous failure per hour)	3.8×10^{-9}		
SFF	96%		
DC	99%		

Table 55: PFD and PFH_D values for UE410-8DI

	Single-channel input, single-channel output	Single-channel input, dual-channel output	Dual-channel input, single-channel output	Dual-channel input, dual-channel output
PFD (Ø)	**2.4 × 10–5**	**7.0 × 10–6**	**2.3 × 10–5**	**5.8 × 10–6**
% of SIL 3	2.4%	0.7%	2.3%	0.6%
PFH_D (1 / h)	**7.3 × 10–9**	**3.8 × 10–9**	**7.3 × 10–9**	**3.8 × 10–9**
% of SIL 3	7.3%	3.8%	7.3%	3.8%

12.2.5 UE410-2RO/UE410-4RO output modules

Table 56: Data sheet UE410-2RO/UE410-4R0

	Minimum	Typical	Maximum
Supply circuit (via UE410-MU)			
Power consumption			
UE410-4RO	–	–	3.2 W
UE410-2RO	–	–	1.6 W
Input circuit B1, B2			
Input Voltage	18 V DC	–	30 V DC
Output circuit (13/14, 23/24, 33/34, 43/44)			
Number of normally open contacts			
UE410-2RO	–	2	–
UE410-4RO	–	4	–
Number of N/C contacts			
UE410-2RO	–	1	–
UE410-4RO	–	2	–
AC switching voltage	5 V AC	230 V AC	253 V AC

