

Functional safety

Safety for every application



Simply integrated

Here at Lenze, we use our centralized/decentralized safety concept to focus on the area of safety engineering. The moving parts of machines create hazards for operating and maintenance personnel, so the task is to protect staff members from these hazards at all times – and the most effective way to do this is to take action at the point in the machine where the hazardous movement originates: directly in the inverter itself.

Take advantage of our expertise and our components to implement safety engineering in your machines simply yet comprehensively (e.g. servo inverters, frequency inverters, safety controllers).

Lower system costs

- Reduction in space requirement
- Reduction in wiring complexity
- No external safety engineering hardware required

Simplification of the system structure

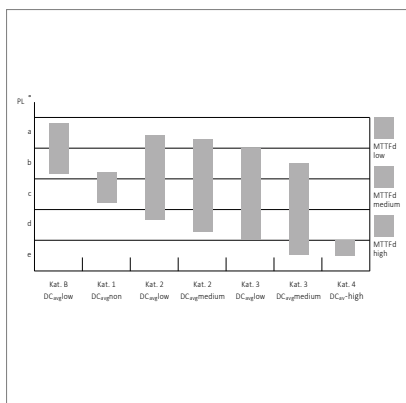
- Greater transparency
- All functions are drive-related and are available for the Controller via FSoE/PROFIsafe.

Enhanced system performance

- Shorter switch-off times due to the absence of contactors
- Shorter reactivation times because the DC bus remains charged



Features at a glance.



Certified

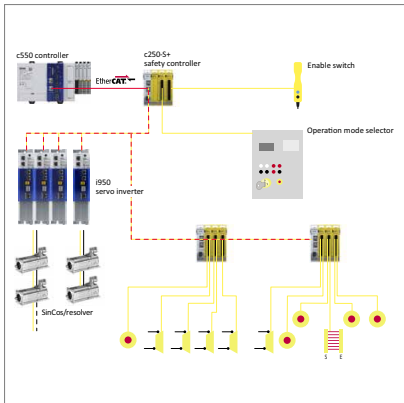
As the safety functions integrated into the drive already come with an EC-type examination, this makes the certification process for the entire machine (by the German TÜV testing authority or the Employer's Liability Insurance Association, for example) much easier. The safety modules are certified in accordance with EN ISO 13849-1, EN IEC 61508 and EN IEC 62061 and achieve the maximum performance level, PL e.

Direct connection

Safe, two-channel inputs are provided for the safety sensor technology to integrate centralized/decentralized safety into your machine's safety chain. A higher-level PLC that processes both standard and safety logic is connected bus systems that can simultaneously transfer safe and non-safe data on a physical bus system, such as PROFI-safe or FsoE.

Simplified planning

We support you in the implementation of your safety requirements with the optional integrated safety engineering. All functions are developed according to IEC 61508, SIL 3 and meet the requirements of EN ISO 13849-1 PL e and EN IEC 62061 SIL 3. This facilitates the acceptance of your entire machine.

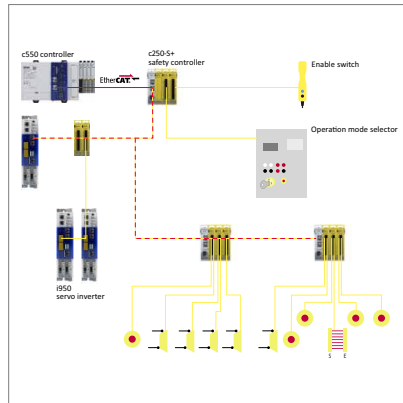


Safety topology

Due to the functional safety in the inverter, safety topologies can be achieved with very little wiring effort.

Thanks to the PLC Designer engineering tool, which can be used throughout, the safety aspects can be integrated very conveniently into the standard machine application. No system change is necessary because standards (PLCo-pen) are used.

The programming, setup and operation of the system can be created consistently with the tool. Operation and diagnostics are done directly or via a bus system.

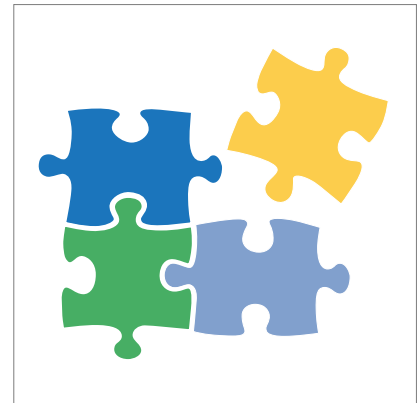


EtherCAT

A very high-quality solution is a safety topology via EtherCAT with its FSoE extension (Functional Safety over EtherCAT).

This solution is a very modern and high-performance bus system.

By using EtherCAT, the inverters can be controlled quite easily and further peripheral components can be connected.



Third party components

Many applications require not only the drives to be integrated into the safety topology, but also other components, so-called "third party components".

When using EtherCAT/FSoE, Lenze has consistently adhered to the associated standards. Thus the integration is possible without any problems.

These components can be integrated without system interruptions and contribute to the implementation of the machine's safety functions.



Safety controller

The safety functions are implemented in the safety controller or in the inverters. These drive-end safety functions can be evaluated in the higher-level control systems.

