

# Motion Safety: Improving Productivity with Safety in Mind

Safe Motion from One Source



**KOLLMORGEN**®

*Because Motion Matters™*

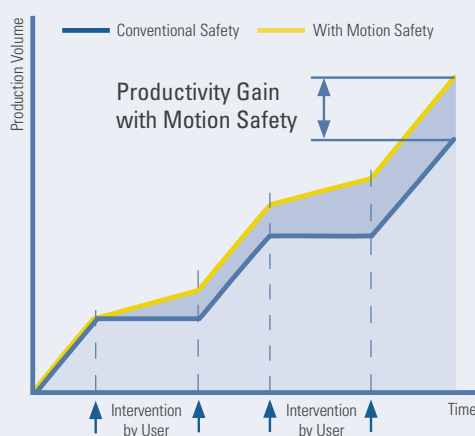
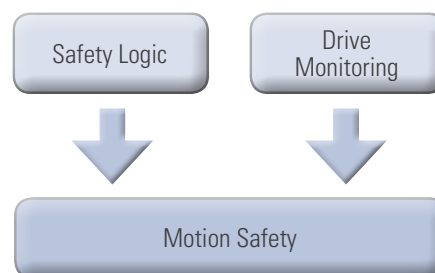
# Motion Safety - Improved Productivity without Compromise

Motion Safety is innovative safety technology from Kollmorgen and means: Safe sensor and actuator signal processing, safe motion monitoring and safe communication directly inside the motion control system. The result: significantly higher productivity compared to conventional safety technology.

## With Motion Safety: Safe Motion Instead of Safe Stop

Safety Motion combines safety logic and the drive monitoring into the motion control system.

Conventional safety technology keeps the operator away from areas with hazardous movement. With Motion Safety, however, drives work on the principle of safe motion and allow operator intervention without process interruption. The safety logic in the drive controls motion so that no danger can come from them, and the process is not interrupted.



## Productivity Gain with Motion Safety

Intelligent Safety functions monitor areas with hazardous motion allowing the machine to effectively intervene with minimal process interruption. Functions such as safe position limit the range of machine motion to ensure that personnel remains safe. Machine zones that pose no risk to the operator remain running. The diagram shows the gain in productivity. You can see from the yellow line that production continues during user intervention with Kollmorgen Motion Safety technology.

## Kollmorgen Has You Covered



Our safety systems were developed using IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems.

