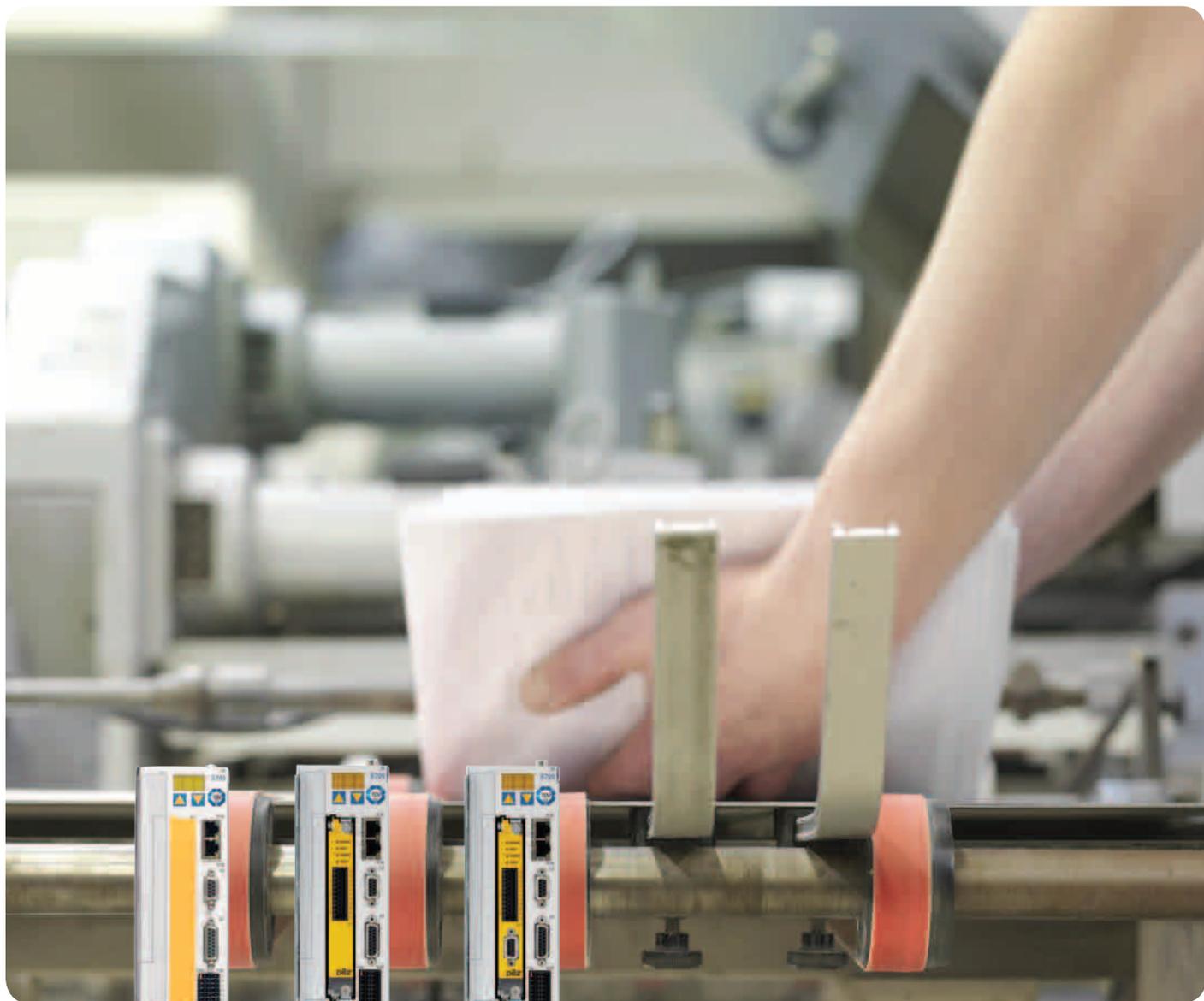


# Safety solutions with Safety Concept S700



**KOLLMORGEN**<sup>®</sup>

*Because Motion Matters™*

# Risk assessment and risk minimisation

## No dangers may be brought about by machines

A hazard analysis as per EN ISO 14121-1 is obligatory. The Machine Directive 2006-42-EC must be applied.

