

Safe switching of the motor starters 3RM10 and 3RM12

SIRIUS Safety

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Applications & Tools

Answers for industry.

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Question

How can safe switching also be ensured when using the 3RM10 and 3RM12 motor starters?

Answer

The 3RM1 motor starter is used for functional switching. Safe switching can also be realized, for example, with a 3SK1 safety relay and power contactors.

The following examples describe possible configurations that correspond to various safety requirements.

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1 Application examples

The following application examples apply to both the 3RM10 direct starters and the 3RM12 reversing starters.

The 3RM1 motor starter has no effect or influence on the safety function of the application. For this reason, the 3RM1 motor starter is not taken into consideration in the safety application, either in the positive or negative sense, and thus does not have to be included in the calculation for normative proof.

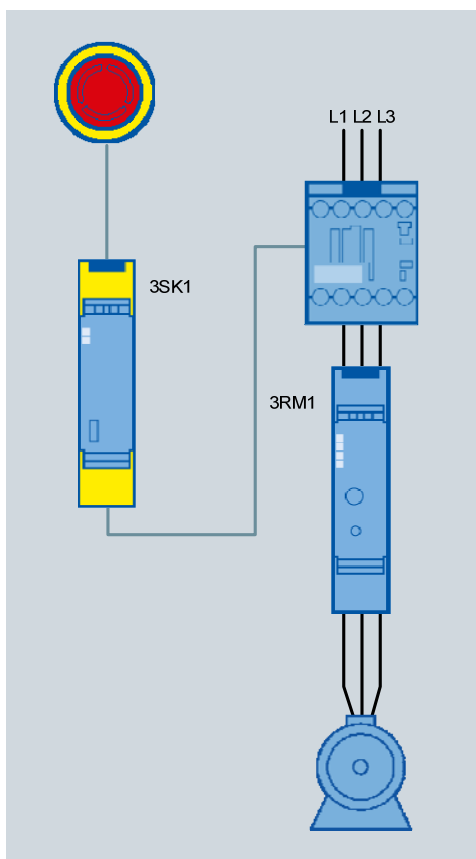
Note

Additional measures, such as a 3RV circuit breaker, are required for protection of the cable, the switching devices, and the motor. Since this protection is not part of the functional safety, it is not included in the overviews and circuit diagrams.