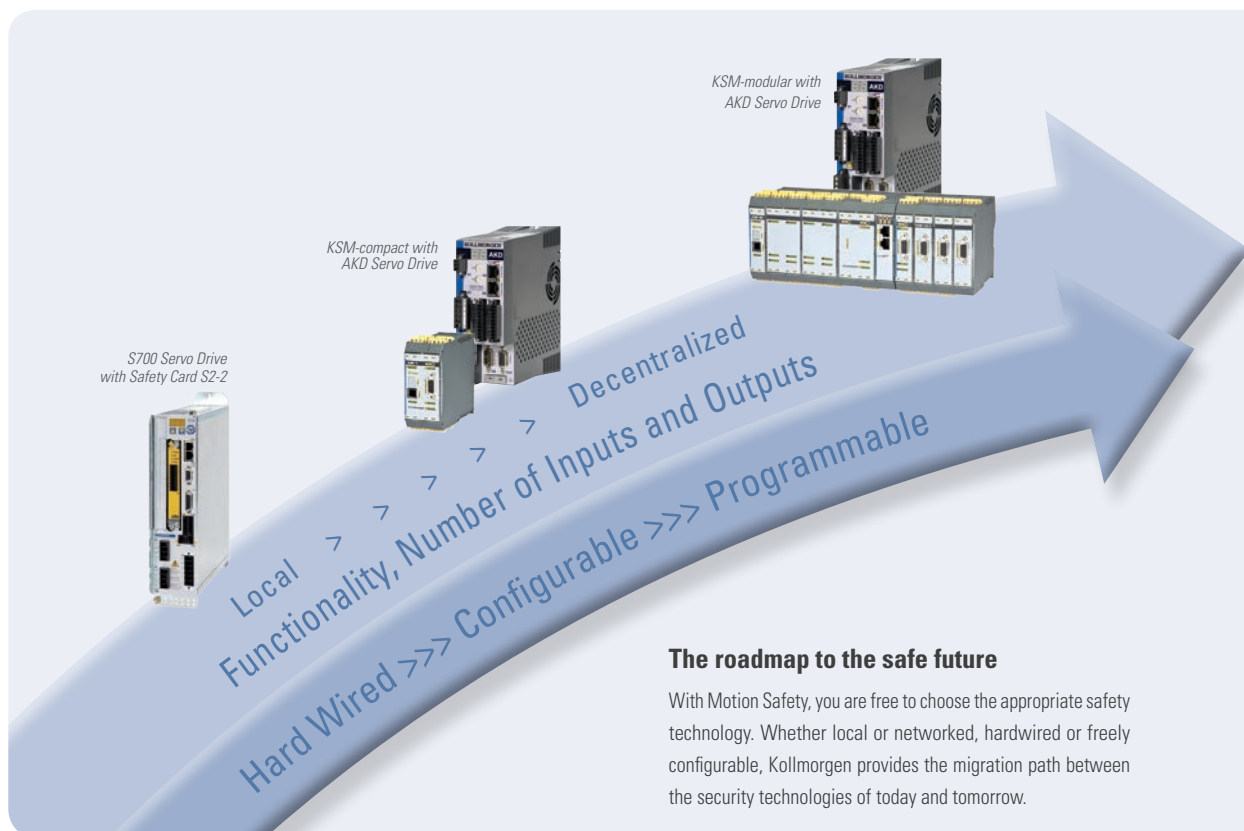
They are suitable for applications following these standards:

- for use in achieving ISO 13894 machine safety requirements up to PL e
- for use in achieving IEC 62061 up to SIL 3
- for use in achieving ANSI B11 U.S. based standards for machine safety
- for use in achieving an emergency stop per U.S. guidelines found in NFPA 79-2012 (NEC)

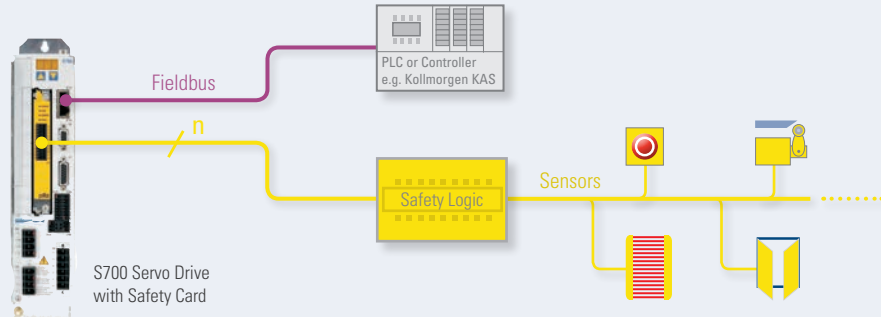
# Motion Safety - A Secure Investment in the Future

## Take advantage of the Motion Safety concept of Kollmorgen

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Higher Productivity</li></ul>          | <ul style="list-style-type: none"><li>• Motion Safety allows user intervention in the ongoing process</li><li>• Safe movement rather than safe shutdown</li><li>• Risk-dependent activation of safety functions</li></ul>                           |
| <ul style="list-style-type: none"><li>• Lower system costs</li></ul>           | <ul style="list-style-type: none"><li>• Optimal adaptation to the requirements through modular design</li><li>• Wide range of standard products</li><li>• Safety controller and drive monitoring in one device</li></ul>                            |
| <ul style="list-style-type: none"><li>• Flexibility</li></ul>                  | <ul style="list-style-type: none"><li>• Modular design, easy retrofitting to existing engines</li><li>• Seamless transition from hard-wired logic to configurable safety logic</li></ul>  |
| <ul style="list-style-type: none"><li>• Fast and easy implementation</li></ul> | <ul style="list-style-type: none"><li>• Important motion-relevant safety functions are integrated</li><li>• Predefined safety function blocks</li><li>• Intuitive tools for programming and parameterization in the field by the customer</li></ul> |



