

Clarification for the use of the STO terminals on the Power Module PM240-2, PM240P-2 and G120X

Question:

What must be considered in order to achieve SIL 2/PL d or SIL 3/PL e via the STO terminals in combination with the different drives?

Answer:

In the SINAMICS G120 Safety Integrated, SINAMICS S120 Safety Integrated function manuals and operating manual SINAMICS G120X, wiring examples according to SIL 2/PL d and SIL 3/PL e are shown.

The combination of the Power Modules with the CU240E-2 and CU250S-2 Control Units is described in the function manual. Here the STO terminals of the Power Module are integrated into the Basic Functions of the Control Unit. Thus, the STO terminals up to SIL3 can be used without additional measures. The parameters for these cases are set in the Startdrive or STARTER commissioning tool.

In addition, the STO terminals can also be used in conjunction with other Control Units. These are SINAMICS G120 Control Units (CU230P-2) and SINAMICS S120 Control Units (CU310-2, CU320-2 with CUA32). Additional measures described in this document are required here.

The permissible combinations are described below. They will also be included in the next editions of the above function manuals.

The STO terminals of the G120X can also be used in conjunction with additional measures. These are described in the operating manual. In addition, the information in the following section "Monitoring the STO feedback" must be considered.

The correct wiring must be validated, see the following section "Acceptance test".

Overview

The following combinations can be used:

| Power Module | Control Unit | | |
|----------------------|--------------|---------|-------------------|
| PM240-2 FSD ... FSG | CU230P-2 | CU310-2 | CU320-2 mit CUA32 |
| PM240P-2 FSD ... FSG | CU230P-2 | ./. | ./. |

The STO terminals of the Power Module can only be used with the SINAMICS S120 Control Units if no safety functions are used on the Control Unit. When using both safety function packages (STO terminals on the Power Module and Basic/Extended/Advanced Functions), mutual errors occur.

A higher-level controller is required to select the safety function STO.

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Basic requirements

- The digital outputs for the feedback of STO are parameterized correctly.
The inverter reports the activation of the STO safety function to the higher-level controller via two digital outputs.

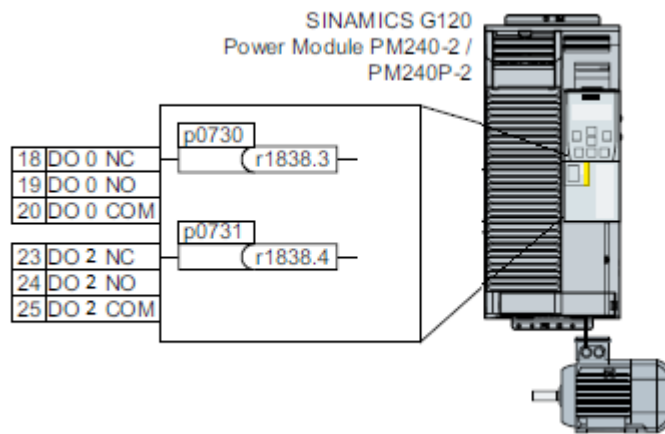


Figure 1: Connection for the feedback signal "STO is active" via digital outputs (example CU230P-2)

With the inverters FSD...FSG you must connect the feedback signals "STO is active" with two digital outputs of the Control Unit:

- r1838.3
- r1838.4
- The higher-level control monitors the selection of the safety function STO and the feedback of the inverter.
- Dynamization (test stop):
The higher-level controller regularly selects the STO safety function and evaluates the feedback from the inverter. We recommend that you implement a time monitoring function in the higher-level controller that reports a warning if the test stop is overdue.

Requirements for SIL 2/PL d

- Suitable higher-level controls
 - SIRIUS 3SK1: 1-channel static feedback loop
 - SIRIUS 3SK2: 2-channel dynamic feedback loop
 - MSS 3RK3: 2-channel dynamic feedback loop
 - SIMATIC: Feedback loop monitoring in the safety program
- Dynamization (test stop) once a year

Requirements for SIL 3/PL e

- Suitable higher-level controls
 - SIRIUS 3SK2: 2-channel dynamic feedback loop
 - MSS 3RK3: 2-channel dynamic feedback loop
 - SIMATIC: Feedback loop monitoring in the safety program
- Dynamization (test stop) every 3 months
- During dynamization, the STO feedback must be time-delayed (expectation for each individual STO channel).

