Safe switching of IO-Link motor starter combination 3RA27 with safety relay 3SK1

IO-Link

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Applikationen & Tools

Answers for industry.

SIEMENS

Question

How can you operationally switch the function module 3RA27 via IO-Link and additionally guarantee safe switching in case of an emergency?

Answer

The function module is operationally switched and powered via IO-Link. Additionally an auxiliary voltage for the contactor below to switch is required. By interrupting that auxiliary power supply as for example by an interconnected safety relay 3SK1 and a two-channel emergency stop commanding device, the contactor will switch off according to stop category 0 described in IEC 60204-1.
The use of a redundant contactor and the monitoring of the feedback circuit will allow the application to reach up to SIL 3 according to IEC 62061 or PL e according to ISO 13849-1.

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1 Introduction

If people work anywhere near machines (e.g. in manufacturing), technical means must be used to provide appropriate protection. The emergency stop is a common component to protect people, the machinery and the environment from possible hazards.

Advantages of this solution

- Certified devices
- Inclusion of the safety application in the operational switching
- No software required, solution by wiring only

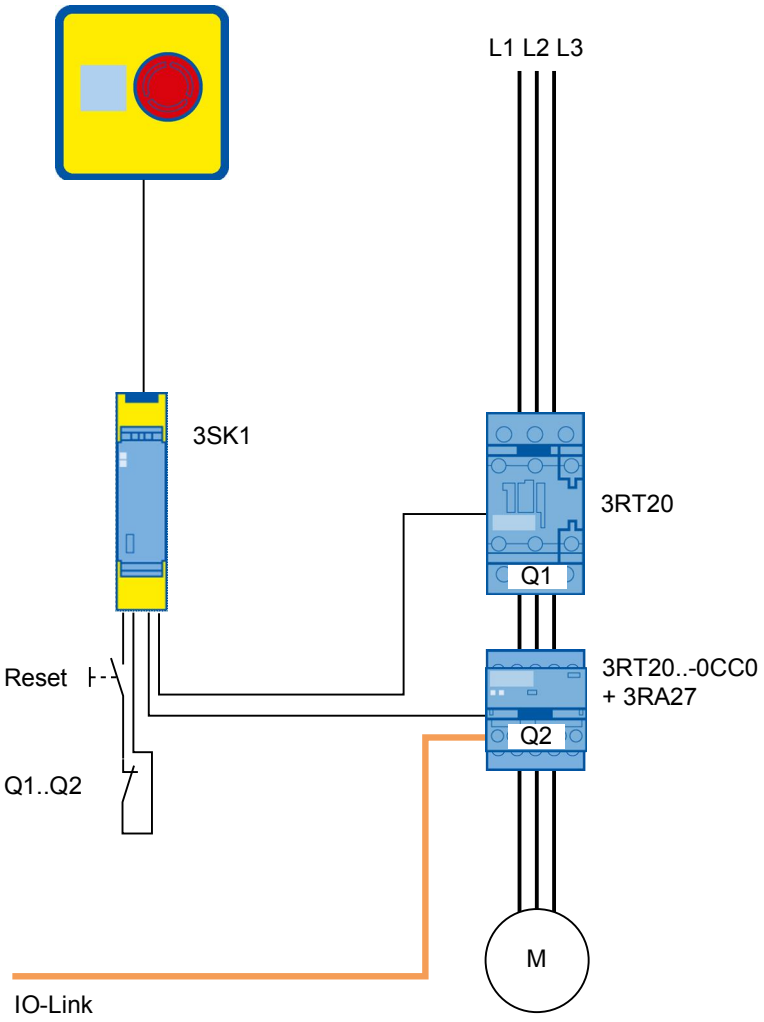
Description of the safety function

The usage of a redundant contactor and monitoring of the feedback circuits will allow the application to reach up to SIL 3 according to IEC 62061 or PL e according to ISO 13849-1.

In order to restart the machinery after an emergency stop the enabling circuits need to be manually reset by a reset button. Afterwards operational switching is possible again.

2 Safe switching of a single motor starter

The following illustration shows the most important components of this solution:



Note

The safety function “Emergency stop” requires the switch on the 3SK1 to be set to “MONITORED”.

