

Safe Motion

Safety and motion solutions
for machinery manufacturers



Safe Motion from LTI _ turning safety engineering into a pleasure

We live in an age of continual change – and that is especially true in relation to the functional safety of machines. A new standard will be coming into force at the end of 2009. It will force the established vendors of safety solutions to reinvent their existing tried and tested approaches. At the same time, however, many new players are also entering the fray. Established solutions are being brought into question. Innovation is dictating the course of events.

And astounding things are happening: Instead of the widely anticipated increase in complexity – and resultant rise in cost – of solutions we are in fact seeing quite the reverse. Assembly, wiring and engineering costs are falling. Machine productivity is improving markedly. Eager to know more? Or maybe still skeptical?

This brochure will provide you with an overview of LTI Safe Motion architecture. Discover the enormous flexibility of our safety product portfolio. Let us demonstrate to you that safe motion is not restricted to high-end servo drives, and be impressed by the integrated functional safety in our ServoOne!

Have we aroused your interest? Well then give us a call, and our highly trained safety experts will be glad to show you how the new standards will bring more opportunity than risk. That's a promise!





Safe Motion _ a wide range of scaleable solutions

The scaleable LTi Safe Motion architecture enables optimum machine safety solutions to be designed. Whether you favour a safety solution based on drives or on controls, our Safe Motion architecture is a master of both. The operation, handling and programming of the safety control system is absolutely identical, regardless of its physical location.

Take a look at the tremendous range of safety functions provided by the ServoOne with integrated SIL 3 safety control, and find out what special solutions are possible with the CDE/CDB/CDF3000 drive controllers and the external Safe Monitoring Control.

Wide range of solutions for ServoOne and c-line DRIVES



ServoOne with integrated safety control in SIL 3
Servo drives from 4 to 72 A with AC or DC feed

Safe Monitoring Control in SIL 3
The modular safety control with various encoder interfaces and scaleable I/Os'

Featuring the following safety functions:



Safe Stop SS1/2
With monitoring of the speed curve



Safe Torque Off
Shutdown category 4/HFT 2



Safe Operating Stop
Monitors the rotation speed or position at stand-still



Safe Limited Torque
Monitors exceeding of a maximum torque or force



Safe Limited Speed
Monitors exceeding of a maximum speed



Safe Limited Increment
Monitors exceeding of a preset incremental feed



Safe Limited Position
Monitors exceeding of a preset position



Safe Direction
Monitors blocking of a direction of rotation





Configuring

Programming

Validating

The „Safe Monitoring PLC“ programming interface provides you with a high-quality programming environment as well as a set of configuration, parameter-setting and validation tools.

Come with us on a tour of the sophisticated user control structure:

Connection, monitoring and processing requirements of safety sensors and actuators must be adapted to the safety level of the specific machine application. A separate configuration menu is provided to help you do this. From the menu, you can select the connected safe sensors, encoders and actuators and configure their parameters in context-sensitive menu fields. The tool provides user-friendly support, enabling easy selection and configuration of the optimum safety setup.

The Configurator supports evaluation of familiar capture units such as: emergency stops, permission switches, mode selector switches,

A programming environment that doesn't use a graphical programming language is barely worth installing! So we chose to use the graphical Function Block Diagram (FBD) language. This programming language is oriented to IEC 61131-3, and visualizes the links between the inputs and outputs of the function blocks in the Safe Monitoring PLC.

The safety application is programmed by way of a dedicated on-screen form. The preconfigured sensors, encoders and actuators are available as logical elements. Then the safety functions for

Then the completed configuration, parameter set and programming has to be validated. Here, too, the Safe Monitoring PLC provides assistance. When the program and the parameter data have been transferred to the drive controller and the safety control where appropriate, a configuration report is issued which then has

guard door switches, deadlocks, walk-on mats, light grids, light curtains, laser scanners and even two-handed controls. After selecting the usual safety sensors, the axis-specific encoders are configured. The encoder configuration and parameter setting automatically enables the permissible safety functions for motion monitoring.

Only the functions permissible with the configured encoders are enabled. And of course, the tool provides you with all the safety assistance you need in this respect too. Finally the actuators are configured. As a result, the complete terminal diagram for your machine's safety application is already fully compiled.

You do the configuring, and your programming interface produces the code for processing of the configured elements in the program menu.

Now it's time for the programming!