When electronics, and above all programmable electronics, started to play an increasingly important part in the field of safety engineering, evaluation criteria were defined for the following aspects:

- Failure rate of the construction elements
- Diagnostic coverage
- Avoidance of faults with common causes

The key safety figures of the entire system can be calculated using "Safety Calculator PAScal" from Pilz GmbH or "Sistema" from the Institute for Occupational Safety and Health (IFA) of the German Statutory Accident Insurance (DGUV). Kollmorgen can provide specially prepared partial systems for S700 with safety card and feedback.

## Relevant standards

### EN 12100-1

"Safety of machinery -- Basic concepts, general principles for design" provides detailed help in identifying hazards, describes the risks to be considered by designers and includes design principles and a method for safe design and risk minimisation.

### ISO 14121/EN 1050

"Safety of machinery. Principles for risk assessment" describes an iterative method for risk analysis and risk assessment to meet the requisite machine safety.

### EN 61508

contains requirements and recommendations for drafting, integrating and validating safety-related electrical, electronic and programmable electronic control systems for machines.

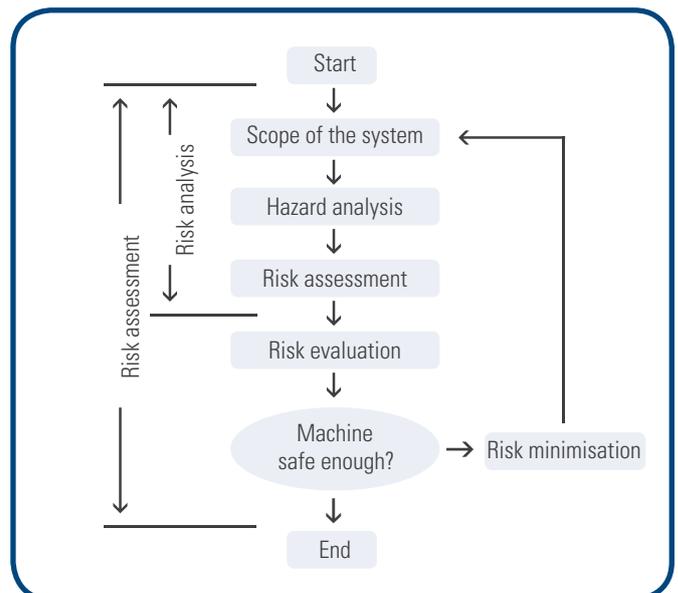
### EN 13849-1

classifies safety-related parts of control systems and all types of machinery both qualitatively and quantitatively, regardless of the technology and form of energy used (electrical, hydraulic, pneumatic, mechanical, etc.). The safety performance is described by the Performance Level (PL).

### EN 62061

contains requirements and recommendations for drafting, integrating and validating safety-related electrical, electronic and programmable electronic control systems for machines. The standard considers the entire lifecycle, from the conceptual phase, right up to decommissioning. The safety performance is described by the Safety Integrity Level (SIL, SILCL).

### Risk assessment approach



## Innovative technology offers users many advantages

The Safety Concept S700 offers the highest level of safety with standard components and facilitates both a flexible and cost-optimised solution. Cost savings of up to 25% per axis can be achieved with Kollmorgen's safety solution. The costs for customer-specific adjustments can, for example, be saved entirely. This in turn allows system costs to be reduced by 20%. Machine availability increases thanks to the safe processes and makes a significant contribution to productivity increases of up to 20%.

