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Start function of the SIRIUS 3SK1 safety relays

SIRIUS Safety Integrated

http://support.automation.siemens.com/WW/view/en/103655974

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1 Introduction

SIRIUS 3SK1 Advanced safety relays can be extended by input expansions via device connectors in order to monitor several sensors in one system setup and combine them to one shutdown path.

Figure 1-1

Each input expansion possesses its own input for a start button as well as a DIP switch to configure the type of start (automatic or monitored).

This documents aims to explain the starting behavior within a 3SK1 system.

Note

In the following the term „starting conditions“ is used. For the SIRIUS 3SK1 safety relays this means that the input circuit and the feedback circuit are closed and the cascading input (if existent) is connected to 24 V DC.

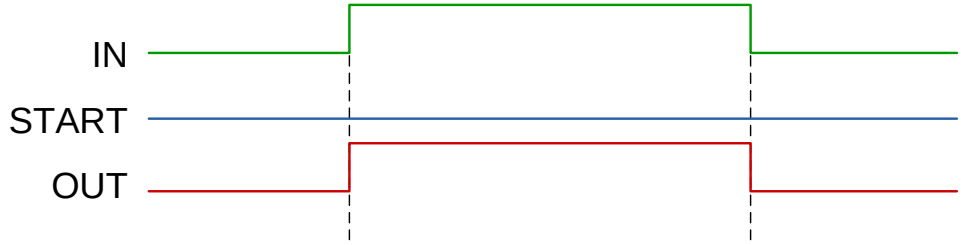
2 Types of start

Each input expansion possesses its own input for a start button as well as a DIP switch to configure the type of start. This can either be set to automatic without the use of a start button or with a start button that is monitored by the device.

Automatic start

With automatic start configured, the outputs will switch on as soon as the starting conditions are fulfilled. This can be useful for example for maintenance covers where, in a closed state, the possibility that a person or parts of the body are still within the hazardous area can be excluded.

Figure 2-1

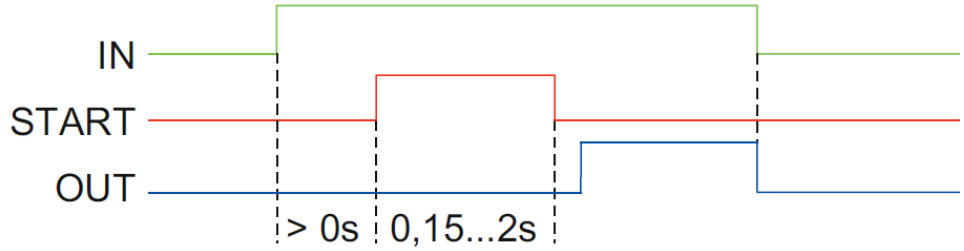


Monitored start

With monitored start configured, an intended, manual action is necessary to start the machinery. This is done through a start button. This type of start is called “monitored” instead of “manual” if a positive as well as a negative slope and the time between the occurrences of both slopes is monitored.

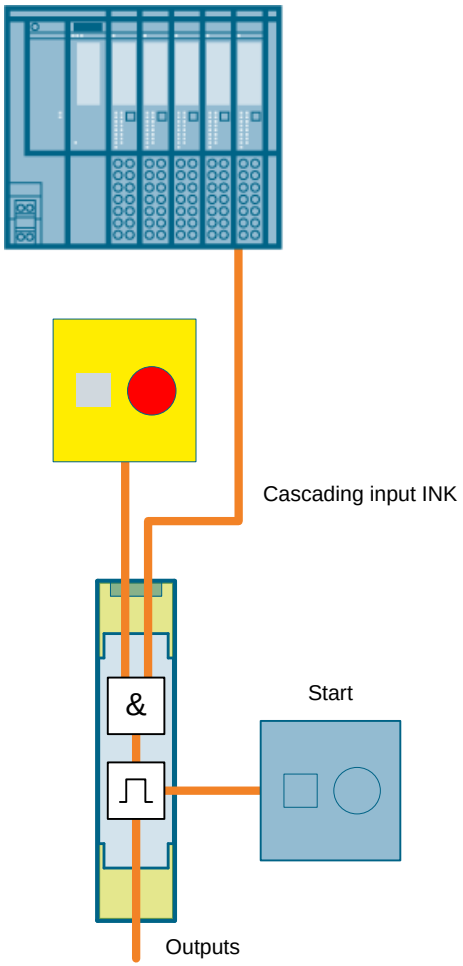
On SIRIUS 3SK1 safety relays the allowed time between those slopes is 2 seconds. The start button has to be released within 2 seconds to be recognized as a starting command. Is the start button pressed for longer than 2 seconds, it is recognized as an error (LED SF flashes red). This ensures a higher protection against manipulation than the “manual” start type.