# Demanding Safety Solutions - Efficiently Implemented



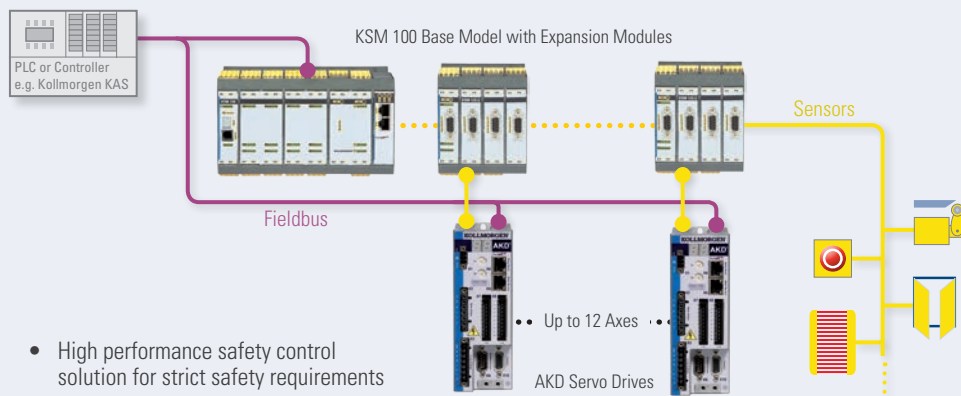
- Safe one-axis motion with minimal response times

*S700 Safety concept: The S700 can be equipped with optional safety expansion cards S1-2 or S2-2 to have safety functions available.*



- Compact and simple solution for 1 or 2 axes

*The Safety Module KSM-compact with the AKD servo drive for up to 2 axes and up to safe 32 I/O*

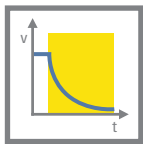


- High performance safety control solution for strict safety requirements

*KSM-modular: The modular safety control for demanding safe motion control applications with up to 12 axes and up to 200 safe I/O*

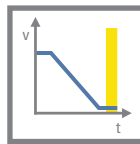
# Extensive Functions for Safe Motion

## STO (Safe Torque Off)



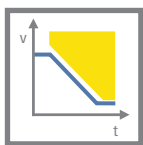
STO interrupts the power supply to the motor safely in the servo amplifier. The motor has no torque.

## SS1 (Safe Stop 1)



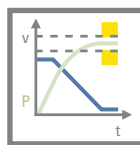
The drive is stopped by controlled braking. Thereafter, the power supply for the motor is interrupted safely and the motor generates no torque.

## SS2 (Safe Stop 2)



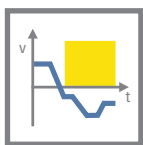
The drive is stopped by controlled braking and then remains at a controlled standstill. The control functions of the drive remain.

## SOS (Safe Operating Stop)



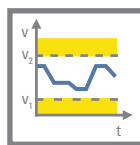
Monitors the stop position reached and triggers for deviations above the prescribed limits SS1. The control functions of the drive remain active.

## SDI (Safe Direction)



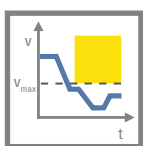
The SDI function ensures that the drive can only move in a defined direction. In case of error SS1 is triggered.

## SSR (Safe Speed Range) 1



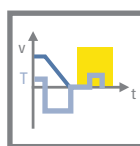
Monitors the drive to maintain a defined speed range. In case of error SS1 is triggered.

## SLS (Safe Limited Speed)



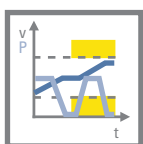
Monitors the drive to maintain a defined speed limit. In case of an error is triggered SS1.