### Advantages at a glance

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Reduced system costs</li> </ul>      | <ul style="list-style-type: none"> <li>• No costly special motors required</li> <li>• No expansion of inventory required</li> <li>• No certified encoders required. Standard encoders such as resolvers, EnDat®, Hiperface®, BiSS® can be used</li> <li>• No second feedback system required</li> <li>• No second feedback line</li> <li>• Affordable TTL feedback to linear motors is supported (up to SIL3 or PLe)</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Increased productivity</li> </ul>    | <ul style="list-style-type: none"> <li>• Fast time-to-market thanks to use of standard components</li> <li>• Greater machine availability</li> <li>• Hassle-free machine setup</li> <li>• Short downtimes thanks to intelligent electronics</li> <li>• Fast machine restart</li> <li>• Support via Kollmorgen co-engineering</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Best safety functionality</li> </ul> | <ul style="list-style-type: none"> <li>• Highest level of safety SIL3 and PLe</li> <li>• Very fast trip time in 2 to 3 ms</li> <li>• Safe braking ramp</li> <li>• Safe monitoring of low speeds (patent pending)</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Increased flexibility</li> </ul>     | <ul style="list-style-type: none"> <li>• No special motors required</li> <li>• Support for all synchronous motor types, including rotational and linear direct synchronous servomotors</li> <li>• Available as an option card</li> <li>• Option cards can be retrofitted; hassle-free update from SIL2 to SIL3</li> <li>• Control via safe I/Os</li> <li>• Compatible with virtually any safe control system</li> <li>• Also ideal for modular machine concepts</li> <li>• Fewer design hurdles</li> <li>• Highest safety level, even for a molding press application</li> </ul> |



S700 servoamplifier with S2 safety card

## Operator safety is absolutely vital in modern drive systems

Great emphasis is placed on safety in the field of automation, in particular for drive technology. However, implementation does not have to involve major investments. With its Safety Concept S700, Kollmorgen offers a safety solution that can be tailored specifically to the individual requirements in each case. Safety solutions with S700 servoamplifiers are simple and affordable to set up using standardised safety function modules.

### Safety guarantees: expertise and certification

Kollmorgen developed the Safety Concept S700 in close cooperation with the automation specialists at Pilz GmbH & Co. KG.

The S700 hardware employs TÜV-approved circuits with wide track spacing, optimised track routing and high-grade components.

Production is continuously monitored. The configuration software "SafetyGUI" guarantees safe parameter entry for the safety functions.

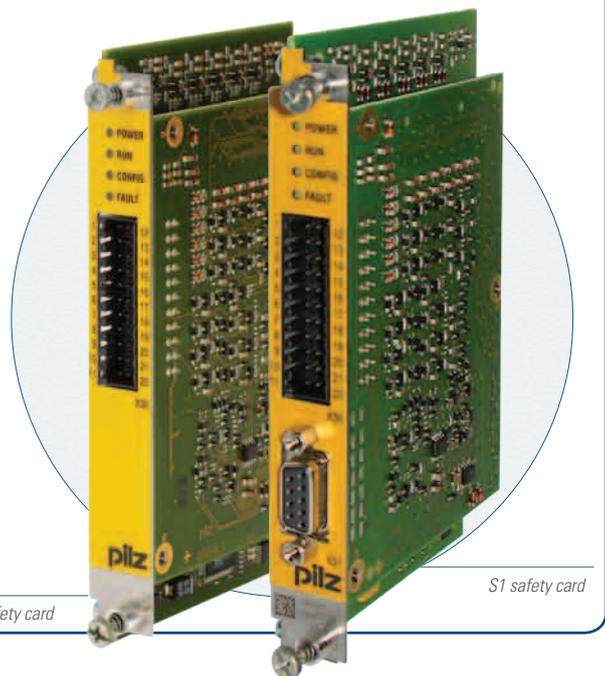
## The Safety Concept S700

Even in the basic standard version of the S700 servoamplifier, the multi-stage Safety Concept S700 offers certified, two-channel, safe torque off (STO).

**Through addition of the S1 and S2 safety expansion cards, safety level SIL2 or PLd and SIL3 or PLe can be achieved with many safety functions.**

- Stage 1: implements safety level SIL2 or PLd with the safety function STO.
- Stage 2: implements safety level SIL2 or PLd with the functions SS1, SS2, SSR, SOS, SDI, SLS via safety card S2.
- Stage 3: implements safety level SIL3 or PLe with the functions SS1, SS2, SSR, SOS, SDI, SLS, SBC via safety card S1.