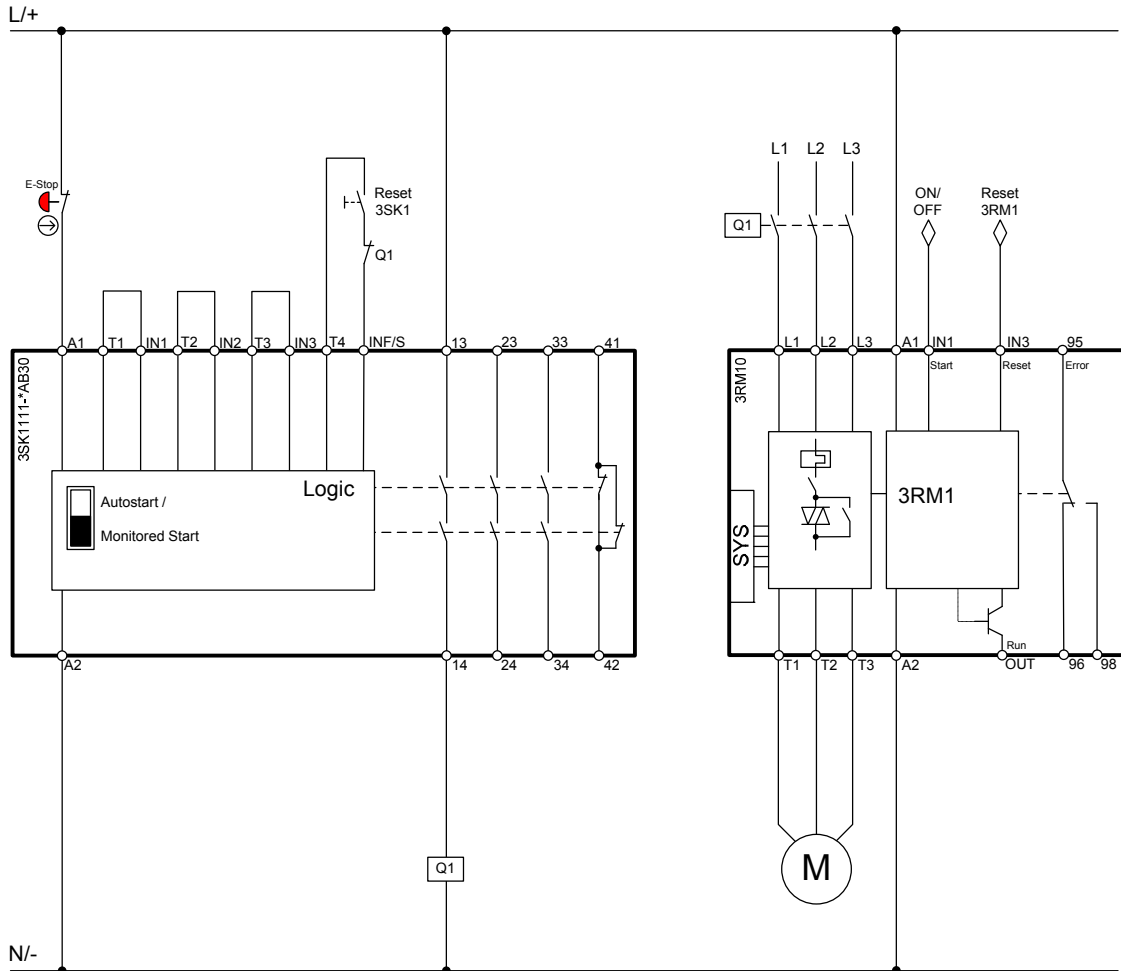
1.1 Safe switching up to SIL 1 or PL c

If achievement of SIL 1 according to IEC 62061 or PL c according to ISO 13849-1 is required, the series connection of an additional contactor with the 3RM1 motor starter, in conjunction with a safety relay suitable for this (e.g. 3SK1111), is necessary, along with monitoring of the contactor's auxiliary contacts.

Basic configuration



Circuit diagram



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1.2 Safe switching up to SIL 2 or PL d

Safe switching up to SIL 2 according to IEC 62061 or PL d according to ISO 13849-1 can either be achieved by a combination of a contactor and a circuit breaker with undervoltage release (e.g. 3RV2902) or by the use of two redundant contactors.

Two-channel monitoring of the EMERGENCY STOP is required in either variant.

Combination of contactor and circuit breaker with undervoltage release

The use of a combination of a power contactor and a circuit breaker with undervoltage release in a safety function is only possible in conjunction with a safety-related evaluation, for example, with a SIMATIC S7 F fail-safe controller, a 3RK3 modular safety system, or a 3SK1 safety relay. The reason behind this is the control of failures by suitable diagnostic measures and the fault reactions triggered by these.

This is not the preferred method because it results in fewer switching cycles and because an automatic restart is not possible since the circuit breaker has to be manually reset.

Time monitoring of the power contactor is achieved by a set time delay on the safety relay (e.g. 3SK1121-1CB41).

The time delay is required so that a power contactor fault can be detected and a corresponding fault reaction – tripping of the circuit breaker by means of an undervoltage release – can be initiated.