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Application examples

Safety relay SIRIUS 3SK1

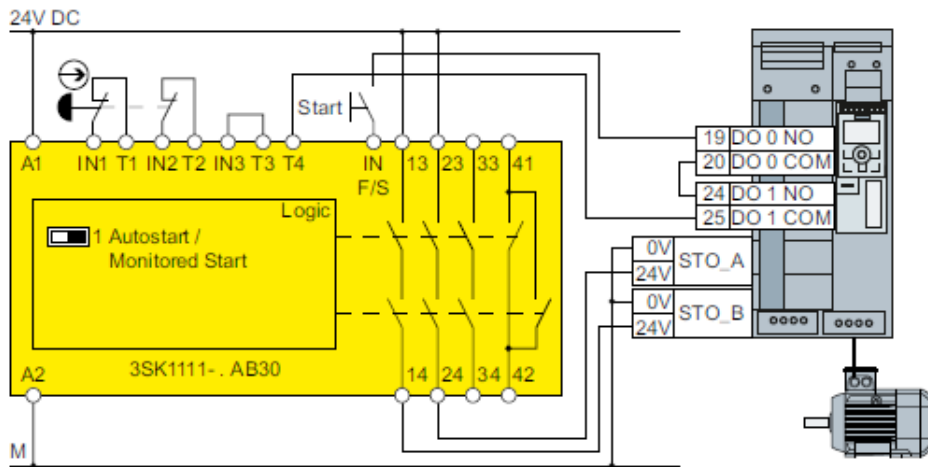


Figure 2: Connection example 3SK1 within a control cabinet for FSD ... FSG

If NO outputs of the DOs are connected, the outputs must be inverted (p748).
If NC outputs of the DOs are used, the outputs must not be inverted. However, the DO0 and DO2 must be used for the CU230P-2, since DO1 has only one NO output.
In addition, with the CU230P-2 it must be ensured that with option L13 of the DO2 a macro is provided to control the main contactor and that when DO0 and DO2 are used for STO feedback, the signal for controlling the main contactor must be wired manually to DO1.

With a safety relay SIRIUS 3SK1 (static monitoring) and the inverter FSD ... FSG you reach SIL 2/PL d.

Safety relay SIRIUS 3SK2

The wiring examples are implemented with safety switching devices with relay release circuits. Implementation via safety switching devices with semiconductor release circuits is also possible.

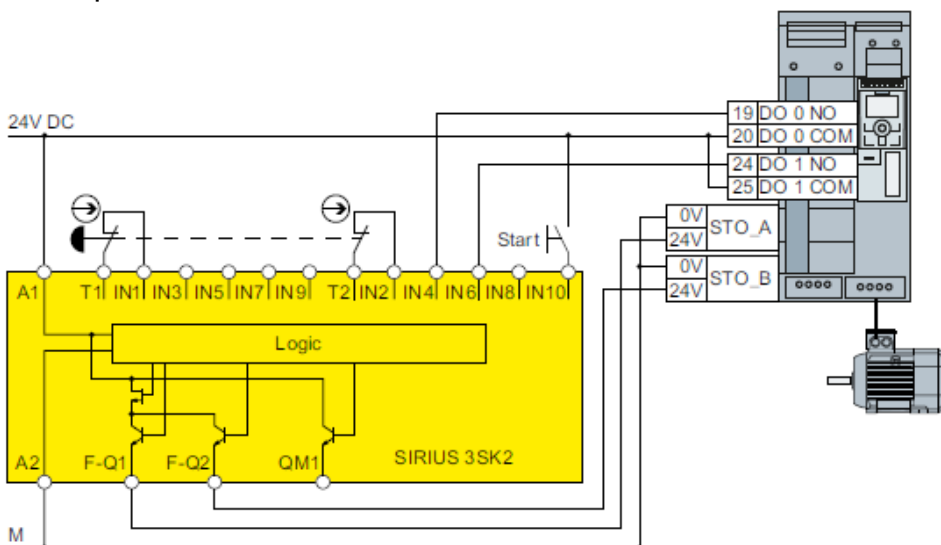


Figure 3: Connection example 3SK2 inside a control cabinet for FSD ... FSG

We reserve the right to technical modifications.

