L-force *Drive-based Safety*

Safe, scaleable and above all integrated

Lenze

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L-force | your future is our drive

Cost efficiency, saving time and improving quality are the challenges of the future. Lenze is meeting these challenges with L-force – the drive and automation family with wide-ranging solutions and compatible interfaces and components. L-force means faster project planning and commissioning, enhanced performance and flexibility in production.

Driven by innovation – New ideas for new possibilities

Always on the lookout: Our idea of innovation is working on even better solutions for our customers, every day.

Driven by flexibility – High degree of scalability for individual solutions

Scalability is an important aspect of the **L-force** philosophy. Performance, scope of functions, software, service provisions and aftersales care – Lenze will provide you with exactly the combination you require.

Driven by usability – Simple solutions, even for complex applications

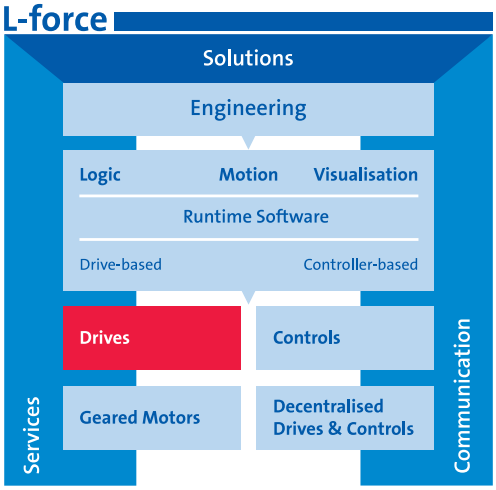
We always focus on the user. Therefore, when we developed **L-force**, we made sure that people with plenty of practical experience were involved, right from the start.

Driven by compatibility – Universal products and solutions

Don't waste any more time searching for suitable components and the right interfaces. With **L-force**, everything is compatible.

Drive-based Safety

Our **L-force** Drives products feature built-in safety engineering for the protection of personnel and machinery.



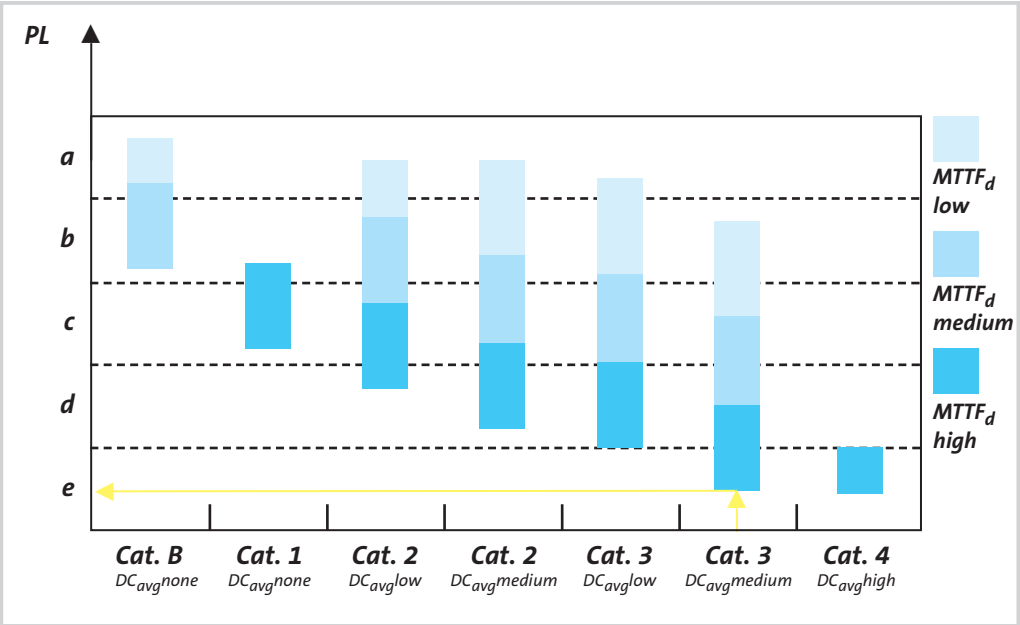
Safety | easily integrated

At Lenze, we have embraced the issue of safety engineering with drive-based safety. It is the moving parts of a machine that pose a risk to operating and maintenance personnel. Staff must be protected from these risks at all times. The most effective approach is to intervene at the place in the machine where the dangerous movement occurs – in other words, directly in the controller. We call functional safety in the controller "Drive-based Safety" – the focus is on ensuring that people remain unharmed.

One simple click and safety engineering is integrated

Safe, scaleable and above all integrated
Safety functions are integrated in the drive and implemented on separate, pluggable modules. The safety modules are available in different grades, thereby providing tailor-made scalability. We have the right module, whatever the requirements of the customer-specific application. This modularity means that the system is open to subsequent developments and you can be confident that your installation is ready to meet the challenges of the future.

