

DID YOU KNOW



MOTOR STARTER WITH STO-FUNCTION

WHAT IS “SAFE TORQUE OFF” (STO)?

The “Safe Torque Off” function, better known as STO function, is a safety function that can be integrated in motor drives. It mainly prevents the drives from generating torque on the motor, as well as the unintentional or unexpected starting as long as the STO function is enabled.

STO is the foundation for drive-based functional safety, since it brings a drive safely to a no-torque state. Upon activation, STO immediately switches off the drive output to the motor and the motor speed then comes to a stop.

The STO function is different from an emergency stop function (E-stop). Depending on the standards and requirements for a particular application, it might be possible to use STO as part of an E-stop system. However, its main purpose is to be used in a dedicated safety control arrangement, designed to prevent foreseeable hazards from occurring, without the use of an E-stop. An E-stop is often used in a machine to allow for unexpected situations where an operator recognizes a hazard and can take action to prevent an accident.

WHAT ARE THE NORMATIVE REQUIREMENTS FOR THE SAFETY FUNCTION?

B The normative requirements for Safe Torque Off is based on the following standards:

- Performance Level (PL) according to EN ISO 13849-1:2008
- Stop Category 0 according to EN 60204-1
- Safety Integrity Level (SIL) according to EN 61508-1/2/3

The Safe Torque Off function ensures that no energy is supplied to the motor that can generate torque. This safety function corresponds to an uncontrolled stop according to IEC 60204-1, stop category 0, which means “stopping by immediate removal of power to the machine actuators”. This safety feature can be used when power-off is required to prevent an unexpected start.

In circumstances where there are external influences (e.g. falling suspended loads), further measures (e.g. mechanical brakes) may be necessary to prevent hazards. Moreover, electronic equipment and contactors do not provide adequate protection against electric shock and additional measures for galvanic isolation may be necessary.

WHAT ARE THE ADVANTAGES OF SAFE TORQUE OFF?

The STO function could be used to avoid the use of several separate components (electromechanical contactors), which results in reduced installation effort. Moreover, this function has a much shorter switching time than the electromechanical components used for conventional solutions. Therefore, the distance between, for example, the light grids and the machine can shorter, which results in the reduction of space required.

This function allows stopping the generation of the torque while keeping the power supply to the drives. That means only that particular drive or part of the larger system is shut down and rest of the system remains unaffected, resulting in a high system- or plant-availability.

The appropriation of the STO function to a category 0 stop limits its use in cases where the residual motion after the deactivation of the torque (inertia) is stopped in a short time, unless additional measures to control the movement are jointly used.

The STO function also gives more alternatives to control hazardous energy control methods when conventional methods (lockout) are not applicable. However, an analysis and evaluation of the safety system in accordance with ISO 13849-1 and 2 must be completed to confirm that the STO provides a level of safety equivalent to the other methods.

The integration of Safe Torque Off into drives eliminates failure modes equivalent to a stuck contactor or relay, so no feedback is required for SIL 3 or PL e. This avoids the need for expensive additional option modules or safety relays, and offers superior integrity at lower cost.

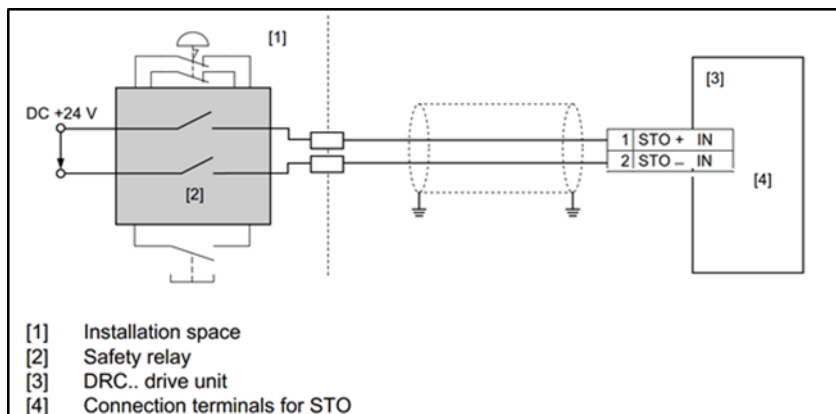
WHAT IS THE ROLE OF STO IN THE NEW MOTORSTARTER PODIS® MS 5HP?

The safety function STO is the main safety feature of the new motor starter. With SIL 3 and PL e, it provides the highest level of safety possible for the motor starter.

Certain conditions must be met in order to operate the motor starter with safety level SIL 3 and PL e:

- Dual-channel control of the STO
- Cross-wire monitoring and ground fault monitoring on the STO connecting cable.

Figure 1: Safety concept for the motor starter



When activated, the safety function STO ensures that the motor is torque-free. In the safe state, two safety-related components on the motor starter are disconnected from the main voltage, namely the hybrid module and the safety relay. From a technical perspective, a minimum of two of the three motor phases are shut down and the motor is reliably free of torque.

The motor starter is connected to the higher-level controller via the STO signal interface. The signal interface provides two independent inputs (STO_A and STO_B).

The safety function STO is triggered by a control signal and the status change from high level to low level. Motor operation is only possible when the safety circuit (STO) on the motor starter has the state Enable High Level.