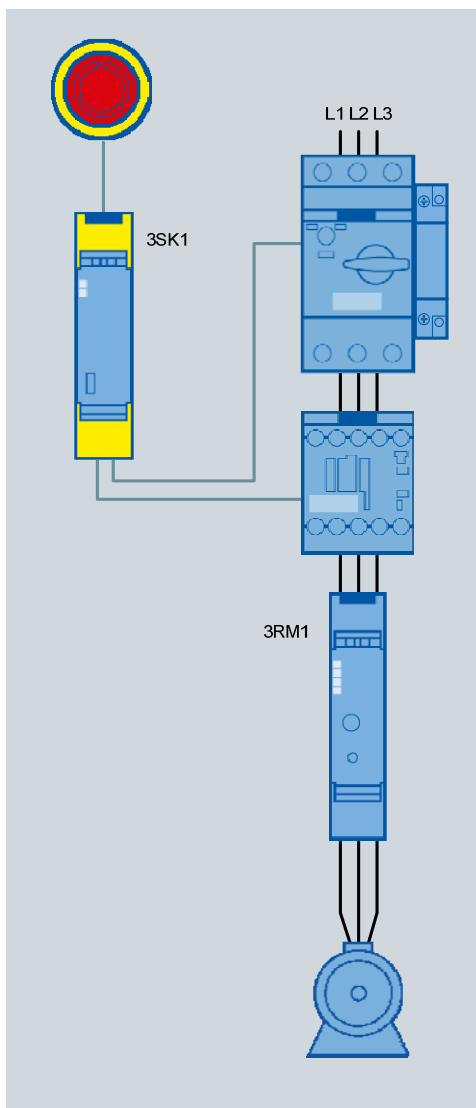
A time delay must be set according to the switching time of the contactor.

Note

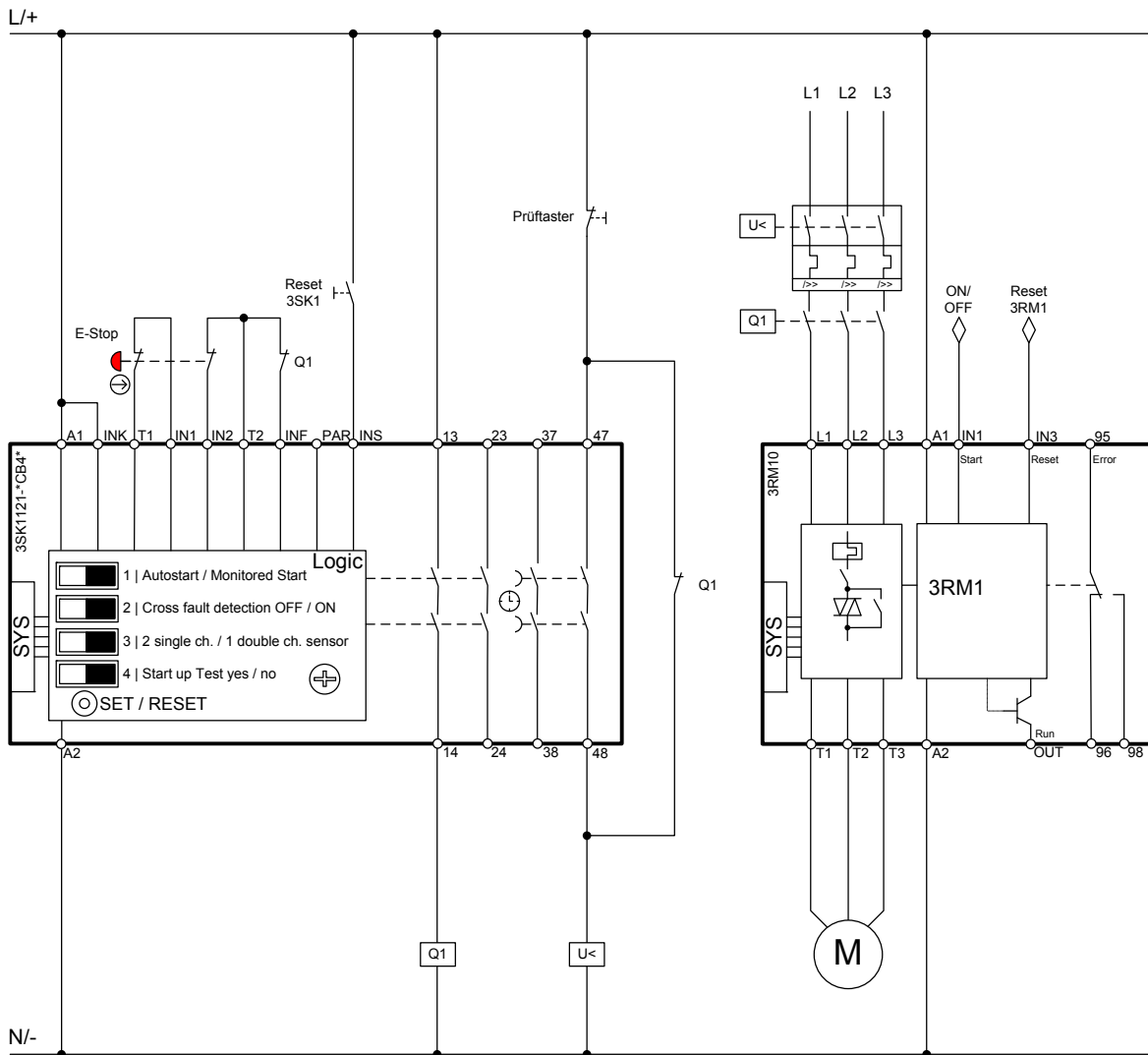
Once the final time value has been set, measures must be taken to protect against a subsequent unintentional change. Application of a sealable cover (e.g. 3ZY1321-2AA00) is therefore mandatory.