In order to achieve high diagnostic coverage it is necessary to inset the normally closed contacts of every contactor into the feedback circuit of the safety relay.

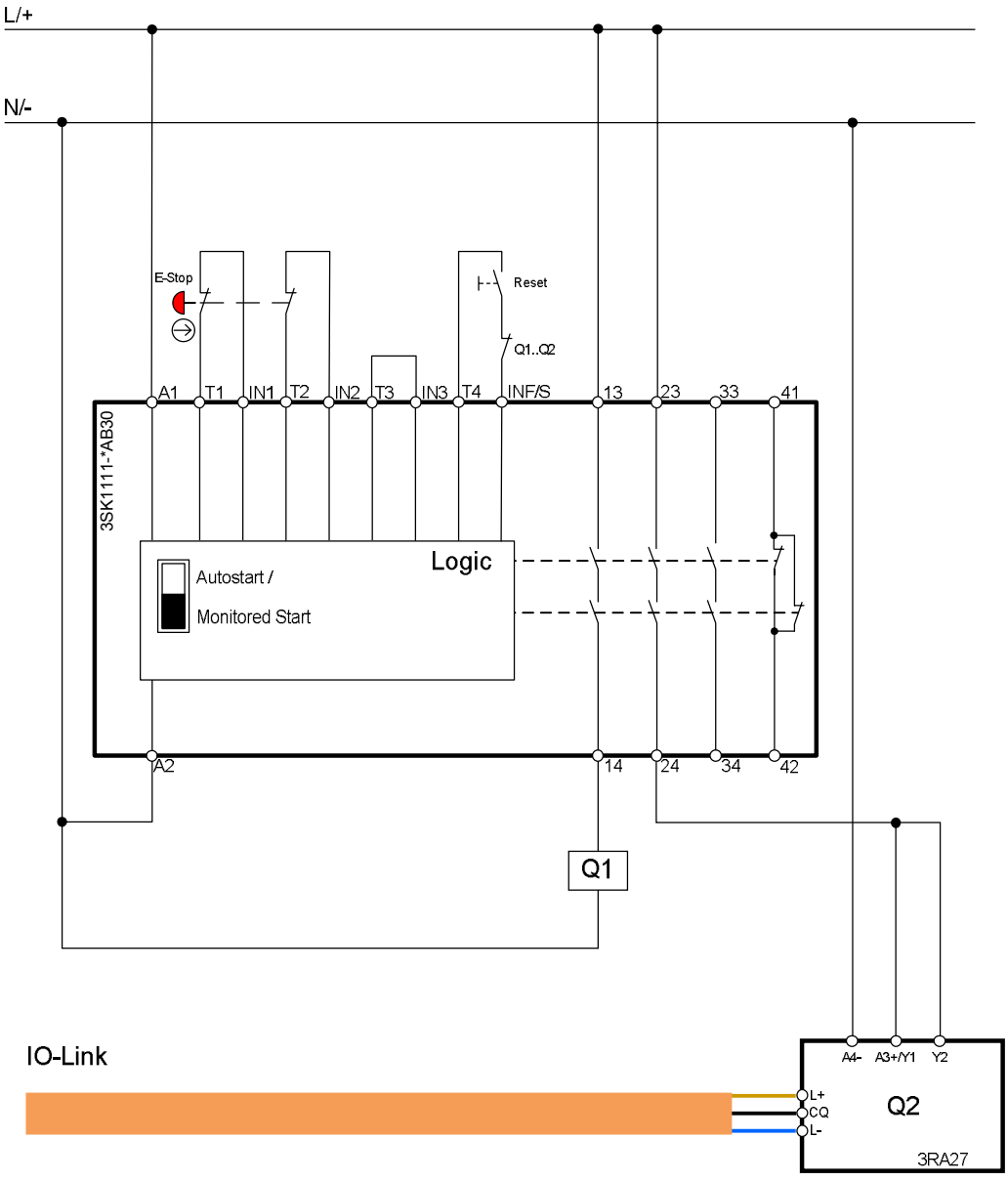
Note

In addition to the above illustrated components of the safety function a PLC as well as an IO-Link master is required for functional switching of the function module 3RA27.