## SBC (Safe Brake Control), SBT



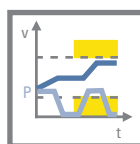
Controls external brakes  
**SBT (Safe Brake Test)** (not standardized)  
 Test function for external and internal brake motor holding brake

## SLP (Safe Limited Position)



Monitors the absolute position of the drive. If the predefined limit is reached, or if the brake torque is too small to stop the drive within the limit, SS1 is triggered.

## SLI (Safe Limited Increments)



Monitors the relative position of the drive based on the current position when the function is triggered. SS1 is triggered when the specified limit is reached.



# Motion Safety Concept S700: Scalable Safety Functionality

The safety concept S700 is certified for level SIL 3 or PL e. Through the use of standard hardware components, it allows for flexible and cost-effective solutions by eliminating custom adjustments that can result in cost savings of up to 25% per axis. Due to the safe processes machine availability and productivity can increase up to 20%.

## From Motion Control to Safe Motion Control: The Safety Expansion Card

The S700 can be equipped with optional safety expansion cards to have safety functions available that are activated by an external safety logic. The upgrade is very simple: the cards are inserted into the S700 card slots, and then configured using the SafetyGUI configuration tool. Done!

Category	Function	S700	S700 + S1-2	S700 + S2-2
	Level	SIL2/PL d	SIL3/PL e	SIL2/PL d
Safe Stop Functions	STO	✓	✓	✓
	SS1	—	✓	✓
	SS2	—	✓	✓
	SOS	—	✓	✓
Safe Speed Functions	SSR	—	✓	✓
	SLS	—	✓	✓
Safe Direction Functions	SDI	—	✓	✓
Safe Brake Function	SBC	—	✓	—
Safe Position Functions	SLI	—	✓	✓
	SLP	—	✓	—



S2-2 Safety Card

S1-2 Safety Card

## Safety Solutions with S700

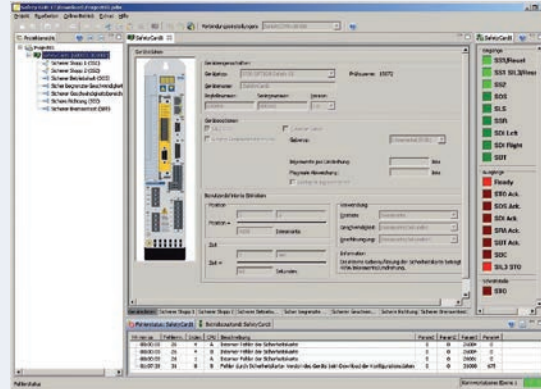
- Easy integration
- Flexibility
- Highest functionality
- Hardwired, compatible with virtually any safety controller
- Ideal for upgrading existing safety solutions
- No external safety logic necessary
- Option cards can be retrofitted
- Comprehensive safety features are included
- Very short response time with direct access to the control electronics

# Easy Customization and Configuration

## Installation and Commissioning

The optional safety expansion card S1-2 or S2-2 are inserted into the appropriate slot of the servo amplifier S700. For each function, there is a clear input window.

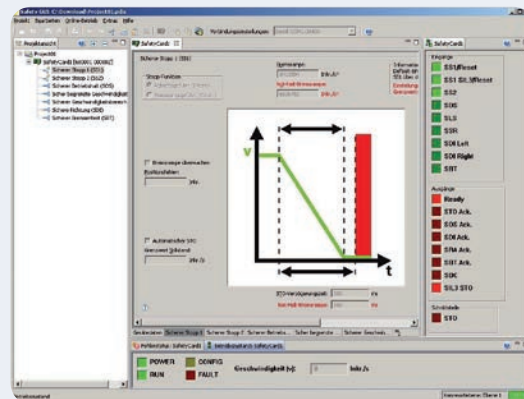
- Changes in projects is possible only with password
- Intuitive and flexible configuration safe motion functions
- TUV approved safety level up to SIL 3 or PL e



## Online Operation with Status Monitoring

In online mode, the status displays of the digital inputs and outputs facilitate setting up the functions. Detailed messages in plain text help in the analysis if the monitoring has responded.