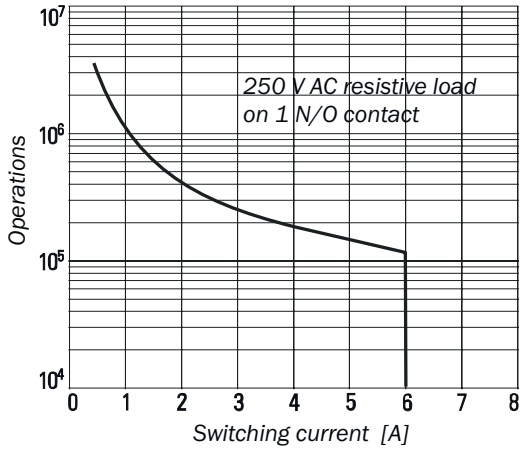


Figure 55: Electrical endurance of relay modules UE4102RO/UE410-4RO

DC switching voltage	5 V DC	230 V DC	253 V DC

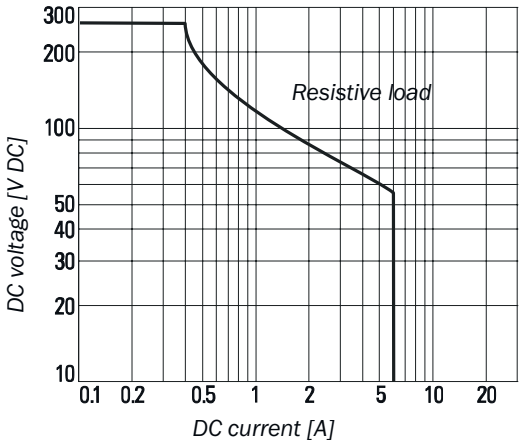


Figure 56: Maximum current at DC voltage for UE410-2RO/UE410-4RO relay modules

	Minimum	Typical	Maximum
Supply circuit (via UE410-MU)			
Switching current	10 mA	–	6 A
Minimum contact load with U_n = 24 V DC	50 mW	–	–
Total current:	–	–	8 A
Response time[29)]	–	–	30 ms
Type of output	Volt-free normally open contacts, positively guided		
Contact material	$AgSnO_2$		
Output circuit fusing	6 A (gG), per current path		
Usage category	AC-15: U_e 250 V, I_e 3 A		
	DC-13: U_e 24 V, I_e 3 A		
Output circuit (Y14, Y24)			
Type of output	Non-isolated N/O contact, positively guided, current-limited		
Number of N/O contacts Y14/24			
UE410-2RO	–	1	–
UE410-4RO	–	2	–
Output voltage	16 V DC	24 V DC	30 V DC
Output current[30)]	–	–	75 mA
Load capacity	–	–	200 nF
General data			
Galvanic separation			
Supply circuit input cr.	No		
Supply cr. output cr.	Yes		
Input circuit-output circuit	Yes		
Weight			
UE410-2RO	0.16 kg		
UE410-4RO	0.19 kg		
Operating data			
Ambient operating temperature (UL/CSA: ambient temperature)	–25 °C	–	55 °C
Storage temperature	–25 °C	–	+70 °C
Air humidity	≤ 95%, non-condensing		
Climatic conditions	EN 61131-2		
Mechanical strength			
Vibration resistance	5–150 Hz / 1 G (EN 60068-2-6) 10–500 Hz / 3 G_{rms} (EN 60068-2-64)		
Shock resistance, continuous shock	10 g, 16 ms (EN 60068-2-27)		
Shock resistance, single shock	30 g, 11 ms (EN 60068-2-27)		
Electrical safety EN 61131–2			
Impulse voltage withstand level (U_{imp})	4 kV		
Overvoltage category	II		

29) Time from LOW on B1/B2 to relay drop-out.

30) The total output current is limited. Maximum total current for all relay modules on Y14 and Y24 is I < 400 mA.

	Minimum	Typical	Maximum
Supply circuit (via UE410-MU)			
Degree of contamination	2 inside, 3 outside		
Rated voltage	300 V AC		
Enclosure rating (IEC 60529) **Housing/terminals**	IP 40 / IP 20		
Immunity to interference	EN 61000-6-2		
Emitted interference	EN 61000-6-4		
Terminal and connection data			
Single-wire or fine-wire	1 × 0.14 mm^2 to 2.5 mm^2 or 2 × 0.14 mm^2 to 0.75 mm^2		
Fine stranded with ferrule in accordance with EN 46228	1 × 0.25 mm^2 to 2.5 mm^2 or 2 × 0.25 mm^2 to 0.5 mm^2		
Stripping length	–	–	8 mm
Maximum tightening torque	–	–	0.6 Nm
For UL 508 and CSA applications			
UE410-xx3..., UE410-xxx3...			
– **Connection cross-section**	AWG 30–12 (only use 60/75 °C copper flexible wire)		
– **Tightening torque**	5-7 lb·in		
UE410-xx4..., UE410-xxx4...			
– **Connection cross-section**	AWG 30–12 (only use 60/75 °C copper flexible wire)		
Safety-related parameters **All these data are based on an ambient temperature of +40 °C.** **For detailed information on the safety configuration of your machine/system, please consult your SICK subsidiary.**			
Safety integrity level (IEC 61508) **Safety integrity level (IEC 62061)**	SIL 3		
Category (ISO 13849)	Category 4		
Performance level (ISO 13849)	PL e		
PFD	1.6×10^{-7}		
PFH_D at I = 0.75 A, switching frequency = h^{-1} **(see also table 57)**	1.2×10^{-9}		
B_{10d} value, switching frequency = h^{-1}	0.75 A (AC 15)/4,150,000 (see also table 57)		
SFF	99.6 %		
DC	99 %		
T_M (mission time, ISO 13849)	Depending on PFHd value, ambient temperature, load and switching operations (see table 57)		

Table 57: PFH_D values

Load type	I[A]	Switching frequency	Switching operations per annum	B_{10d}	PFH_D
AC15	0.1	1/h	8760	10.000.000	5.00 x 10^{-10}
	0.75	**1/h**	**8760**	**4,150,000**	**1.20 x 10-09**
	3	1/h	8760	400,000	1.20 x 10^{-08}
	5	1/h	8760	70,000	7.20 x 10^{-08}
DC13	1	1/h	8760	2,000,000	2.50 x 10^{-09}
	3	1/h	8760	450,000	1.10 x 10^{-08}
AC1	2	1/h	8760	1,000,000	5.00 x 10^{-09}
	4	1/h	8760	600,000	8.40 x 10^{-09}