Certified according to EN ISO 13849-1
Since the safety functions integrated in the drives have already been certified, this greatly simplifies the process of having the entire machine approved by a certification body (e. g. TÜV or an Employer's Liability Insurance Association in Germany). The safety modules are already certified in accordance with EN ISO 13849-1 (successor standard of EN 954-1) and achieve the highest performance level PL e.



Relationship between category, DC_{avg}, $MTTF_d$ and PL in accordance with EN ISO 13849-1

Benefits for you | driven by us

All benefits at a glance
Take advantage of our expertise and our components to implement safety engineering in your machines simply yet comprehensively.

- **Lower system costs**
  - Reduction in space requirement
  - Reduction in wiring
  - No external safety engineering hardware required
- **Less complex system structure**
  - Reduction in wiring
  - Greater transparency
- **A complex issue made simple**
  - All functions are integrated in the controller
  - Greater transparency
- **Enhanced system performance**
  - Shorter switch-off times due to the absence of contactors
  - Shorter restart times as the DC bus remains charged
- **Improved EMC**
  No interruption to shielding required as mains and/or motor contactors are not needed
- **Improved diagnostics**
  All safety states can be scanned via diagnostic channels in the standard drive
- **Certification ensures compliance with applicable standards**
  Certification of entire system made easier
- **Scalability**
  Only the safety functions actually required need to be installed

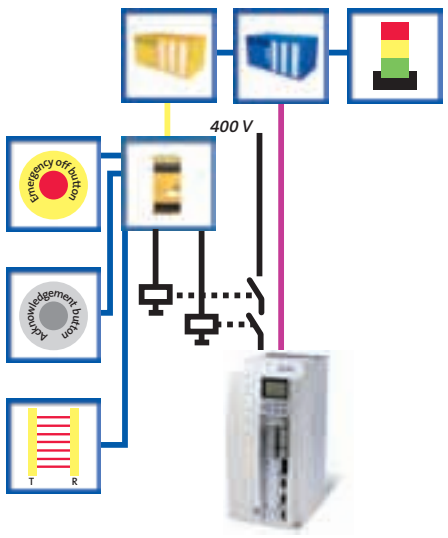
Conventional solutions for implementing safety functions use external switching elements and monitoring devices. Now, cost-cutting potential is achieved by means of the integrated safety engineering we call “Drive-based Safety”.

Drive-based Safety | a safe way to save money

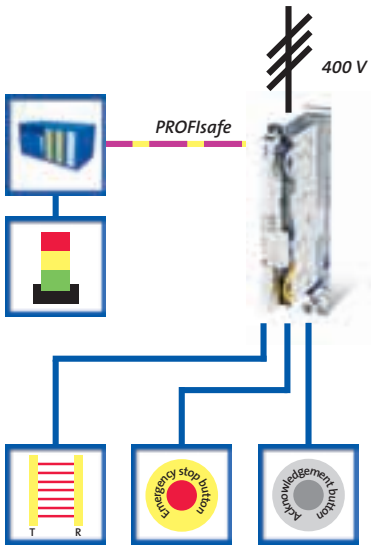
Cost-saving potential
Drive-based safety can save you money, as demonstrated by this example application, taken from a German automotive manufacturer.

The task:
To safeguard the danger zone in the body in white plant, where body shells are finished manually. By comparing a conventional solution with a drive-based safety solution, we can see the potential savings.

Conventional solution with
- ▶ Standard PLC + safety PLC
- ▶ Fieldbus + safety bus system
- ▶ Safety switching device
- ▶ Light guard
- ▶ 2 mains contactors per drive



With drive-based safety, only the following remain:
- ▶ 1 PLC for standard and safety logic
- ▶ 1 fieldbus – PROFIsafe
- ▶ 1 mains contactor for one drive group
- ▶ 1 drive-based Safety module



Advantages of Drive-based Safety
- ▶ Clear reduction in the amount of engineering required
- ▶ Clear reduction in the amount of hardware and control cabinet space required
- ▶ Improved rate of utilisation thanks to safely limited speed
- ▶ Full diagnostics via fieldbus communication
- ▶ Increased system engineering availability thanks to fewer components
- ▶ Improved productivity thanks to shorter cycle times
- ▶ TCO (Total Cost of Ownership) analyses using Drive-based Safety demonstrate beneficial cost savings of up to 20 %, depending on the application

Integration | into your safety concept

Direct connection
Safe, two-channel inputs are provided for the safety sensor technology to integrate Drive-based Safety into your machine's safety chain. A higher-level PLC that processes both standard and safety logic is connected via bus systems that can transfer safe and non-safe data to a physical bus system simultaneously – such as PROFIsafe.