The set time value must be documented verifiably.

Basic configuration



Circuit diagram



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While the enabling circuits of the safety relay are closed, the undervoltage release is supplied with voltage. When the EMERGENCY STOP is actuated, the power contactor switches off immediately. The voltage at the time-delayed outputs 37/38 and 47/48 is retained for the set time. After expiration of this time, the undervoltage release will continue to be supplied with voltage via the power contactor's auxiliary contact, which is now closed again.

Only in the case of a fault in which the contactor does not switch off and the auxiliary contact thus remains open does the undervoltage release switch off after expiration of the set time according to the switching time of the contactor.

Note If the contactor fails to act, the reaction time increases by the amount of the set delay time.
Please note that when this occurs the circuit breaker must be manually reset.

To avoid accumulating undetected faults, the circuit breaker must be tested after 6 to 12 months at the latest. This can be done using the test button shown in the circuit diagram.

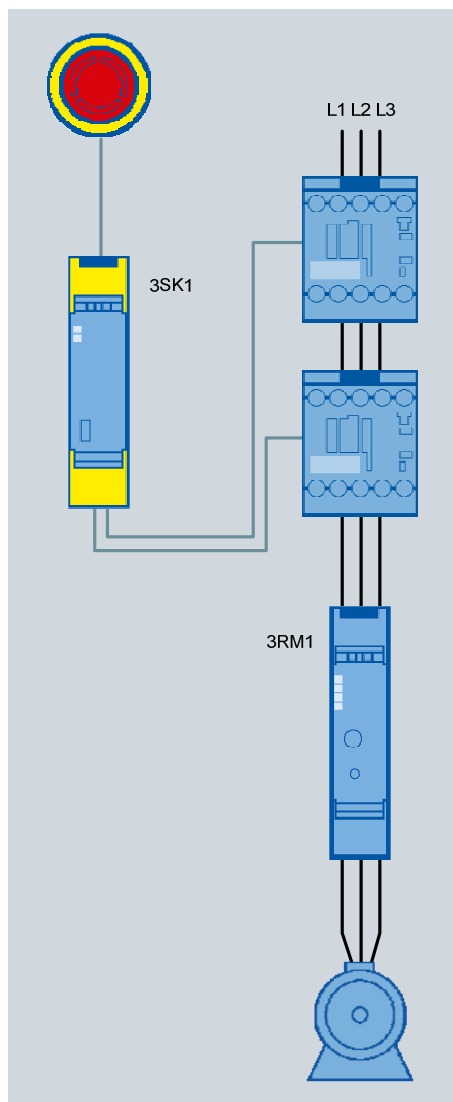
Note This test setup must be documented in the description of the safety function and the operating instructions of the machine.
In addition, the tests performed by the user during the use phase must be documented verifiably.