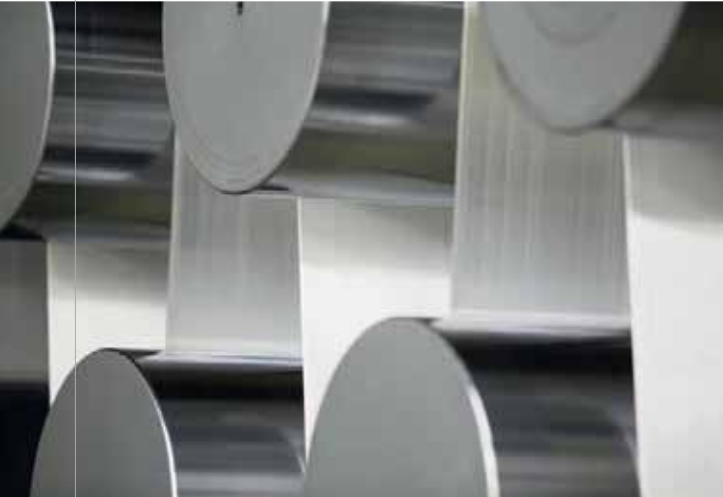
motion monitoring (SLS, SLI, SLP etc.) are selected and configured by way of the associated context-sensitive menu fields. They, too, are reduced down to one logical input and output state respectively. The actual programming is carried out by linking the motion monitoring functions to the logic functions (AND, OR, XOR, NEG, Logic 1, RS-Flip Flop, Timer).

In this way the torque, speed, acceleration, deceleration and position of the individual axes are monitored.

to be validated according to the prescribed rules. Then the program and the parameter data are locked so that no more changes can be made.

This validated data set is then deployed in the production machine.





Unlimited flexibility

Regardless of what machinery you are manufacturing, the new Safe Motion architecture will meet your safety requirements and provide you with a solution that is cost-effective, conforming to all applicable standards, and above all future-proof. The drive-based machine safety solution featured in the ServoOne is particularly well suited to machinery executing complex multi-axis movements. The control-based solution architecture featuring Safe Monitoring Control offers major advantages where only one or two axis movements need to be safely monitored.

You will be delighted by the benefits our wide range of solutions can deliver for your safe machine automation needs: you will be able to eliminate unnecessary safety relays, reduce the size of mounting surfaces and cut assembly and installation costs. The tools provided to help configuration and programming, produce configuration reports and assist in standardized validation meet all conceivable needs.

In conjunction with the wide variety of coordinated c-line positioning controllers, ServoOne multi-axis controllers and range of motor concepts, the potential applications are limitless. Highly dynamic state-of-the-art servomotors and linear or rotary direct drives can move any application – and of course all safely monitored.

Make sure you, too, profit from the benefits of our uniquely flexible solutions!

Machine tools

- Milling machines
- Drilling machines
- Lathes
- Grinding machines
- Pipe bending machines
- Spark erosion machines
- Measuring machines
- Machining centres
- Flying shears

Woodworking machinery

Robots

- Welding robots
- Painting robots

Plastics processing machines

- Injection moulding machines

Printing machines

Packaging machines

- Sleeve wrapping machines
- Metering equipment
- Blister packaging machines
- Boxing machines
- Palletisers