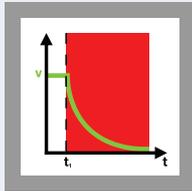
The safety concept offers many advantages. The concept increases flexibility for future application requirements, as the safety cards can be individually retrofitted. Commissioning times are reduced, since the machine's mains power supply remains in place during safe operation.



### The goal of a calculable residual risk

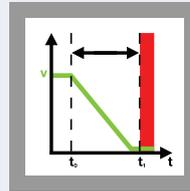
As there is no such thing as "zero risk" in a technical context, the goal is to achieve an acceptable level of residual risk. "Safe software" and "safe parameter transfer" should eliminate the risk of any user input errors. The requisite safety is achieved with clearly structured, intuitive handling and clearly defined functions.

# Fast and simple implementation of complex safety functions



## STO Safe Torque Off

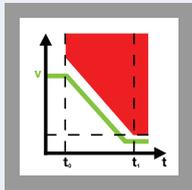
The STO function is used to interrupt the energy supply to the motor directly in the servoamplifier. The motor is then torque-free.



## SS1 Safe Stop 1

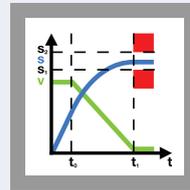
The function "Safe Stop 1" (SS1) is used to stop the drive through controlled braking and subsequent safe interruption of the energy supply to the motor.

Once at standstill, the drive then cannot generate any torque or force. This means that no dangerous movements can take place.



## SS2 Safe Stop 2

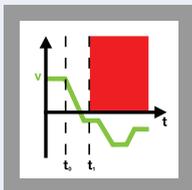
The function "Safe Stop 2" (SS2) is used to stop the drive through controlled braking and then keep the drive at controlled standstill. The control functions of the drive remain fully intact here. Two-channel monitoring is used to prevent dangerous movements of the drive due to any errors that may potentially occur.



## SOS Safe Operating Stop

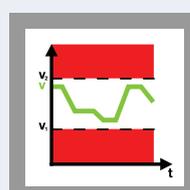
The function "Safe Operating Stop" (SOS) monitors the stop position reached and prevents any deviation from this position outside a defined range. The control functions of the drive remain fully intact here.

In the event of an error, SS1 is triggered.



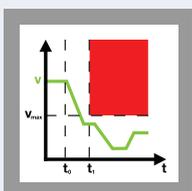
## SDI Safe Direction

The function "Safe Direction" (SDI) ensures that a drive can only move in one (defined) direction. In the event of an error, SS1 is triggered.



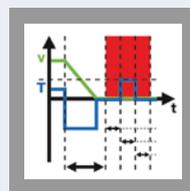
## SSR Safe Speed Range

With the safety function "Safe Speed Range" (SSR) the current speed of the drive is monitored to ensure it remains within the maximum and minimum limits. In the event of an error, SS1 is triggered.



## SLS Safely Limited Speed

The function "Safely Limited Speed" (SLS) monitors the drive for compliance with a defined speed limit. In the event of an error, SS1 is triggered.



## SBC Safe Brake Control \*

The safety function "Safe Brake Control" (SBC) is used to control external brakes.

## SBT Safe Brake Test \*

The safety function "Safe Brake Test" (SBT) is used to test the external mechanical brake and the internal motor holding brake (non-standardised function).

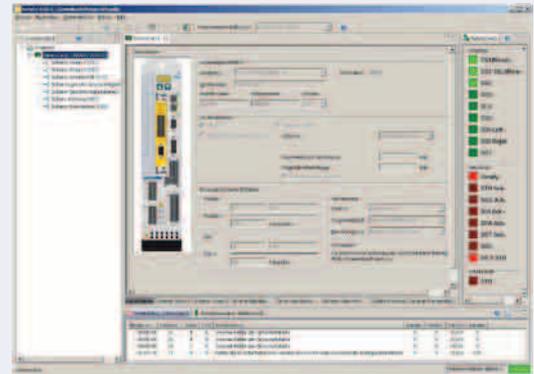
# Installation, configuration and analysis functions

The optional safety expansion cards S1 and S2 are plugged into the socket allocated on the S700 servoamplifier.

