Safety modules

For virtually any application, the provision of extensive safety engineering is one of the most important tasks of the plant constructor. However, this issue can only be solved with the help of complicated wiring. Thanks to the "Drive-based Safety" solution that can be integrated in servo drives 9400, this can be implemented using axis modules. The safety engineering, which can be integrated as an option, has a modular structure.
The range of functions begins with the "safe torque off" function (formerly "safe standstill") and extends as far as integration in safety bus systems. The modular approach of drive-based safety also provides the option for expanding systems in future and, at the same time, ensures flexibility.

SM301 safety module

The following modules are available with safety functions in accordance with IEC 61800-5-2:
- SM0 (necessary for the MSI slot if no safety functions are required)
- SM100
- SM301
- SM302

Mode			
Safety module	SM100	SM301	SM302
Function			
Safe torque off (STO)	●	●	●
Safety sensor connection	●	●	●
Safe stop 1 (SS1)		●	●
Safe stop 2 (SS2) [1)]		●	●
Safe operational stop (SOS) [1)]		●	●
Safely limited speed (SLS) [1)]		●	●
Safe maximum speed (SMS) [1)]		●	●
Safe speed monitoring (SSM) [1)]		●	●
Safe direction (SDI) [1)]		●	●
Operation mode selector (OMS) with enable switch (ES)		●	●
Safely limited increment (SLI) [1)]		●	●
Cascading of the STO safety function		●	●
Safe limited position (SLP) [1)]			●
Position-dependent safely limited speed (PDSS) [1)]			●
Safe cam (SCA) [1)]			●
Safety bus PROFIsafe		PROFIBUS DP PROFINET IO (optionally via MXI1)	PROFINET IO (optionally via MXI1)
Safety bus FSoE			EtherCAT (optionally via MXI1)
Operation with safety PLC		Optional	Optional
Transmission of position and speed data to safety control			PROFIsafe or FSoE
Certification according to IEC 61508	Cat 4 PL e / SIL 3	Cat 3 PL e / SIL 3	Cat 4 PL e / SIL 3

[1)] For speed-dependent safety functions, the motor-feedback system combinations listed on the following page are available.

Safety modules

Product key						
			E94AYAA	E94AYAB	E94AYAE	E94AYAF
Mode						
Safety module			SM0	SM100	SM301	SM302
Certification						
EN 954-1				Category 4	Category 3	Category 4
EN ISO 13849-1				PLe	PLe	PLe
Fail-safe state						
				Safe torque off	Safe torque off	Safe torque off
Safe inputs/outputs						
Number of connectable active safety sensors				1	4, choice between active or passive	4, choice between active or passive
Number of connectable passive safety sensors					4, choice between active or passive	4, choice between active or passive
Monitor (1-channel output)				1		
Diagnostics						
Status display				2 LEDs	6 LEDs	6 LEDs
Rated voltage						
	$U_{N, DC}$	[V]		24.0	24.0	24.0

Speed-dependent safety functions in connection with the safety modules SM301 and SM 302

For the following speed-dependent safety functions, the motor-feedback system combinations listed in the following table are available:

- Safe stop 1 (SS1)
- Safe stop 2 (SS2)
- Safe operational stop (SOS)
- Safely limited speed (SLS)
- Safe maximum speed (SMS)
- Safe direction (SDI)
- Operation mode selector (OMS) with enable switch (ES)
- Safe speed monitor (SSM)
- Safely limited increment (SLI).
- Position-dependent safely limited speed (PDSS)
- Safely limited position (SLP)
- Safe cam (SCA)

	Encoder type	Encoder type	Product key		Safe speed monitoring
Synchronous servo motors (MCS, MDXKS)	SinCos absolute value	Single-turn	AS1024-8V-K2		PL d/SIL 2
		Multi-turn	AM1024-8V-K2		
	Resolver		RV03		PL e/SIL 3
				2-encoder concept	up to PL e / SIL 3

	Encoder type	Encoder type	Product key		Safe speed monitoring
Asynchronous servo motors (MCA, MQA)	SinCos incremental	Multi-turn	IG1024-5V-V3		PL e/SIL 3
	Resolver		RV03		
				2-encoder concept	up to PL e / SIL 3

Please refer to the servo motors catalogue for details on the concrete assignments of the individual motor frame sizes and the corresponding technical properties.

A "2-encoder concept" is a resolver as motor feedback unit and, at the same time, an absolute value encoder (SinCos), and incremental encoder (TTL), an SSI encoder or bus encoder as position encoder at the machine