Fit for the future
The modular design of the 9400 Servo Drives allows for later extensions. For example, a safety module with additional safety functions can be connected to the controller simply by clicking it in. The required safety function can be easily parameterised in the controller's engineering environment.

Since fieldbus communication also takes the form of pluggable modules, this allows flexible response to developments in the safety fieldbus systems in the market. TodayPROFIsafe is used, but tomorrow it could be EtherCAT Safety or EtherNet/IP Safety.

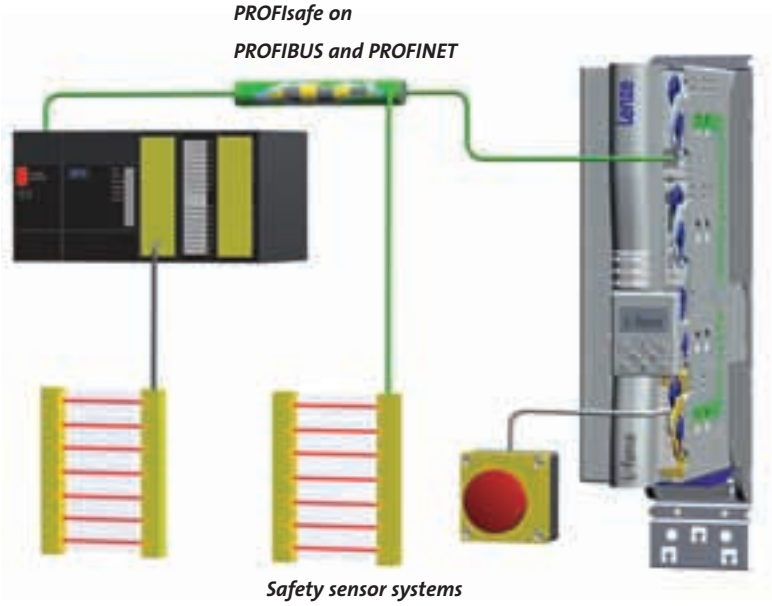
From planning right through to acceptance
We support you in meeting your safety requirements through optionally integrable safety engineering.
All functions have been developed in accordance with IEC 61508, SIL 3, and meet the requirements of EN 954-1 Cat. 4, in accordance with EN ISO 13849-1 PL e and EN IEC 62061 SIL 3. This makes obtaining approval for your overall machine much simpler.

SM301

SM100

PROFIsafe on PROFIBUS and PROFINET

PLC with standard logic and safety logic



9400 Servo Drives with Drive-based Safety engineering

Safety sensor systems

Drive-based Safety | functional overview

Function	Frequency inverter	Servo inverter	Servo Drives 9400	
	8400 9300 8200	ECS 9300	SM100 E94AYAB	SM301 E94AYAE
Safe torque off (STO)	●	●	●	●
Connection of active safety sensors			●	●
Connection of passive safety sensors				●
Safe stop 1 (SS1)				●
Safe stop 2 (SS2) ** Safe operational stop (SOS) **				●
Safely limited speed (SLS) **				●
Safe maximum speed (SMS) **				●
Safe speed monitor (SSM) **				●
Safe direction (SDI) **				●
Operation mode selector (OMS) with enable switch (ES)				●
Safely limited increment (SLI) **				●
Cascading of the STO safety function				●
Safe feedback				●
Safe parameter				●
PROFIsafe safety bus (via slot MXI1)				PROFIBUS DP PROFINET IO (optional)
Operation with safety PLC				optional
Safety module certification according to EN 954-1 / EN ISO 13849-1 / IEC 61508			Cat. 4 PL e/SIL 3	Cat. 3 PL e/SIL 3

Lenze motor combinations for SM301 safety module

Several functions are marked with ** in the table above.

These functions apply to the following drives:

Synchronous servo motors (MCS, MDxKS)	Achievable PL/SIL
AS1024-8V-H	PL d/SIL 2
AM1024-8V-H	PL d/SIL 2
RS0 (Resolver)	PL d/SIL 2
2-encoder concept	PL e/SIL 3

Asynchronous servo motors (MCA, MQA)	Achievable PL/SIL
IG1024-5V-V	PL e/SIL 3
RS0 (Resolver)	PL d/SIL 2
2-encoder concept	PL e/SIL 3

A “2-encoder concept” indicates a resolver functioning as motor feedback and an absolute value encoder (SinCos), incremental encoder (TTL), SSI encoder or bus encoder simultaneously functioning as position encoder on the machine.

TÜV-certified safety

Lenze products with functional safety are developed in compliance with the latest standards and guidelines, and we take pride in the verification of our products by means of regular certification from TÜV Rheinland. The safety-relevant parameters are provided in a SISTEMA library for further use at your convenience.
SISTEMA – a IFA (BGIA) tool is used to determine the PL achieved in different applications.

TÜV Rheinland Group
TÜV Industrie Service GmbH
Automation, Software und Informationstechnologie