For protection of the engine and the cables additional components like a circuit breaker 3RV are required.

Circuit diagram

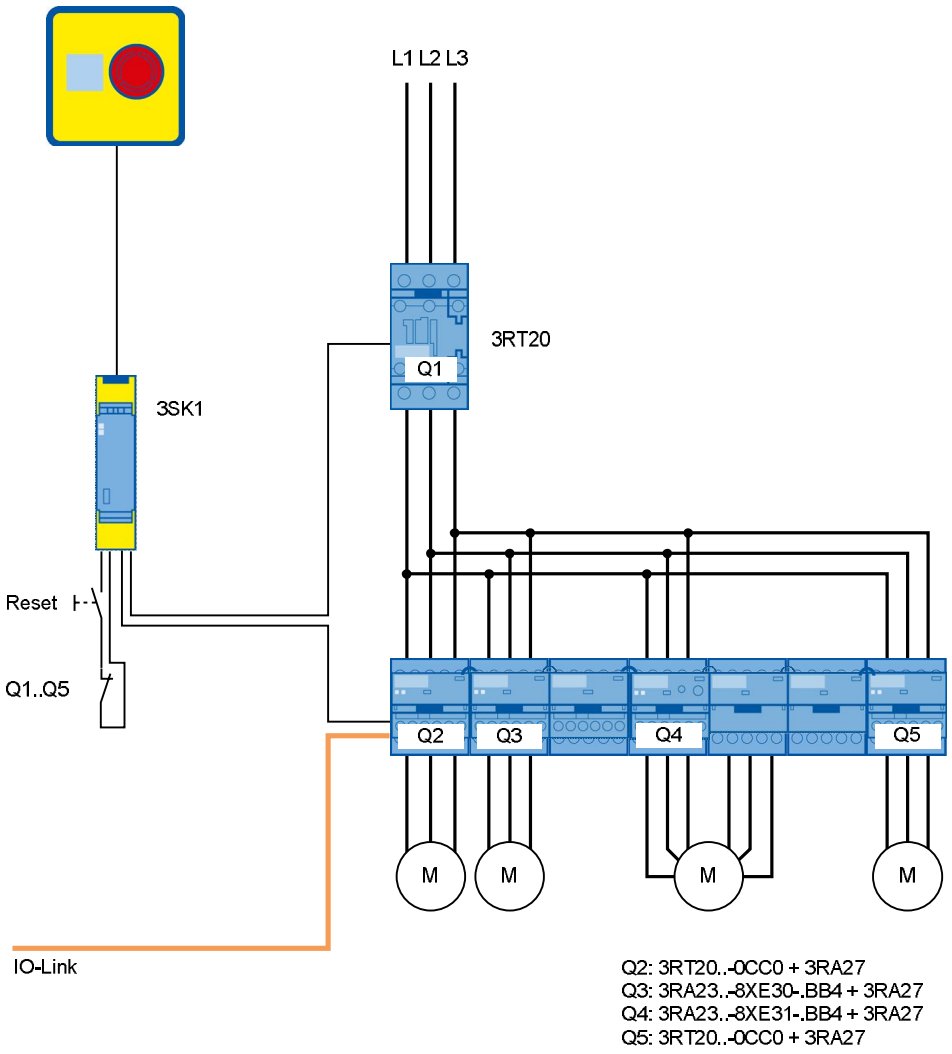
The firmware of the function module is powered via IO-Link. The auxiliary voltage for the contactor to switch is connected to the clamps A3+/Y1 and A4-. The safety relay 3SK1 is interconnected between power supply and A3+/Y1. Additionally a jumper is placed between Y1 and Y2.



3 Safe switching of a group of motor starters

With IO-Link it is possible to group up to four function module to one IO-Link device. Within this group any combination of direct, reversing and star-delta starter is allowed. Communication to the IO-Link master as well as the power supply for both the firmware and the contactors is distributed via a 14-pin module connector from the first module to the rest of the group. Is the auxiliary voltage of the first module interrupted every contactor in the group will switch off.