Paper machines

Winding machines

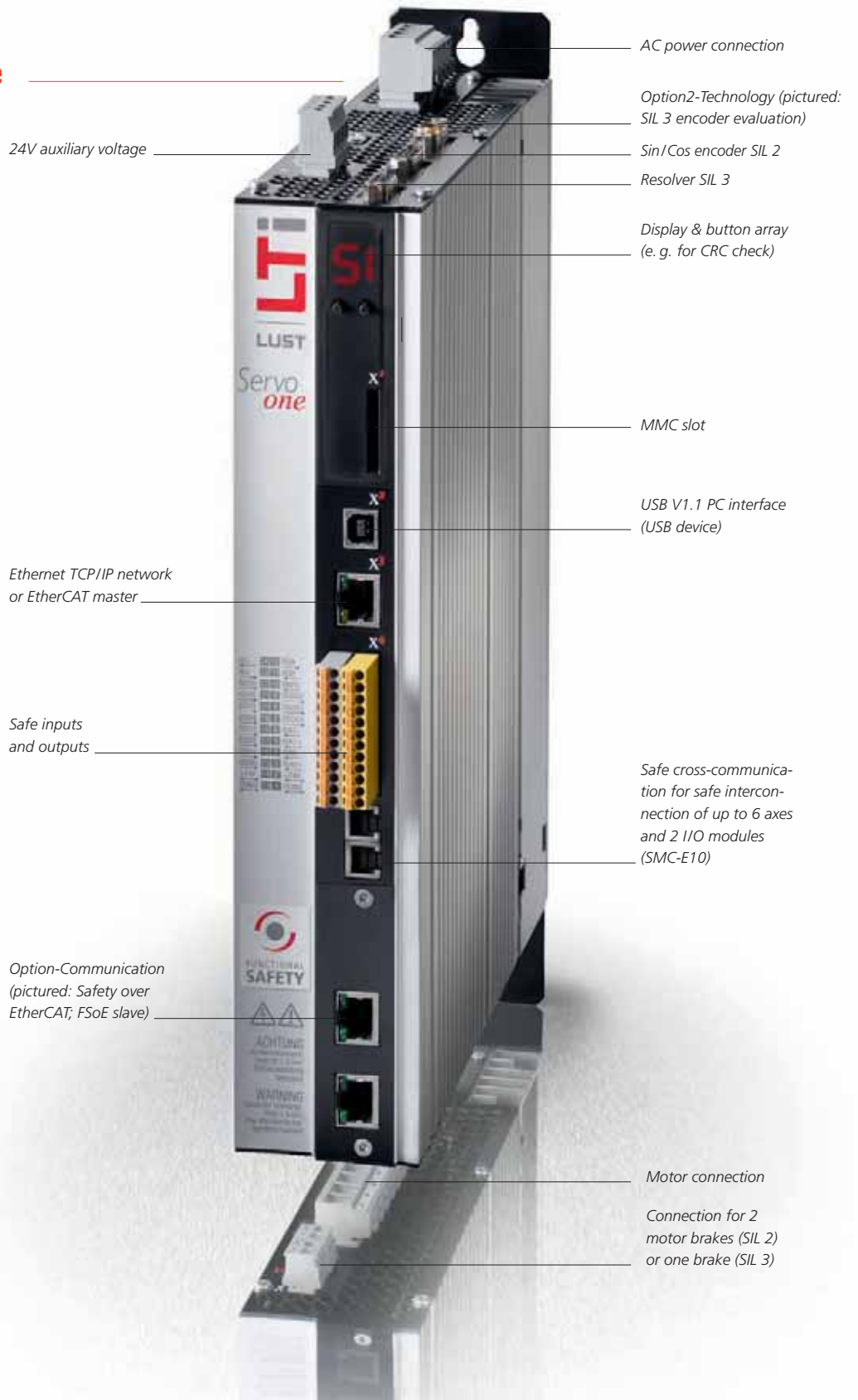
Special machines

You don't see your sector listed here?

Please let us know ...



ServoOne





ServoOne _ drives that set standards

| | BG1 | BG1 | BG2 | BG3 | BG4 | BG5 |
|---|---|--|----------------|-----------------|-----------------|-------------------|
| System voltage | 1 x 230 V (-15% +10%) | 3 x 230/400/480 V (±10%) AC or 700/780 V (±10%) DC | | | | |
| Continuous current effective (I _N) [A _{RMS}] at 3 x 400 V | 4 (1 x 230 V) | 4/6 | 8/12 | 16/20 | 24/32 | 45/60/72 |
| Dimensions (W x H x D) in mm | 58.5 x 355 x 242 | 58.5 x 355 x 242 | 90 x 355 x 242 | 130 x 355 x 242 | 175 x 355 x 242 | 190 x 382.5 x 255 |
| Safety certificates | SIL 3 to IEC 61508/IEC 62061, PL e and Cat 4 to EN ISO 13849 | | | | | |
| Safe digital inputs | 4 | | | | | |
| Safe digital outputs | 4 | | | | | |
| Safe analog inputs | - | | | | | |
| Safe brake outputs | 2 | | | | | |
| Safe pulse outputs | 2 ¹⁾ | | | | | |
| Safe relay outputs | - | | | | | |
| Connectable safety sensors | Light grids, emergency stops, guard doors, laser scanners, mode selector switches, deadlocks, permission buttons, two-handed controls, etc. | | | | | |

¹⁾ Use of 2 safe digital outputs as pulse outputs possible

Functional Safety _ an overview

| | STO (Safe Torque Off) | SS1 (Safe Stop 1) | SS2 (Safe Stop 2) | SLS (Safe Limited Speed) | SDI (Safe Direction) | SSM (Safe Speed Monitoring) | SLSmax (Safe Limited Speed maximum) | SOS (Safe Operating Stop) | SZM (Safe Zero Monitoring) |
|-------------------|--------------------------|----------------------|----------------------|-----------------------------|-------------------------|--------------------------------|--|------------------------------|-------------------------------|
| | Speed-dependent | | | | | | | Rotation or position-dep | |
| ServoOne (Safety) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| SMC series | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