12.3 Dimensional drawings

UE410-MU and UE410-GU main modules

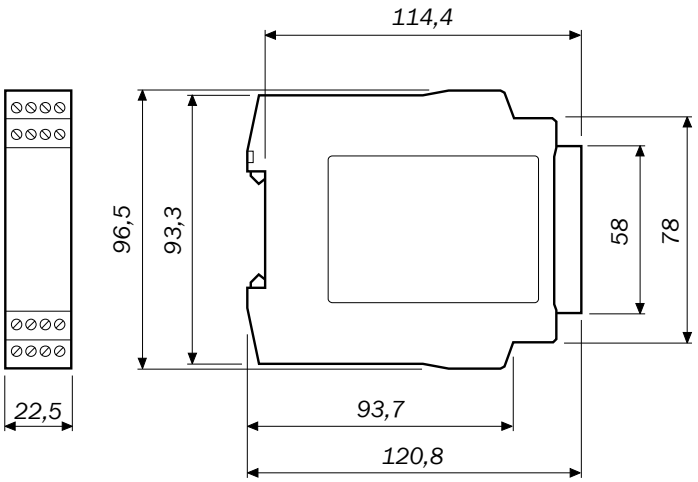


Figure 57: Dimensioned drawing for UE410-MU and UE410-GU (mm)