The requirements of the customized application are clear - we have the right option. This leaves room for subsequent developments, and creates systems that are fit for the future. The desired safety topology can be realized via the following devices:



c250-S safety controller



- Centralized/Decentralized Safety
- Functions according to PLCopen TC5



i950 cabinet



- Basic Safety-STO
- Extended Safety



i700 cabinet



- Basic Safety-STO
- Single and double axes



i550 motec



- Basic Safety-STO



i550 cabinet



- Basic Safety-STO



8400 motec



- Basic Safety-STO

c250-S safety controller

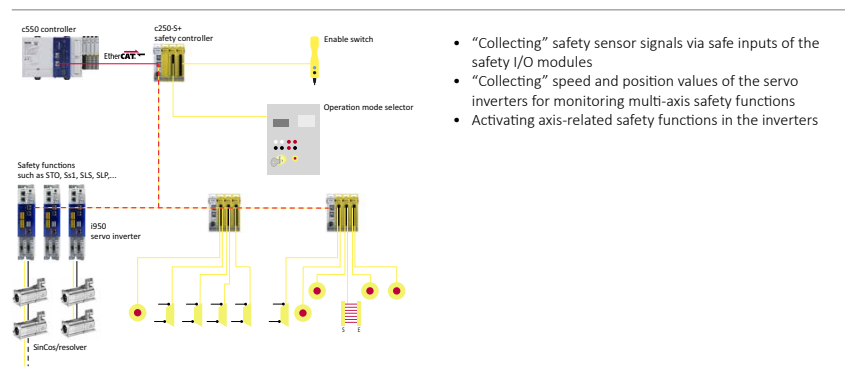
Safety in the system does not begin with the drives first, but at the control level. The c250-S safety controller provides a complete automation solution for safety functions, control tasks, and drive tasks.

Rounded off with the Safety I/O module, all safety aspects can be evaluated in the machine module. EtherCAT is used for data transfer.

The safety controller is used for the higher-level management of the monitoring functions of the inverters, which are shown on the following pages.

Highlights

- Compact for easy mounting using the DIN rail
- Safety I/O modules that can be mounted directly in a row, with integrated connection without any further wiring
- Plug-in ports of the safety I/O modules for fast commissioning
- Portfolio expansion means reduction of machine components
- High-quality safety solution thanks to PL e/SIL 3



Safe stop and standstill functions

-
-
-
-
-

Safe basic motion functions

-
-
-

Safe extended motion functions

-
-
-
-

Additional safety functions

-
-
-
-
-
-
-
-
- PLC-open TC 5 functions

Safe communication

-
-
-
- Safety bus FSoE
- Secure transfer of current position and speed data
-

Servo inverter

In everyday production, safety-relevant events often lead to machine downtime, loss of production, and unnecessary costs. For this reason, it is worth considering safety functions that meet requirements at an early stage when designing your new machine.

The inverters with integrated safety functions are certified according to EN ISO 13849-1, EN IEC 61508, and EN IEC 62061.

Highlights

- i700 cabinet has Basic Safety-STO on the yellow terminals
- i950 cabinet has Basic Safety-STO or Extended Safety depending on the requirement of the machine



i700 cabinet

Safe stop and standstill functions

- Safe torque off (STO)
-
-
-
-

Safe basic motion functions

-
-
-

Safe extended motion functions

-
-
-
-

Additional safety functions

-
-
-
-
-
-
-

Safe communication

- Connection of safety sensors (safe inputs)
-
-
-
-

i950 cabinet

Safe stop and standstill functions

- Safe torque off (STO)
- Safe stop 1 with ramp monitoring (SS1-r)
- Safe stop 1 with time monitoring (SS1-t)
- Safe stop 2 (SS2)
- Safe operational stop (SOS)
- Safe stop emergency (SSE)

Safe basic motion functions

- Safely limited speed (SLS)
- Safely limited position (SLP)
- Safe maximum speed (SMS)

Safe extended motion functions

- Safe cam (SCA)
- Safe speed monitor (SSM)
- Safe direction (SDI)
- Safely limited increment (SLI)

Additional safety functions

- Operation mode selection with enable switch (ES) (OMS)
- Repair mode select (RMS)
- Safe monitor (safe outputs)
-
- Cascading of the STO safety function (CAS)
- Position-dependent safely limited speed (PDSS)
- Safe brake control (SBC)
-

Safe communication

- Connection of safety sensors (safe inputs)
- Muting of input signals
- Safety bus PROFIsafe/PROFINET
- Safety bus FSoE
- Secure transfer of current position and speed data
- Operation with safety PLC

Frequency inverter

In everyday production, safety-relevant events often lead to machine downtime, loss of production, and unnecessary costs. For this reason, it is worth considering safety functions that meet requirements at an early stage when designing your new machine.

The inverters with integrated safety functions are certified according to EN ISO 13849-1, EN IEC 61508, and EN IEC 62061.