An example of the configuration with two contactors can be found in the next section.

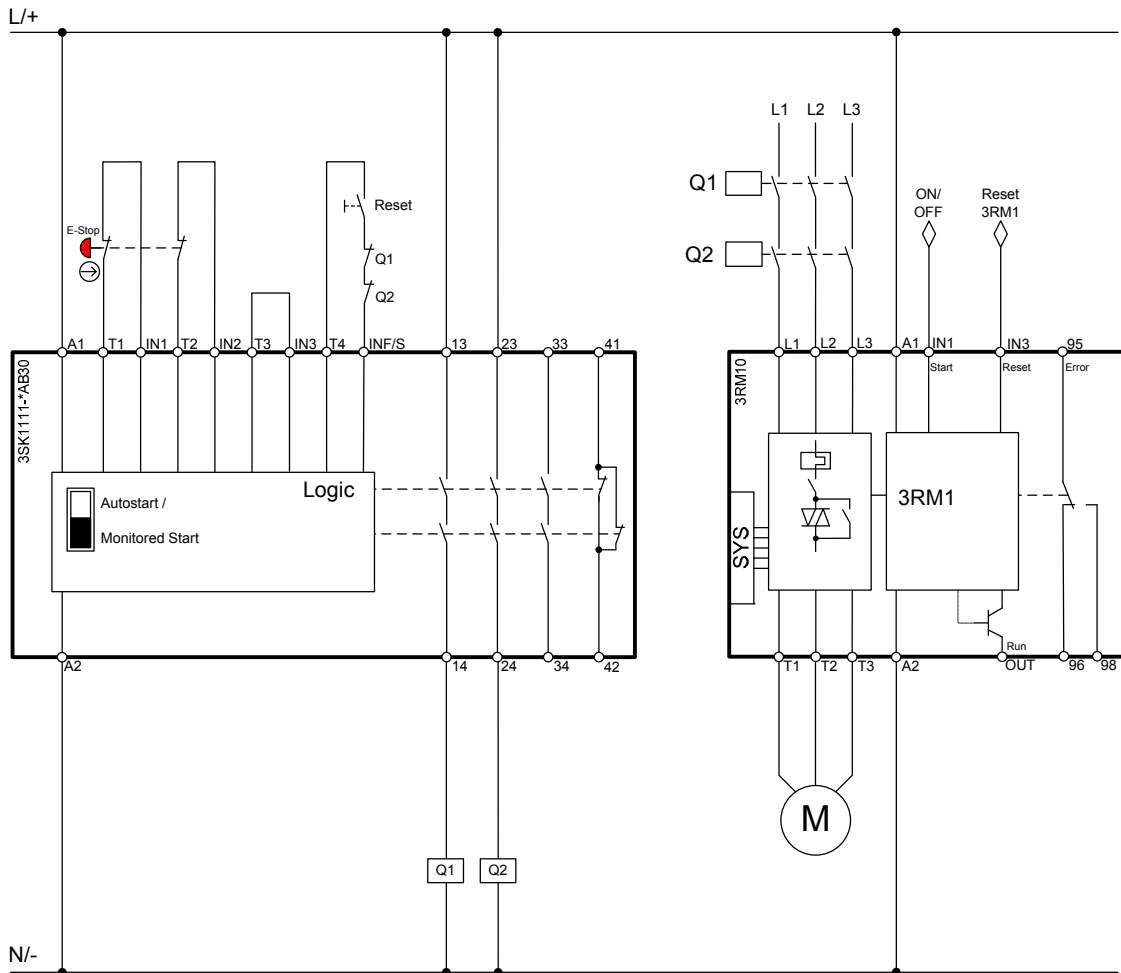
1.3 Safe switching up to SIL 3 or PL e

Safe switching up to SIL 3 according to IEC 62061 and PL e according to ISO 13849-1 requires the use of two redundant contactors and monitoring of the auxiliary contacts of both contactors. Two-channel monitoring of the EMERGENCY STOP is also required here.