UE410-SD safety evaluation module

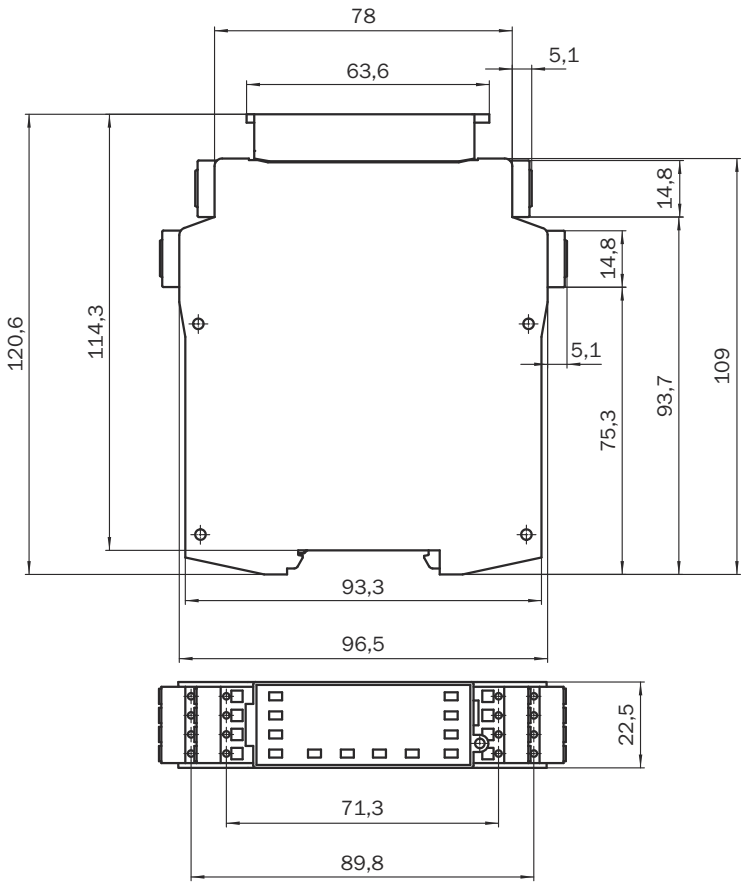


Figure 58: Dimensional drawing UE410-SD400

Dimensions in mm

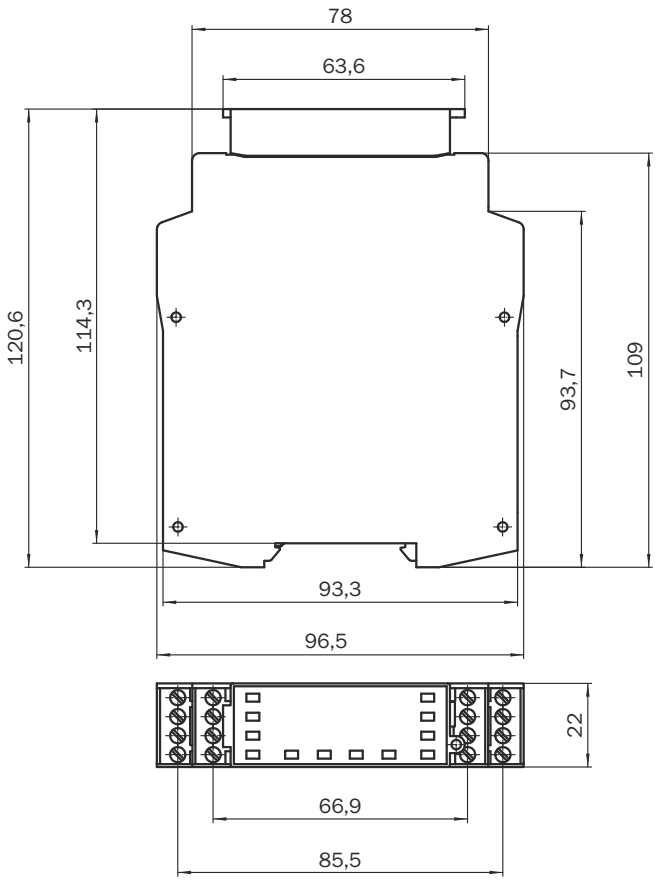


Figure 59: Dimensional drawing UE410-SD300

Dimensions in mm

Expansion modules

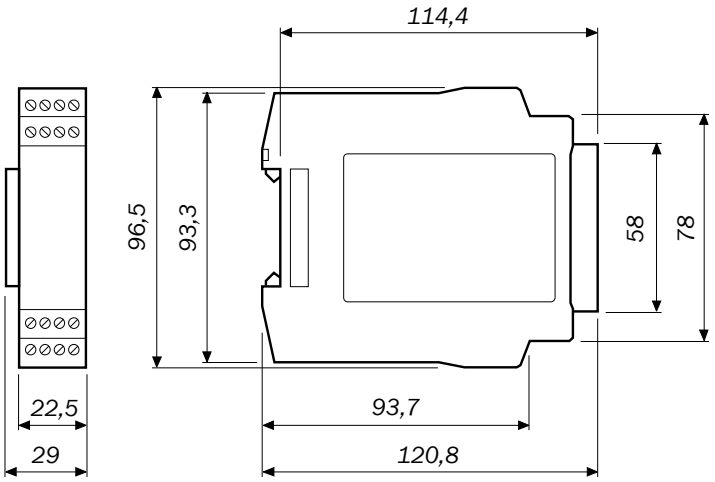


Figure 60: Dimensional drawing for UE410-XU, UE410-8DI, UE410-2RO, UE410-4RO, UE410-PRO, UE410-DEV, UE410-CAN (mm)

13 Ordering information

13.1 Ordering information for modules

Table 58: Part numbers of safety controller modules

Part	Type code	Part number
Main module 4 inputs/4 outputs No delay Plug-in screw terminals	UE410-MU3T0	6035242
Main module 4 inputs/4 outputs Delay possible: 0-5 s Plug-in screw terminals	UE410-MU3T5	6026136
Main module 4 inputs/4 outputs Delay possible: 0-50 s Plug-in screw terminals	UE410-MU3T50	6026137
Main module 4 inputs/4 outputs Delay possible: 0-300 s Plug-in screw terminals	UE410-MU3T300	6026138
Main module 4 inputs/1 output Plug-in screw terminals	UE410-GU3	1072177
Input extension module 4 dual-channel inputs Plug-in screw terminals	UE410-8DI3	6026139
Output module 2 N/O contacts and 1 24 V DC alarm signal Plug-in screw terminals	UE410-2RO3	6026144
Output module 4 N/O contacts and 2 24 V DC alarm signals Plug-in screw terminals	UE410-4RO3	6026143
Input/output extension module 4 inputs/4 outputs No delay Plug-in screw terminals	UE410-XU3T0	6035244
Input/output extension module 4 inputs/4 outputs Delay possible: 0-5 s Plug-in screw terminals	UE410-XU3T5	6032470
Input/output extension module 4 inputs/4 outputs Delay possible: 0-50 s Plug-in screw terminals	UE410-XU3T50	6032471
Input/output extension module 4 inputs/4 outputs Delay possible: 0-300 s Plug-in screw terminals	UE410-XU3T300	6032472
Main module 4 inputs/4 outputs No delay Plug-in spring terminals	UE410-MU4T0	6035243