Figure 2-2



CAUTION	**Simplified the input circuit, the cascading input and the enable signal from the device connectors, as explained in the next chapter, are AND-connected. The configured type of start applies to all three signals. If monitored start is configured, a starting command is necessary no matter which of these three signals caused the shutdown.**

Figure 2-3



3 Arranging the input expansions

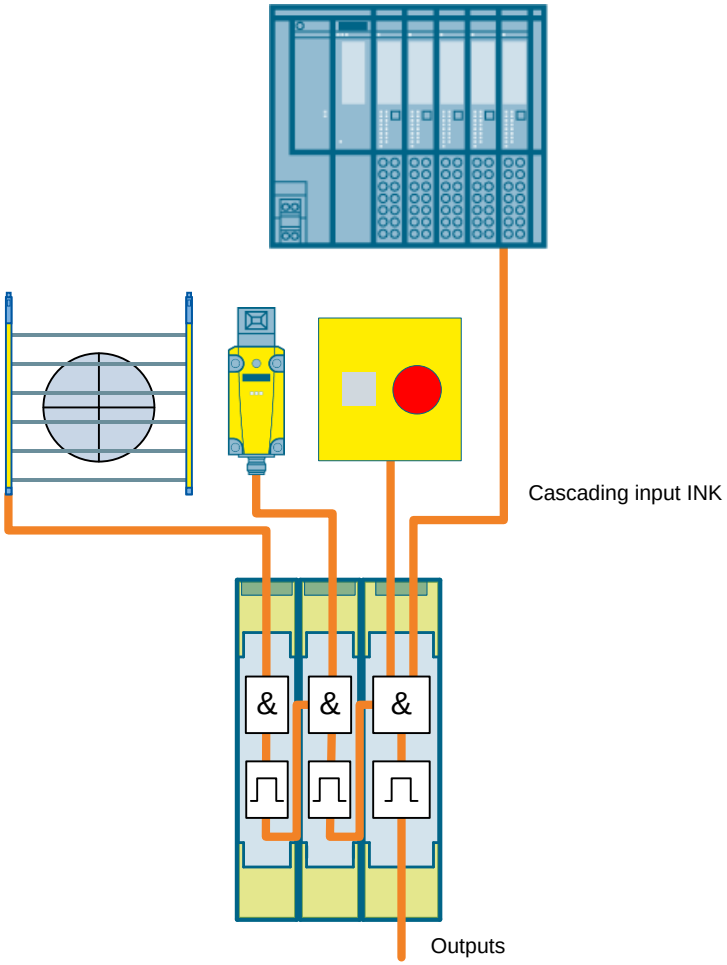
3.1 Signal sequence

Input expansions are always placed on device connectors on the left of the base unit. Each input expansion monitors its own sensors and sends an enable signal through the device connector to the next device on its right if the starting conditions are fulfilled and the start button has been activated (monitored start). This state is displayed by green DEVICE, OUT and IN LEDs.

On the next input expansion, this enable signal is AND-connected with this input expansion's own starting conditions. Only if the starting conditions are fulfilled, the enable signal from the input expansion on the left is received and the start button has been activated (monitored start), the input expansion generates its own enable signal and again sends it through the device connector to the next device on its right.

When at last an enable signal is received by the base unit and its own starting conditions are fulfilled and the start button has been activated (monitored start), the outputs and connected output expansions will be switched on.

Figure 3-1



When the input circuit on one of the input expansions is opened or a fault occurs, the devices on its right switch off their enable signal and the base unit switches off the outputs and connected output expansions.

Note In the illustrated example above, all devices are configured with monitored start. When an input exansions causes the shutdown, all devices on its right require a starting command to switch on the machinery again.