Highlights

- The i550 cabinet is available with the extension of a safety module (Basic Safety-STO)
- The i550 protec is available with the extension of a safety module (Basic Safety-STO)
- The 8400 motec is available with the extension of the Basic Safety-STO function in the communication unit



i550 cabinet

Safe stop and standstill functions

- Safe torque off (STO)
-
-
-
-

Safe basic motion functions

-
-
-

Safe extended motion functions

-
-
-
-

Additional safety functions

-
-
-
-
-
-
-

Safe communication

- Connection of safety sensors (safe inputs)
-
-
-
-

i550 protec

Safe stop and standstill functions

- Safe torque off (STO)
-
-
-
-

Safe basic motion functions

-
-
-

Safe extended motion functions

-
-
-
-

Additional safety functions

-
-
-
-
-
-
-

Safe communication

- Connection of safety sensors (safe inputs)
-
-
-
-

8400 motec

Safe stop and standstill functions

- Safe torque off (STO)
-
-
-
-

Safe basic motion functions

-
-
-

Safe extended motion functions

-
-
-
-

Additional safety functions

-
-
-
-
-
-
-

Safe communication

- Connection of safety sensors (safe inputs)
-
-
-
-

Inverter selection

The options shown here represent a selection of possible solutions for simple functional safety.
No suitable solution for you? Please contact us if you have other requirements.

	Rated power	Mains voltage range	Rated output current	Degree of protection	Basic Safety-STO	Extended safety
	[kW]		[A]			
Single-phase mains connection 120 V						
i550 cabinet	0.25 ... 1.1	1/N/PE AC 90 V ... 132 V	1.7 ... 6	IP20	●	
i550 protec	0.37 ... 1.1	45 Hz ... 65 Hz	2.4 ... 6	IP66	●	
Single-phase mains connection 230/240 V						
i950 cabinet	0.37 ... 1.5 kW	1/N/PE AC 170 V ... 264 V	2.4 ... 7	IP20	●	●
i550 cabinet	0.25 ... 2.2 kW	45 Hz ... 65 Hz	1.7 ... 9.6	IP20	●	
i550 protec	0.37 ... 2.2 kW		2.4 ... 9.6	IP66	●	
Three-phase mains connection 230/240 V						
i950 cabinet	0.37 ... 5.5	3/PE AC 170 V ... 264 V	2.4 ... 23	IP20	●	●
i550 cabinet	0.25 ... 5.5	45 Hz ... 65 Hz	1.7 ... 23	IP20	●	
i550 protec	0.37 ... 11		2.4 ... 42	IP66	●	
Three-phase mains connection 400 V						
i950 cabinet	0.55 ... 110	3/PE AC 340 V ... 528 V	1.8 ... 212	IP20	●	●
i700 cabinet	0.75 ... 15	45 Hz ... 65 Hz	2.5 ... 32	IP20	●	
i550 cabinet	0.37 ... 132		1.3 ... 254	IP20	●	
i550 protec	0.37 ... 11		1.3 ... 23.5	IP66	●	
8400 motec	0.37 ... 7.5		1.3 ... 16.5	IP65	●	
Three-phase mains connection 480 V						
i950 cabinet	0.55	3/PE AC 340 V ... 528 V	2.9	IP20	●	●
i700 cabinet	0.75 ... 15	45 Hz ... 65 Hz	2.5 ... 32	IP20	●	
i550 cabinet	0.37 ... 132		1.3 ... 254	IP20	●	
i550 protec	0.37 ... 11		1.3 ... 23.5	IP66	●	

Operation with motors

These functions can be used with the following motor/encoder combinations:

m850 synchronous servo motor	Max. achievable PL / SIL up to	MCS synchronous servo motors	Max. achievable PL / SIL up to
AM20-8V-D2 (OCT, One Cable Technology)	PL d / SIL 2	AM20-8V-D2 (OCT, One Cable Technology)	PL d / SIL 2
		AS1024-8V-K2 (absolute value encoder)	PL d / SIL 2
		AM1024-8V-K2 (absolute value encoder)	PL d / SIL 2
AM128-8V-K2 (absolute value encoder)	PL d / SIL 2	AM128-8V-K2 (absolute value encoder)	PL d / SIL 2
RV03 (resolver)	PL e / SIL 3	RV03 (resolver)	PL e / SIL 3
2-encoder concept	PL e / SIL 3	2-encoder concept	PL e / SIL 3
MCA, MQA asynchronous servo motors	Max. achievable PL / SIL up to	m550 three-phase AC motor	Max. achievable PL / SIL up to
IG1024-5V-V3 (incremental encoder)	PL e / SIL 3		
IG2048-5V-V2 (incremental encoder)	PL d / SIL 2	IG2048-5V-V2 (incremental encoder)	PL d / SIL 2
IG2048-5V-V3 (incremental encoder)	PL e / SIL 3	IG2048-5V-V3 (incremental encoder)	PL e / SIL 3
RV03 (resolver)	PL e / SIL 3		
2-encoder concept	PL e / SIL 3	2-encoder concept	PL e / SIL 3

MCA and MQA 20, 22 and 26 as brake motors do not come with a RV03 safety resolver.

With absolute value encoders, only the Sin-Cos interface is safety rated.

With the 2-encoder concept, the PL/SIL achievable depends on the feedback systems used.