⁵⁾ Unsafe signalling channel



Safe Monitoring Control

| | SMC1-Z10 | SMC1-Z20 | SMC1-Z30 | SMC1-Z40 | SMC-E10 | SMC-B10 |
|-----------------|--|-----------------|-------------------|-------------------|-----------------------------------|-------------------|
| Supply Voltage | 24 V (-15 % +10 %) | | | | Supply via rear panel bus | |
| Outputs | - | | | | | |
| Dimensions (mm) | 45 x 114.5 x 99 | 45 x 114.5 x 99 | 67.5 x 114.5 x 99 | 67.5 x 114.5 x 99 | 45 x 114.5 x 99 | 22.5 x 114.5 x 99 |
| Standards | SIL 3 to IEC 61508/IEC 62061, PL e and Cat 4 to EN ISO 13849, EN 50178 | | | | | |
| Inputs | 14 | | | | 12 | |
| Outputs | 4/2 ²⁾ | | | | 10 ³⁾ /2 ²⁾ | |
| Inputs | - | | | 4 ⁴⁾ | - | |
| Outputs | - | | | | - | |
| Inputs | 2 | | | | - | |
| Outputs | 2 | | | | - | |
| Notes | Module to connect the SMC1-ZXX to a CANopen bus system (unsafe signalling channel) | | | | | |

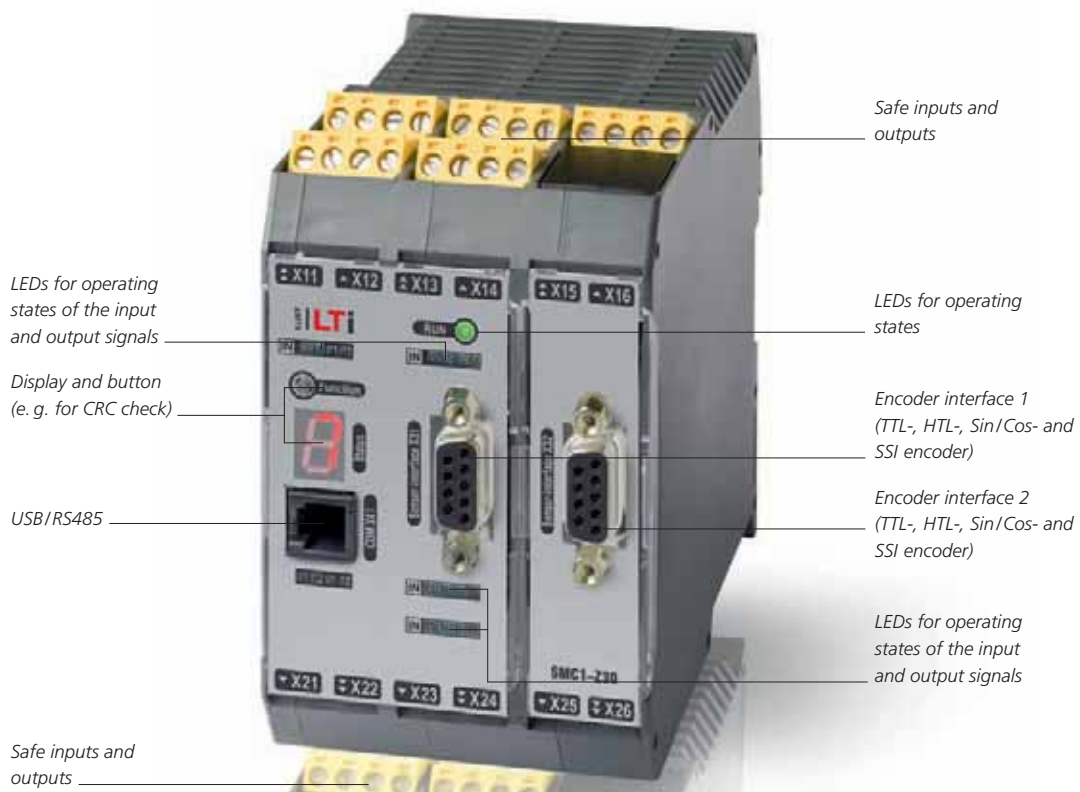
²⁾ Unsafe outputs

³⁾ Optionally usable as input/output

⁴⁾ 4 voltage inputs or 2 current inputs

| SLT (Safe Limited Torque) | SLI (Safe Limited Increment) | SLP (Safe Limited Position) | SCA (Safe Cam) | Sref (Safe Reference) | SBC (Safe Brake Control) | SBT (Safe Brake Test) | SCC (Safe Cross-Communication) | CANopen | Safety over EtherCAT; FSoE slave |
|------------------------------|---------------------------------|--------------------------------|-------------------|--------------------------|-----------------------------|--------------------------|-----------------------------------|-----------------|----------------------------------|
| dependent | | Position-dependent | | | | Brake | | BUS | |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ ⁵⁾ | ■ |
| | ■ | ■ | ■ | | | | | ■ ⁵⁾ | |

Safe Monitoring Control



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