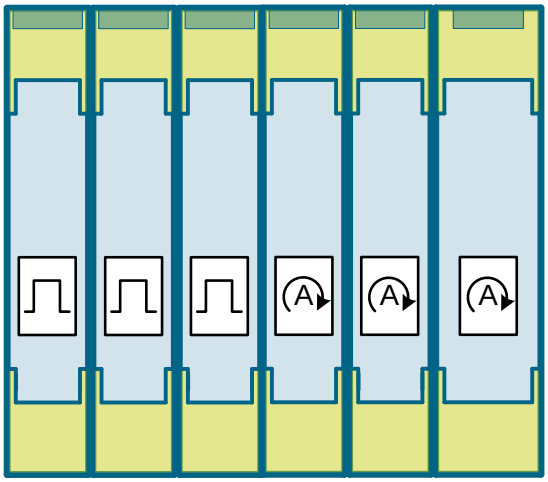
3.2 Arrangement with mixed types of start

When devices within a 3SK1 system are configured with different types of start, a certain order has to be maintained.

All devices that use monitored start should be placed on the left of the system and all devices with automatic start on its right side.

For example all emergency stops are wired to devices on the left side and sensors that allow automatic start are connected to devices on the right side.

Figure 3-2

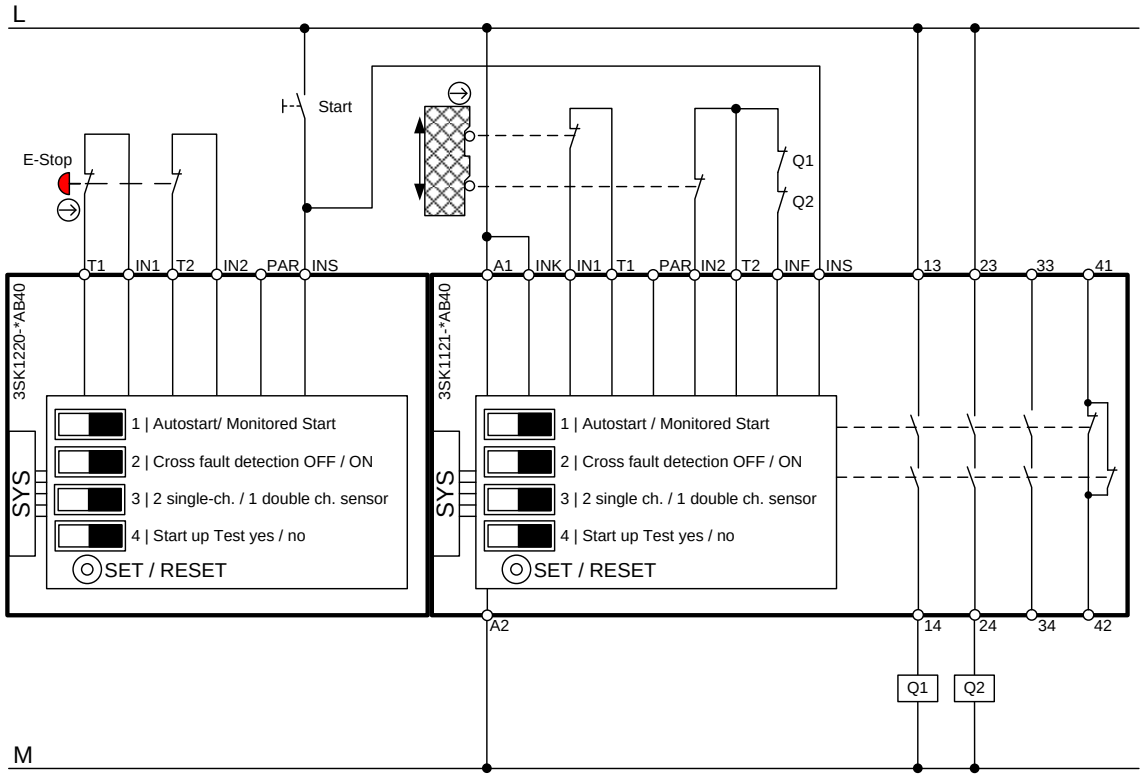


Note If this order is not maintained, the last device with monitored start will always require a starting command, even if a device with automatic start caused the shutdown.

4 Wiring the start button

When several devices are configured with monitored start, it is possible to use only one start button that acts on all these devices. In that case only a jumper needs to be placed between the start inputs.