Basic configuration



Circuit diagram



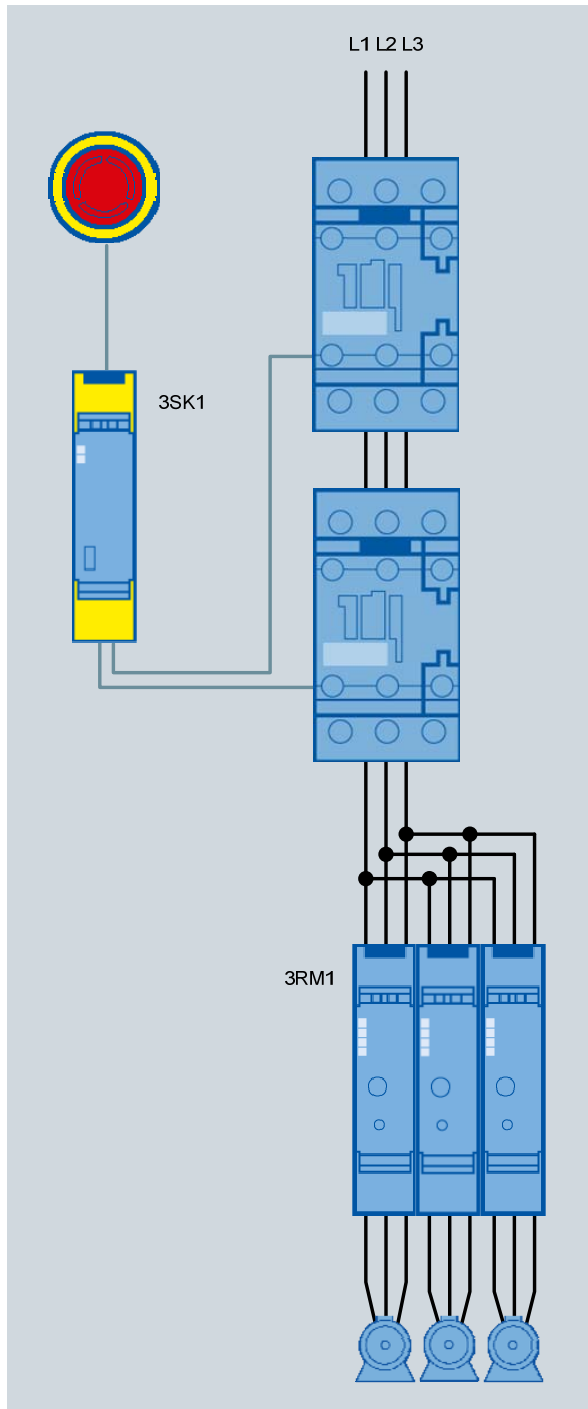
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1.4 Safe switching of a group of motor starters up to SIL 3 or PL e