The password-protected "SafetyGUI" software is used to configure the safety functions.

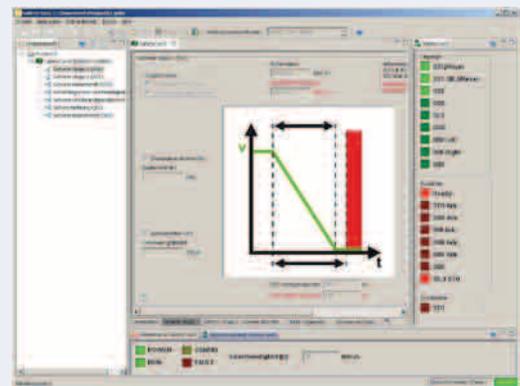
Just a few parameter entries are required here in each case.

There is a clearly structured input window available for each function.



In online mode, status displays of the digital inputs and outputs help users set up the functions. Detailed messages in plain language support the analysis when the monitoring system has responded.

- Changes to projects require a password.
- Users can work with SI units.
- The set of parameters is tied to the serial number of the safety card.
- The set of parameters can be saved to the safety card.

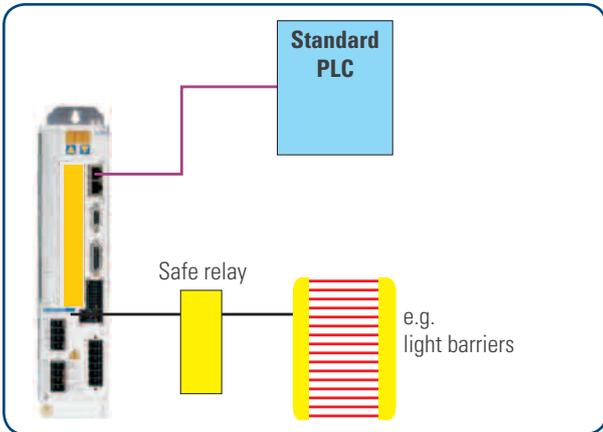


Status information can also be polled via the DriveGUI parameterisation software. A detailed cause analysis is available for checking the messages.

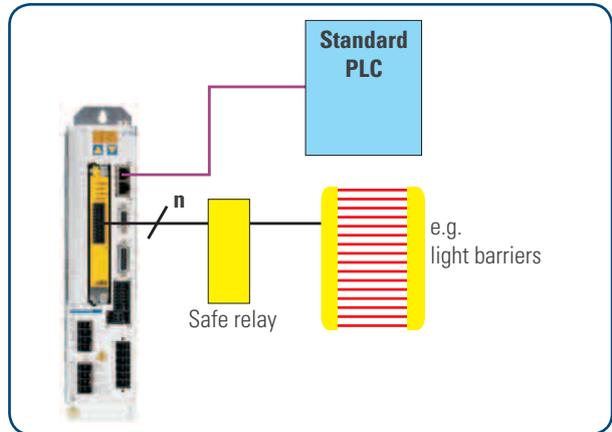


Message	Time	Index	Obj.	Event	Start	Stop	Start	Stop
000	12.12.2011	1	1	1	12.12.2011	12.12.2011	12.12.2011	12.12.2011
001	12.12.2011	1	1	1	12.12.2011	12.12.2011	12.12.2011	12.12.2011
002	12.12.2011	1	1	1	12.12.2011	12.12.2011	12.12.2011	12.12.2011