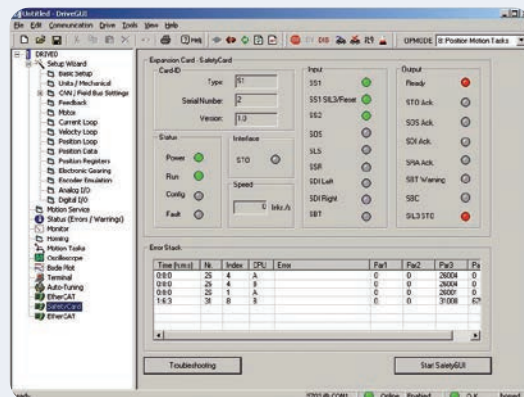
- SI units can be used
- The parameter set is linked to the serial number of the card
- The parameter set can be saved to a memory card.



## Status Query using Parameterization

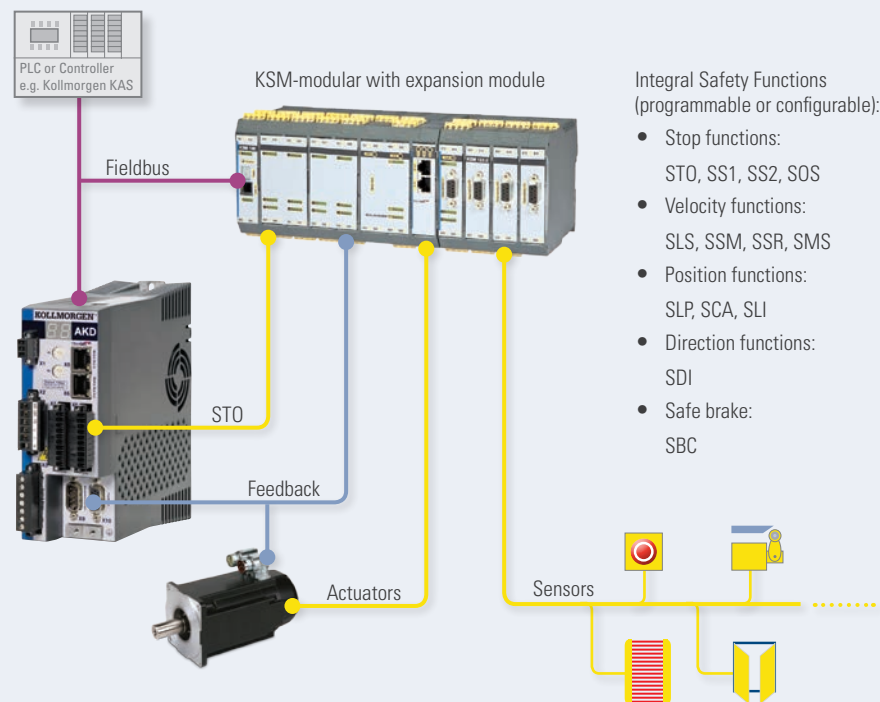
Status information can be queried via the parameterization tool DriveGUI. For the analysis of the messages a detailed cause analysis function is available.

- Close link between motion functions and safety functions
- Extensive debugging functions for error analysis
- Graphical monitor for status display of all transaction data



# KSM - The Complete Solution for Efficient and Safe Control

The KSM safety controller achieves PL e / SIL 3, which is critical for supporting the requirements of modern functional safety. Whether your application consists of 2 axes requiring only a few safe I/O or it consists of many axes requiring 100 or more safe I/O and is used in combination with the AKD servo drive and other Kollmorgen automation solutions: You can develop expandable and safe motion systems with better performance, improved productivity and reduced system costs.