Part	Type code	Part number
Main module 4 inputs/4 outputs Delay possible: 0-5 s Plug-in spring terminals	UE410-MU4T5	6032669
Main module 4 inputs/4 outputs Delay possible: 0-50 s Plug-in spring terminals	UE410-MU4T50	6032670
Main module 4 inputs/4 outputs Delay possible: 0-300 s Plug-in spring terminals	UE410-MU4T300	6032671
Input/output extension module 4 inputs/4 outputs No delay Plug-in spring terminals	UE410-XU4T0	6035245
Input/output extension module 4 inputs/4 outputs Delay possible: 0-5 s Plug-in spring terminals	UE410-XU4T5	6032672
Input/output extension module 4 inputs/4 outputs Delay possible: 0-50 s Plug-in spring terminals	UE410-XU4T50	6032673
Input/output extension module 4 inputs/4 outputs Delay possible: 0-300 s Plug-in spring terminals	UE410-XU4T300	6032674
Input extension module 4 dual-channel inputs Plug-in spring terminals	UE410-8DI4	6032675
Output module 4 N/O contacts and 2 24 V DC alarm signals Plug-in spring terminals	UE410-4RO4	6032676
Output module 2 N/O contacts and 1 24 V DC alarm signal Plug-in spring terminals	UE410-2RO4	6032677
EtherNet/IP gateway Plug-in screw terminals	UE410-EN1	1042964
Modbus TCP/IP and Ethernet TCP/IP gateway Plug-in screw terminals	UE410-EN3	1042193
PROFINET IO gateway Plug-in screw terminals	UE410-EN4	1044078

Table 59: Part numbers for safety controller modules for Safeguard Detector safety system

Part	Type code	Part number
Main module 4 inputs / 4 outputs Can only be used in Safeguard Detector safety system Plug-in spring terminals	UE410-SD400	1088689

Part	Type code	Part number
Main module 4 inputs / 4 outputs Can only be used in Safeguard Detector safety system Plug-in screw terminals	UE410-SD300	1089540

13.2 Accessories/Spare parts

13.2.1 Single-beam photoelectric safety switches

Table 60: Part numbers of single-beam photoelectric safety switches

Part	Type code	Part number
Through-beam photoelectric sensor, sender, 24 V DC, operating range 60 m, PNP, size M30, male connector M12 × 4	L21S-33MA2A	6034870
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 60 m, PNP, size M30, male connector M12 × 4	L21E-33MA2A	6034871
Through-beam photoelectric sensor, sender, 24 V DC, operating range 16 m, PNP, size M18, male connector M12 × 4	L21S-21KA1A	6034872
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 16 m, PNP, size M18, male connector M12 × 4	L21E-21KA1A	6034873
Through-beam photoelectric sensor, sender, 24 V DC, operating range 5 m, radial axis, PNP, size M18, male connector M12 × 4	L21S-11MA1A	6034876
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 5 m, radial axis, PNP, size M18, male connector M12 × 4	L21E-11MA1A	6034877
Through-beam photoelectric sensor, sender, 24 V DC, operating range 25 m, PNP, Q+/Q, male connector M12 × 4	L27S-3D2430	2043906
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 25 m, PNP, Q+/Q, male connector M12 × 4	L27E-3P2430	2043904
Through-beam photoelectric sensor, sender, 24 V DC, operating range 18 m, PNP, Q+/Q, male connector M12 × 4	L28S-3D2431	2044515
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 18 m, PNP, Q+/Q, male connector M12 × 4	L28E-3P2431	2044516
Through-beam photoelectric sensor, sender, 24 V DC, operating range 60 m, PNP, size M30, male connector M12 × 4	L41S-33MA2A	6034863
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 60 m, PNP, size M30, male connector M12 × 4	L41E-33MA2A	6034862
Through-beam photoelectric sensor, sender, 24 V DC, operating range 10 m, PNP, size M18, male connector M12 × 4	L41S-21KA1A	6034864
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 10 m, PNP, size M18, male connector M12 × 4	L41E-21KA1A	6034865

Part	Type code	Part number
Through-beam photoelectric sensor, sender, 24 V DC, operating range 5 m, radial axis, PNP, size M18, male connector M12 × 4	L41S-11MA1A	6034868
Through-beam photoelectric sensor, receiver, 24 V DC, operating range 5 m, radial axis, PNP, size M18, male connector M12 × 4	L41E-11MA1A	6034869