The following illustration shows schematically the combination of a direct starter, a reversing starter, a star-delta starter and another direct starter:



Note

The safety function “Emergency stop” requires the switch on the 3SK120 to be set to “MONITORED”.

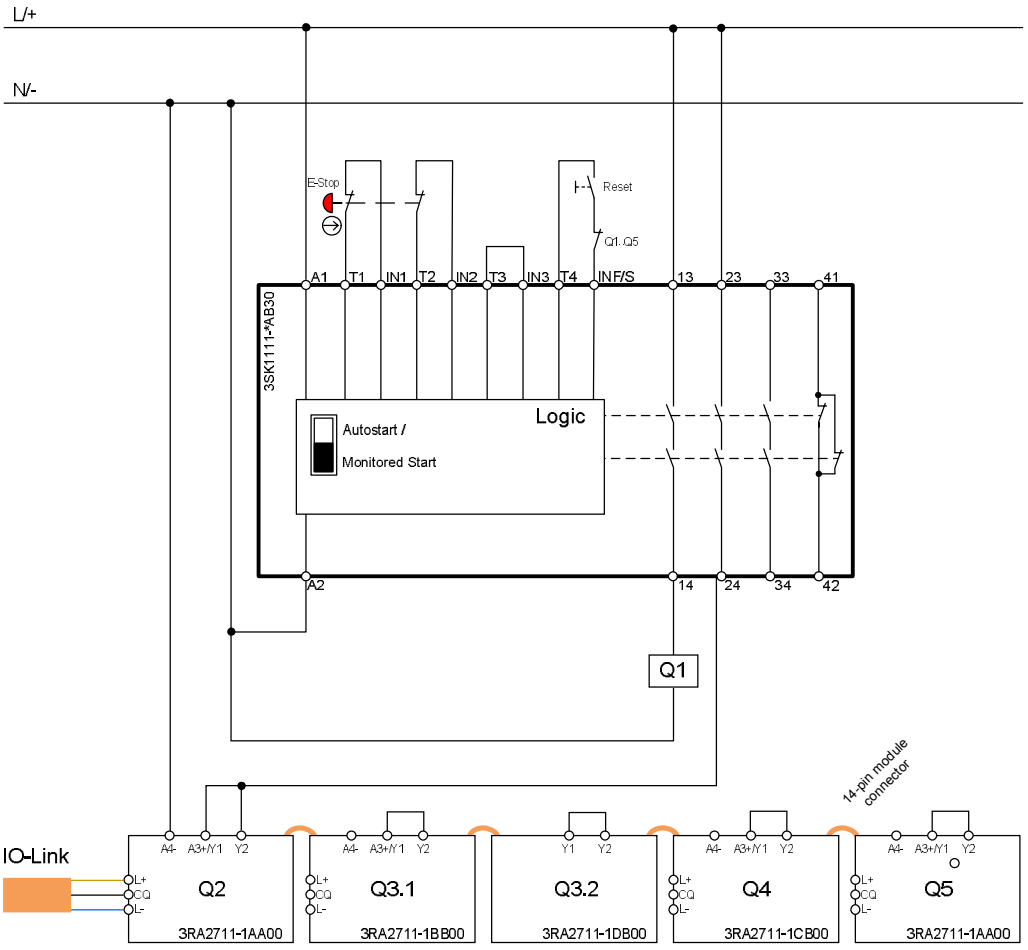
In order to reach SIL 3 according to IEC 62061 or PL e according to ISO 13849-1 it is necessary to insert the normally closed contacts of every contactor (this includes the coupling modules) into the feedback circuit of the safety relay.

Note

In addition to the above illustrated components of the safety function a PLC as well as an IO-Link master is required for functional switching of the function module 3RA27.

For protection of the engine and the cables additional components like a circuit breaker 3RV are required.

The following illustration shows the wiring of the safety components:



Note

Q3.2 illustrates the coupling module for the reversing starter. A jumper between Y1 and Y2 is required.

The two coupling modules for the star-delta starter require no additional wiring besides the integration in the feedback circuit and thus are left out of the diagram.

4 Contact/Support

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