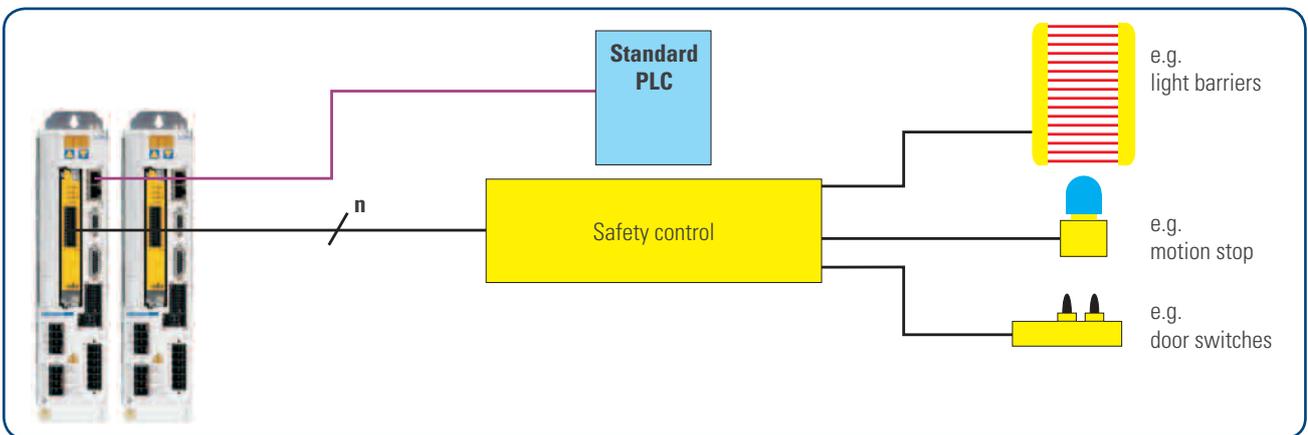
# Switching examples for controlling safety functions



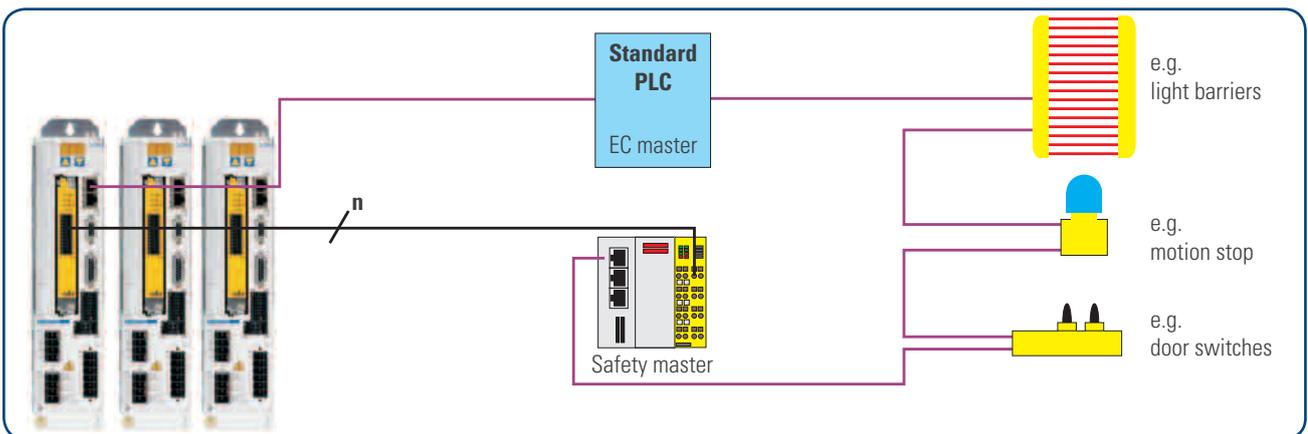
Simple functionality STO – I/Os without safety card



Simple functionality – I/Os with safety card



Complex functionality – I/Os



Complex functionality – fieldbus I/Os (EtherCAT)