13.2.2 Non-contact safety switches

Table 61: Part numbers of non-contact safety switches

Part	Part number	Part number
Switch and actuator RE21, 5 m cable	RE21-DA05	6035617
Switch and actuator RE27, 5 m cable	RE27-DA05L	6034343
RE13 sensor and actuator, M8 plug	RE13-DAC	6036769
RE31 sensor and actuator, M8 plug	RE31-DAC	6036768
T4000 Direct sensor	T4000-E0101K	6035041
Actuator for T4000 Direct, cuboid	T4000-1KBQ	5311153
IN4000 switch Q40, M12 male connector	IN40-D0101K	6027389
IN4000 switch M30, M12 male connector	IN40-D0202K	6027392
IN4000 switch M18, M12 male connector	IN40-D0303K	6027391
IN4000 Direct Q40, M12 male connector	IN40-E0101K	6027388
IN4000 connecting cable M12, 4-pin with 10 m cable	DOL-1204-G10M	6010543
T4000 Direct connecting cable M12, 8-pin with 10 m cable	DOL-1208-G10MA	6022152
RE13 / RE31 connecting cable M8, 4-pin with 10 m cable	DOL-0804-G10M	6010754

13.2.3 Safety light curtains and multiple light beam safety devices

Table 62: Safety light curtains and multiple light beam safety devices

Part		Part number
C4000	All variants	–
M4000	All variants	–
C2000	All variants	–
M2000	All variants	–
miniTwin	All variants	–

13.2.4 Safety laser scanners and safety camera system

Table 63: Safety laser scanner and safety camera sensor

Part		Part number
S3000	All variants	–
S300	All variants	–
V300	All variants	–

13.2.5 Muting lamp and cable

Table 64: Part numbers for muting lamp and cable

Part	Type code	Part number
Muting lamp with mounting kit	–	2020743
LED muting lamp with cable 2 m	–	2019909
LED muting lamp with cable 10 m	–	2019910

13.2.6 Anti-manipulation cover

Table 65: Part numbers for switch cover

Part	Part number
AM cover, 10 switch covers	5319789

14 Glossary

AWG	American Wire Gage: standardization and classification of wires and cables according to type, diameter, etc.
Control input	A control input receives signals, e.g. from the machine or from the control. Use of control inputs is how the protective device receives information about the conditions at the machine, e.g., if there is a change of operating mode. If the protective device is configured appropriately, it will activate a different monitoring case after receiving a new control input. The control input information must be transmitted reliably. Generally, at least 2 separate channels are used to do this. Depending on the device, a control input can be realized as a static control input or a dynamic control input.
Dangerous state	A dangerous state is a status of the machine or facility, where people may be injured. Protective devices prevent this risk if the machine is operated within its intended use. The figures in this document always show the dangerous state of the machine as movement of a machine part. In practice, there are different dangerous states, such as: • Machine movements • Electrical parts • Visible and invisible beam • A combination of multiple hazards
EDM	External device monitoring
ESPE	Electro-sensitive protective device
EtherNet/IP	EtherNet/IP™ (EtherNet Industrial Protocol) is an Ethernet-based network used in industrial automation. EtherNet/IP™ implements the CIP™ (Common Industrial Protocol) based on the Ethernet and TCP/IP protocol family. EtherNet/IP™ with the CIP Safety™ protocol extension is also suitable for safety-related data communication.
External device monitoring	The external device monitoring (EDM) monitors the status of downstream contactors. In order to use external device monitoring, positively guided contactors must be used to switch off the machine. If the auxiliary contacts of the positively guided contactors are connected to the external device monitoring, the external device monitoring checks whether the contactors switch correctly when the OSSDs are switched off.
Hazardous area	Hazardous area is any space within and/or around machinery in which a person can be exposed to a hazard. (ISO 12100)
OFF state	The OFF state is the status of the outputs of the protective device, where the controlled machine is triggered to quit its dangerous state and the start-up of the machine is prevented (e.g., the voltage at the OSSDs is LOW, so that the machine is switched off and remains still).
ON state	The ON state is the status of the outputs of the ESPE, where the controlled machine is permitted to operate (e.g., the voltage at the OSSDs is HIGH so that the machine can run).