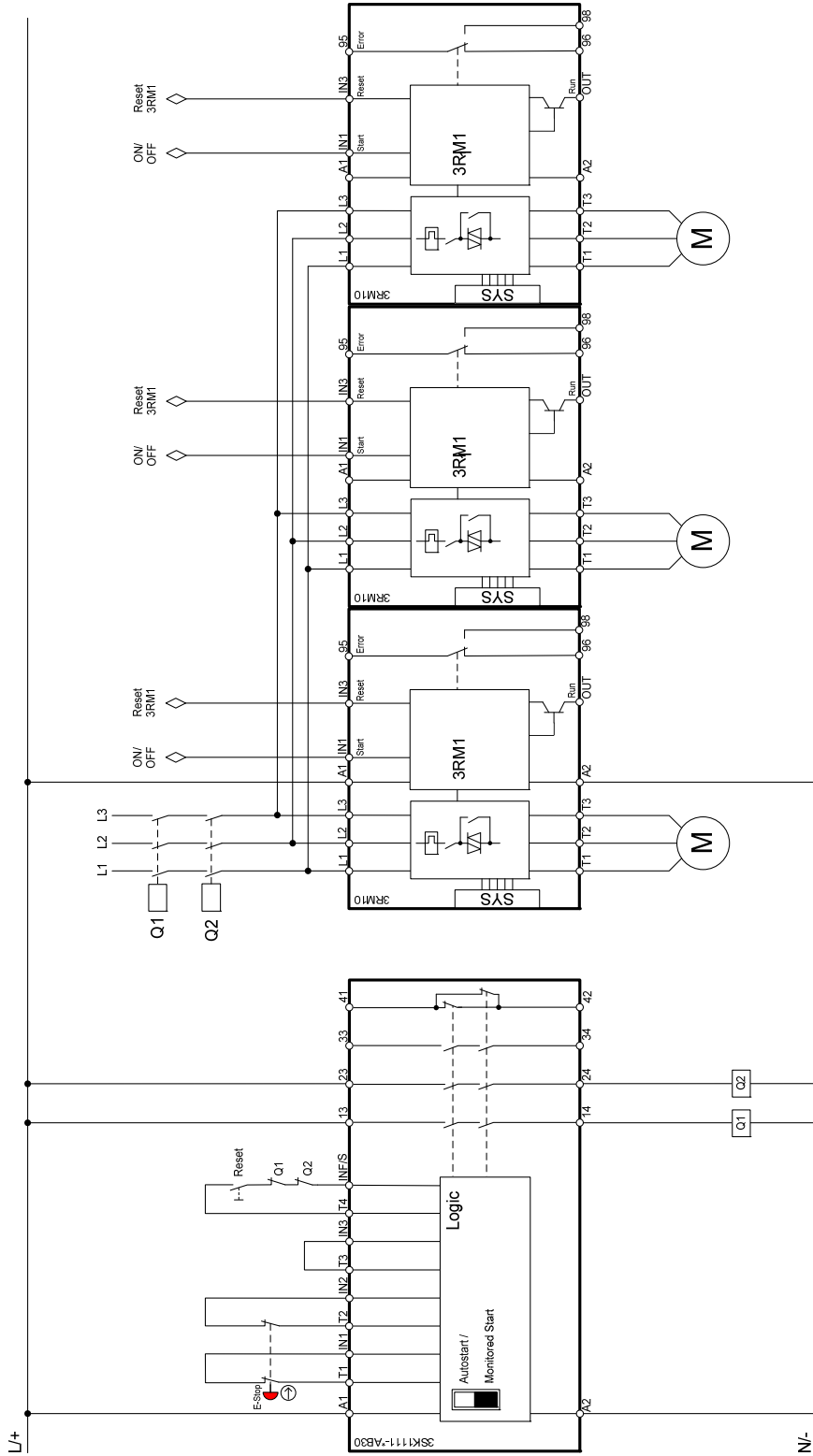
Safe switching of a group of motor starters up to SIL 3 according to IEC 62061 or PL e according to ISO 13849-1 is implemented in the same way as for an individual motor starter. The power contactors must be dimensioned accordingly.

The 3ZY1 device connector enables up to five motor starters to be connected to each other. In this case, the control supply voltage only has to be connected to the first motor starter and is then distributed to the downstream motor starters via the device connectors. In order not to have to expand the circuit diagram unnecessarily, an example configuration with only three motor starters is shown here.

Basic configuration



Circuit diagram



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2 Contact/Support

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