*Example solution using the Kollmorgen Motion Safety concept.*

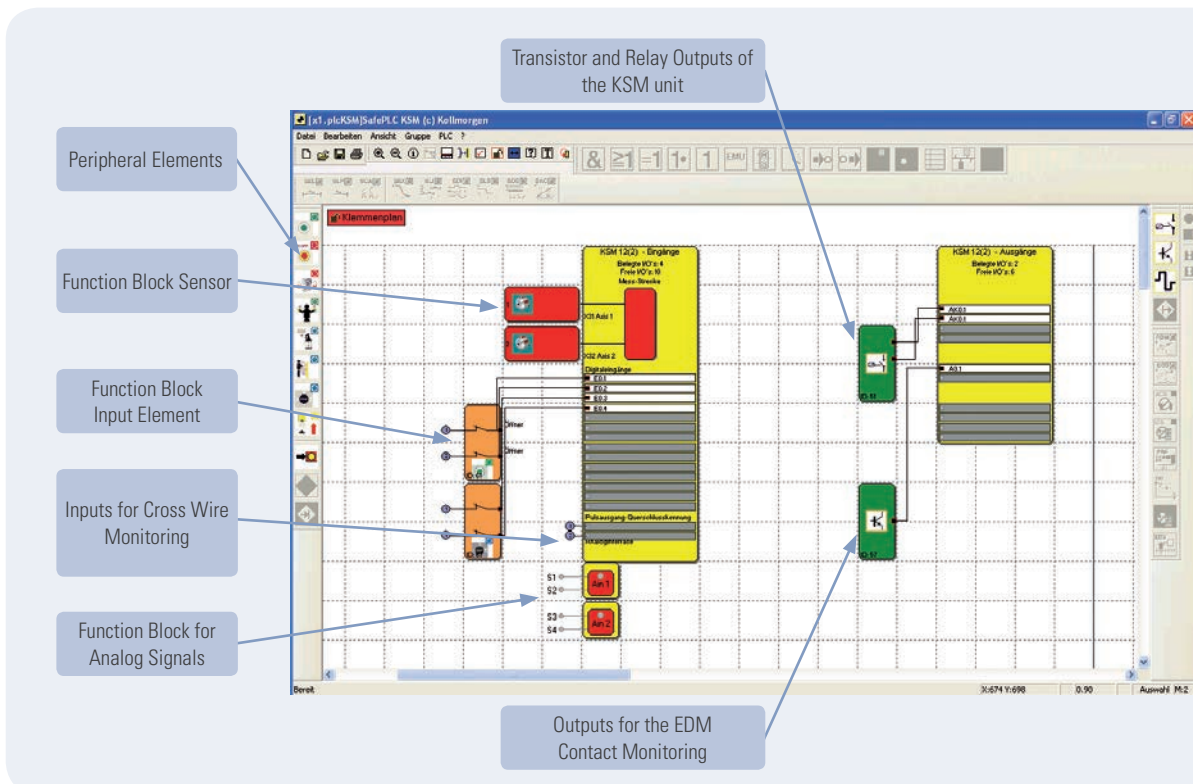
## KSM Safety Controllers - Your Advantages:

- Improved productivity
  - Allows operator intervention without process interruption
  - Safe motion rather than safe shutdown
  - Activation of safety functions depends on risk for the machine operator
- Reduced system costs
  - Safety control and drive monitoring in one device
  - Servo drive and resolvers are standard components
  - Short development times through efficient programming tools
  - Comprehensive safety function library reduces development time
- Investment for the future
  - Modular design, easy upgrade for changing requirements
  - Combining different safety concepts poses no problem



## Ease of Use: SafePLC® and SafePMT®

Take advantage of the comprehensive function library delivered with SafePLC and start immediately programming the KSM modules or develop your own library for very specific safety programs. Practical and safe: With the tool SafePMT you or your client configure the safety controller by changing shared parameters without opening the program.