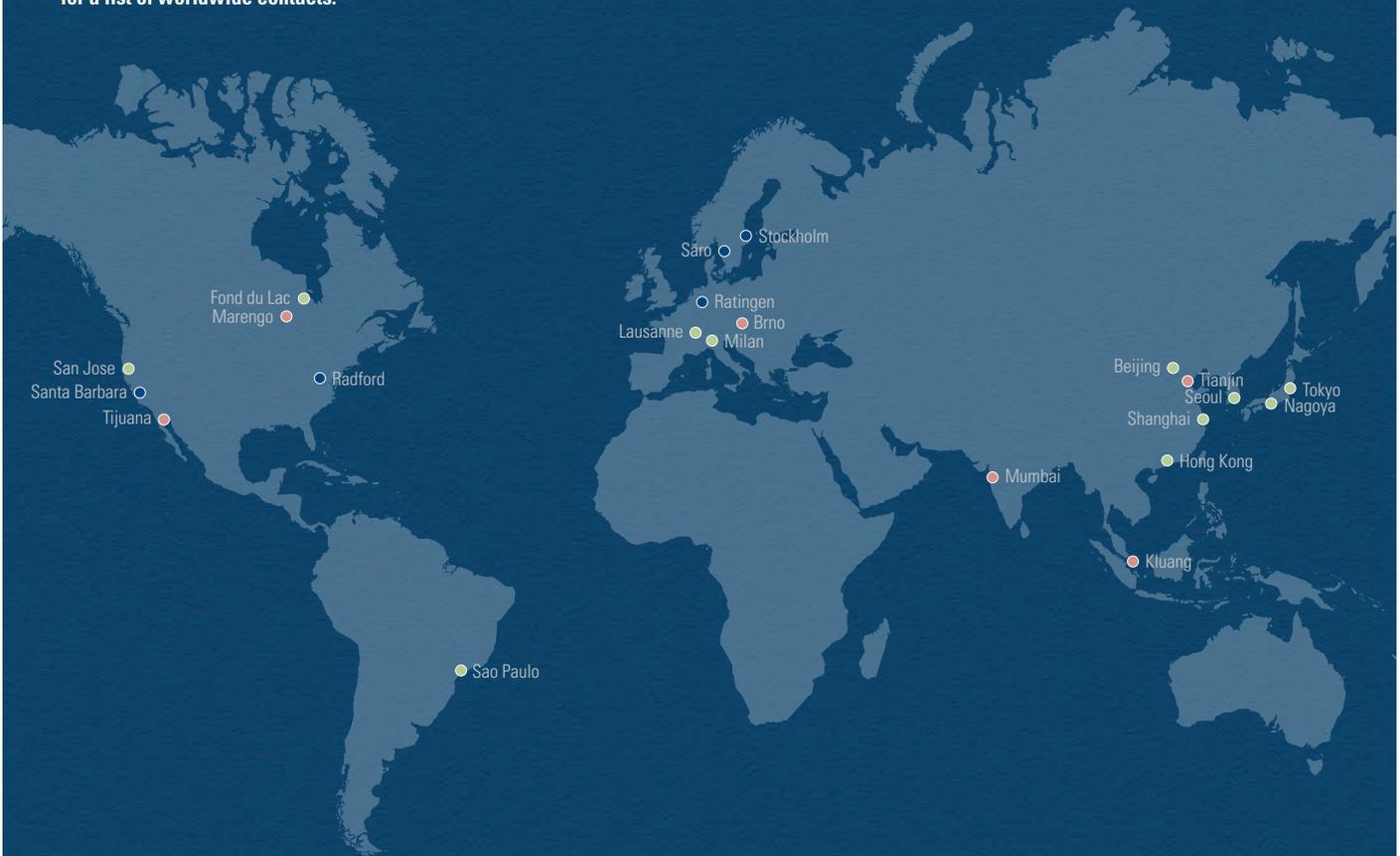
You can also find additional information at [www.wiki-kollmorgen.eu](http://www.wiki-kollmorgen.eu) - media code: **111aaad**

### Some interesting facts about Kollmorgen

Kollmorgen is a leading provider of drive systems and components for engineering. Thanks to first class expertise in the field of drive systems, its insistence on the highest quality, as well as its comprehensive technical knowledge in terms of linking and integrating standardised and specifically manufactured products, Kollmorgen supplies pioneering solutions which are unparalleled in terms of performance, reliability and user friendliness and which offer machine builders a huge competitive advantage.

If you would like support in setting up your applications, please go to [www.kollmorgen.com](http://www.kollmorgen.com) for a list of worldwide contacts.

- Application centres
- International R&D and manufacturing locations
- International manufacturing locations



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