Figure 4-1



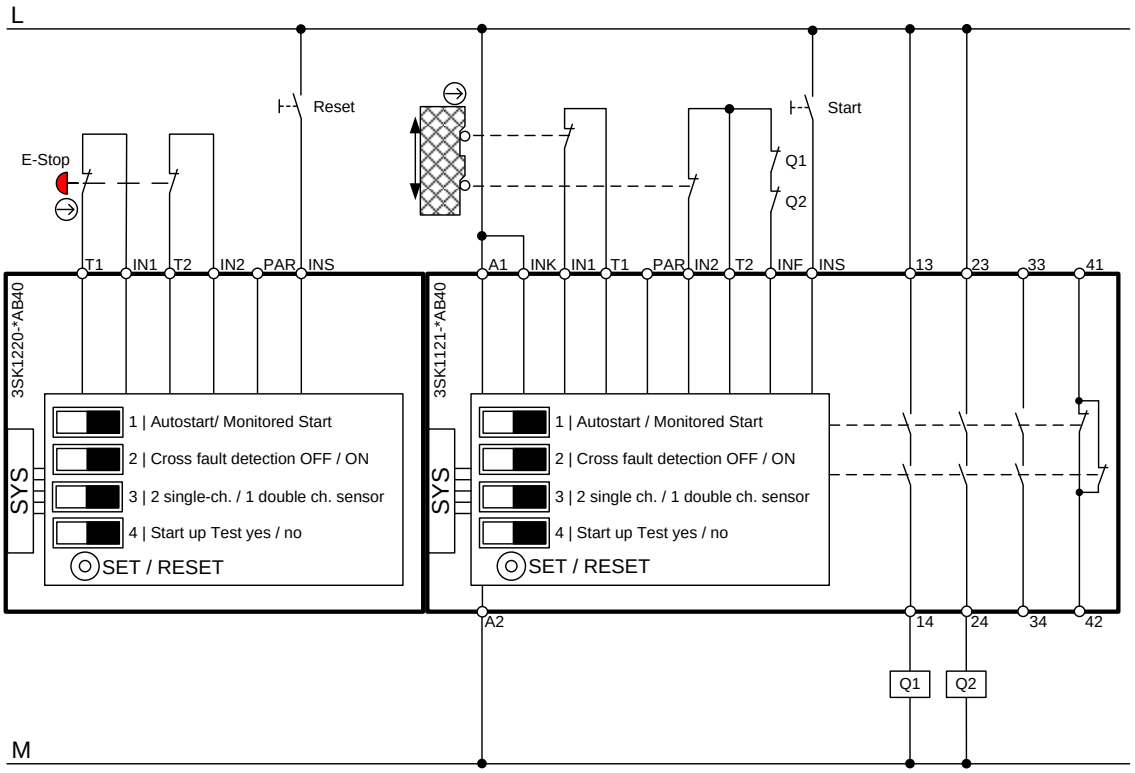
Since the starting command is occurring on all devices at the same time, it is memorized by the respective device if its starting conditions are fulfilled and only the enable signal from the device on its left is missing.

In the example above, this would be the case if the start button had been activated before the emergency stop was released. In that case the IN LED will flash yellow on the base unit (right) and green on the input expansion (left).

Alternatively each device can have a separate start button connected to it. This can be necessary when the hazardous area cannot be overlooked from every position and each safety function needs to be reset locally and separately.

In the example below both start buttons have to be activated after the emergency stop caused as shutdown.

Figure 4-2



DANGER

When several devices monitor sensors that require a monitored start, each of these devices needs to be configured to monitored start. In that case it is not permitted to configure only the last device to monitored start and to wire the start button only to this device.

In the example above the danger would be that the base unit (right) memorizes the starting command before the emergency stop was released. The machine would then switch on the moment the emergency stop is released

That is not permitted.

5 Interpreting the LEDs

This chapter provides a brief overview of the LEDs during operation. For a complete description of the LEDs, please see the SIRIUS 3SK1 manual:

http://support.automation.siemens.com/WW/view/de/67585885

Table 5-1

DEVICE	OUT	IN	SF	Description
Green	Off	Off	Off	Input circuit open
Green flashing	Off	Off	Off	Startup test necessary
Green	Off	Green flashing	Off	Start button not yet pressed
Green	Off	Yellow flashing	Off	Enable signal missing, start button memorized or automatic start
Green	Green	Green	Off	All outputs ON / enable signal ON
Green	Green / yellow flashing	Off	Off	Instantaneous outputs OFF, time-delayed outputs ON
Green	Off	Green flashing	Red flashing	For 1x2-channel: Simultaneity violated For two-hand operation: time monitoring violated
Green	Off	Yellow flashing	Red flashing	Short-circuit test clock output T1 or T2
Green	Yellow flashing	Off	Red flashing	Start button was pressed too long or has a short-circuit
Green	Green flashing	Green	Red flashing	Feedback circuit error
Green / yellow flashing	--	--	--	Configuration has been changed (PAR, DIP switch, potentiometer)

6 Contact/Support

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