With a safety relay SIRIUS 3SK2 (dynamic monitoring) and the inverter FSD ... FSG you reach SIL 3/PL e.

Modular Safety System 3RK3

To control the fail-safe digital inputs in the inverter, you may use the following Use exits:

- The fail-safe digital outputs in the central modules of the Modular Safety System 3RK3
- The fail-safe digital outputs in the expansion module EM 2/4F-DI 2F-DO
- The fail-safe digital outputs in the EM 4F-DO expansion module
- The fail-safe relay outputs in the extension module EM 4/8F-RO
- 2 individual relay contacts of the expansion module EM 2/4F-DI 1/2F-RO

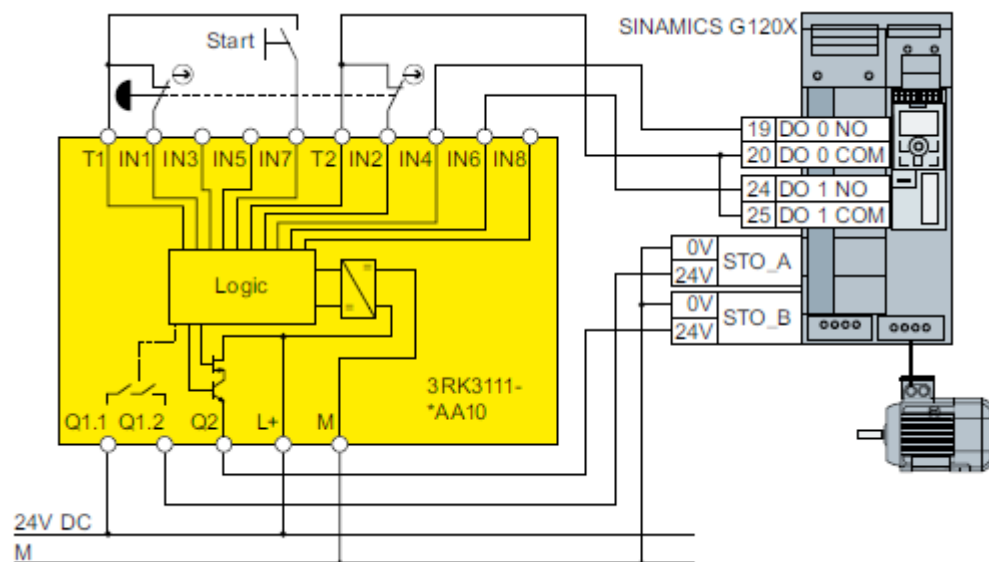


Figure 4: Connection 3RK3 within a control cabinet for FSD ... FSG

With a Modular Safety System 3RK3 (dynamic monitoring) and the inverter FSD ... FSG you can reach SIL 3/PL e.

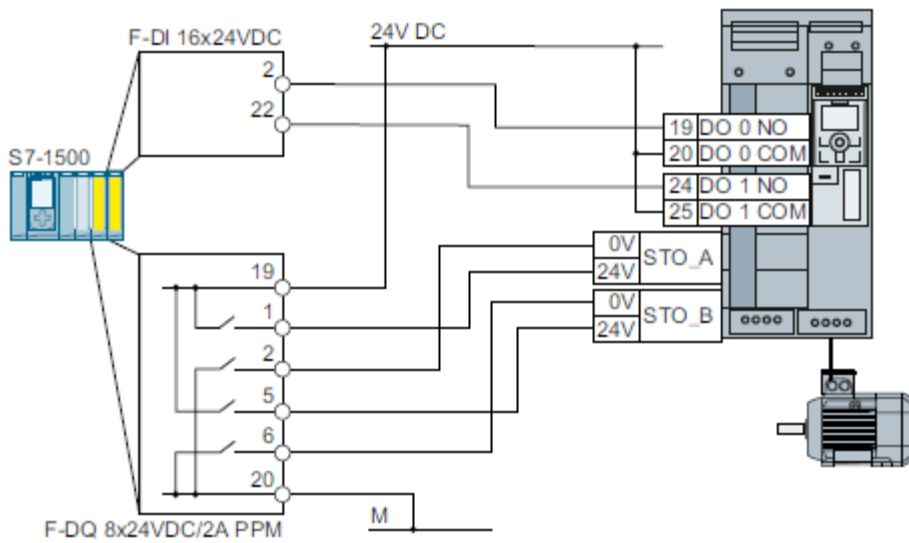


Figure 5: Connection of the SIMATIC S7-1500 within a control cabinet for FSD ... FSG

With a SIMATIC System (dynamic monitoring) and the inverter FSD ... FSG you can reach SIL 3/PL e.