OSSD	Output signal switching device: signal output for the protective device, which is used for stopping the dangerous movement. An OSSD is a safety switching output. The functionality of each OSSD is tested periodically. OSSDs are always connected in pairs and must undergo dual-channel analysis for safety reasons. An OSSD pair is formed from 2 OSSDs that are connected and analyzed together.
PFH_D	Probability of dangerous failure per hour
PL	Performance level (ISO 13849)
PROFINET	PROFINET (Process Field Protocol) is an Ethernet-based network used in industrial automation. With PROFIsafe , PROFINET is also suitable for safety-oriented data communication.
Protective field	The protective field is the area in which the test object specified by the manufacturer is detected by the electro-sensitive protective equipment (ESPE). As soon as the electro-sensitive protective device detects an object in the protective field, it switches the associated safety outputs to the OFF state. This signal can be passed to controllers resulting in the dangerous state coming to an end, e.g. to stop the machine or the vehicle.

Reset	When a protective device has sent a stop command, the stopped state must be maintained until a reset device is activated and the machine can be restarted in a second step.
	
	The reset brings the protective device back to the monitoring state after it has sent a stop command. The reset also quits the start-up or restart interlock of a protective device, so that the machine can be restarted in a second step.
	
	The reset must only be possible, when all safety functions and protective devices are functional.
	
	The reset of the protective device must not introduce any movement or dangerous situations itself. The machine is only permitted to start after the reset once a separate start command has been sent.
	
	• Manual resets are performed using a separate, manually operated device, such as a reset pushbutton.
	• Automatic resets by the protective device are only permitted in special cases, if one of the following conditions is met:
	  ○ It must not be possible for people to be in the hazardous area without triggering the protective device.
	  ○ It must be ensured that no people are in the hazardous area during or after the reset.

Response time	The protective device's response time is the maximum time between the occurrence of the event leading to the sensor's response and supply of the switch-off signal to the protective device's interface (for example OFF state of the OSSD pair).
Restart interlock	The restart interlock prevents the machine from automatically starting up, for example after a protective device has responded while the machine is operating or after changing the machine's operating mode. The restart interlock can be implemented in the protective device or in the safety controller. A command to reset the protective device must be given, for example using a reset pushbutton, before the machine can be restarted.

Safety function	Function of a machine whose failure can result in an immediate increase of the risk(s). (ISO 12100)
Safety output	A safety output provides safety-related information. Safety outputs are OSSDs, for example, or safety-related information on a safety-related network.
SIL	Safety integrity level

15 Annex

15.1 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

15.1.1 EU declaration of conformity

Excerpt

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.

- ROHS DIRECTIVE 2011/65/EU
- EMC DIRECTIVE 2014/30/EU
- LV DIRECTIVE 2014/35/EU
- MACHINERY DIRECTIVE 2006/42/EC

15.1.2 UK declaration of conformity

Excerpt

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- Electromagnetic Compatibility Regulations 2016
- Supply of Machinery (Safety) Regulations 2008

15.2 Checklist for initial commissioning and commissioning

Checklist for manufacturers/installers when installing the product

The details relating to the items listed below must be available no later than when the system is commissioned for the first time. However, these depend on the specific application (the requirements of which must be reviewed by the manufacturer or installer).

This checklist should be retained and kept with the machine documentation to serve as a reference during recurring thorough checks.

This checklist is not a substitute for initial commissioning or periodic thorough checks by qualified safety personnel.

Have the safety rules and regulations been observed in compliance with the directives and standards applicable to the machine?	Yes ☐ No ☐
Are the applied directives and standards listed in the declaration of conformity?	Yes ☐ No ☐
Does the protective device correspond to the required PL/SIL and PFHd in accordance with ISO 13849 / IEC 62061 and the required type in accordance with IEC 61496?	Yes ☐ No ☐
Are the required protective measures against electric shock in effect (protection class)?	Yes ☐ No ☐

Has the safety function been checked in compliance with the test notes of this documentation?	Yes ☐ No ☐
Is it ensured that a complete test of the safety functions is done after any configuration change of the product?	Yes ☐ No ☐

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8011509/1M9J/2024-06-24/en

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