Monitoring STO feedback

The following times must be taken into account for dynamic monitoring of the STO feedback. This avoids error messages for all wiring variants of the various safety relays. These specifications apply to devices that require dynamic monitoring of the STO feedback:

- PM240-2 and PM240P-2 FSD ... FSG
- G120X FSA ... FSG
- Devices for which static monitoring of the STO feedback is sufficient, but which are connected to a higher-level controller with dynamic feedback loop.

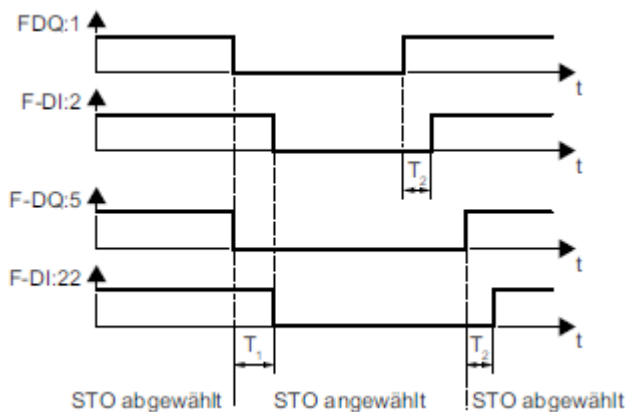


Figure 6: Monitoring the STO feedback

$T_1 \geq 50 \text{ ms}$
 $T_2 \geq 50 \text{ ms}$

If the feedback signal is different, the safety relay must select the STO function and report an error.

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Acceptance Test

As part of the acceptance test, a feedback signal test is required for installation with static monitoring based on the 3SK1 safety relay or comparable safety relays. The correct wiring of the two relay outputs must be checked.

This is illustrated by the following test (proposal) using 3SK1 as an example:

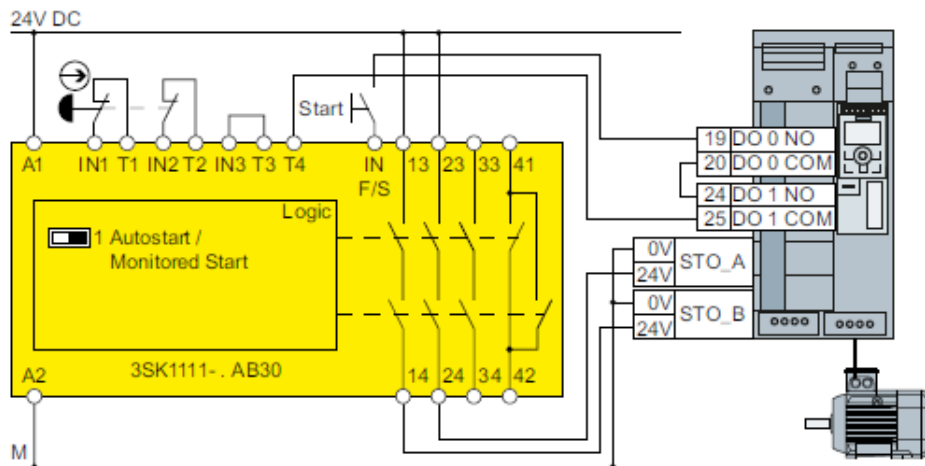


Figure 7: Connection example 3SK1 within a control cabinet for FSD ... FSG

1. The system is properly installed and commissioned.
2. Observe the usual rules when handling electrical voltages.
3. Place a bridge between terminals 13 and 14 on the 3SK1.
4. Activate STO. The drive coasts down.
5. Unlock the emergency stop button and give the start command. Due to the 1-channel feedback, the 3SK1 will not unlock and the start command will not be executed.
6. Restore the original wiring by removing the jumper.
7. Now give the start command. The drive must start properly.
8. Repeat the above test steps with a jumper between terminals 23 and 24.
9. Record the acceptance test incl. countersignature.