### SafePLC: Safety Programming without Limits

- Graphical hardware configuration via terminal plan
- Certified, configurable function blocks
- Individual program components are stored as a macro
- Linking elements such as timers, flip-flops, terminal blocks or signaling channels can be defined
- Universal monitor, diagnostic and analysis tools
- Scope monitor for motion safety functions
- All process data are available to higher-level controller via EtherCAT

### SafePMT: Safe Parameterization on Site

- On site configuration by the user
- Safe - No change to the programming
- Easy to use

# KSM-compact: Versatile Safety Controller for 1 or 2 Axes

The KSM compact transforms a drive train into a safe drive train. And important safety and monitoring functions for motion as well as function blocks to process sensor and actuator signals are already included. Develop highly efficient and safe motion systems combining KSM compact with other components from Kollmorgen, such as the AKM or AKMH™ motors.



KSM-compact  
A self-contained safety controller

CANopen

EtherCAT

PROFINET

## Certified function blocks for KSM-compact and KSM-modular

- Emergency Stop
- Door monitoring with interlock
- Two-hand buttons, permission switch
- Release, start, reset buttons
- Operating mode selection switch
- Light curtains, scanners
- Muting

## KSM-compact Safety Controller

- For PL e / SIL 3
- For 1 or 2 axes
- Up to 2 expansion modules
- Base unit with 16 safe I/O
- Expandable up to 60 safe I/O
- 1 Safe relay, expandable
- 2 Pulse outputs, 2 standard outputs
- Expandable up to 6 pulse outputs and 6 standard outputs
- Up to 800 function blocks
- Space-saving, compact design

	KSM-compact Base Units		Expansion Modules up to 2 Modules		
	KSM 11/-2 <sup>2)</sup>	KSM 12/-2 <sup>2)</sup>	KSM 31	KSM 31R	KSM 5x
Safe Axes	1	2	—	—	—
Safe In	14	14	12	12	—
Safe Out	2	2	—	2	—
Safe I/O	—	—	10	—	—
Safe Relay	2	2	—	4	—
Safe Analog In	—	—	—	4	—
Communication <sup>1)</sup>	With KSM 5x		—	—	Yes

1): Either EtherCAT, CANopen or PROFINET

2): KSM 11-2 and KSM 12-2 with 2 sensor interfaces for safe velocity and position monitoring

# KSM-modular: Safety Controller up to 12 Axes

KSM-modular is the best choice if complex safety features and a large number of interfaces are required. The modular system is flexible and can be easily adapted to changing requirements at any time. With up to 3000 function blocks the KSM-modular is a powerful safety PLC.



KSM-modular  
Base unit KSM 100 with expansion modules for demanding applications

## KSM-modular Safety Controller / Safety PLC

- For PL e / SIL 3
- Up to 12 axes
- Up to 8 expansion modules
- Base units with 56 safe I/O
- Expandable up to 200 safe I/O
- 1 Safe relay, expandable
- 2 Pulse outputs, up to 10 standard outputs
- Expandable up to 14 pulse outputs and 22 standard outputs
- Up to 3000 function blocks
- For demanding applications with complex safety logic and many I/O

	KSM-modular Base Units			Expansion Modules, up to 8 modules in total				
	KSM 100-1	KSM 100-2	KSM 100-4	KSM 121/-2 <sup>4)</sup>	KSM 122/-2 <sup>4)</sup>	KSM 122A	KSM 131	KSM 131R
Safe Axes	With KSM 121 or KSM 122			1 <sup>2)</sup>	2 <sup>3)</sup>	2 <sup>3)</sup>	—	—
Safe In	14	14	14	12	12	12	12	12
Safe Out	2	2	2	—	—	—	—	—
Safe I/O	—	20	40	—	—	—	10	2
Safe Relay	2	2	2	—	—	—	—	4
Safe Analog In	—	—	—	—	4	2	—	4
Communication <sup>1)</sup>	Option, onboard			—	—	—	—	—

1): Either EtherCAT, CANopen or PROFIBUS DP 2): Up to 6 modules for max. 6 axes 3): Up to 6 modules for max. 12 axes

4): KSM 121-2, KSM122-2 with 2 sensor interfaces per axis for safe velocity and position monitoring

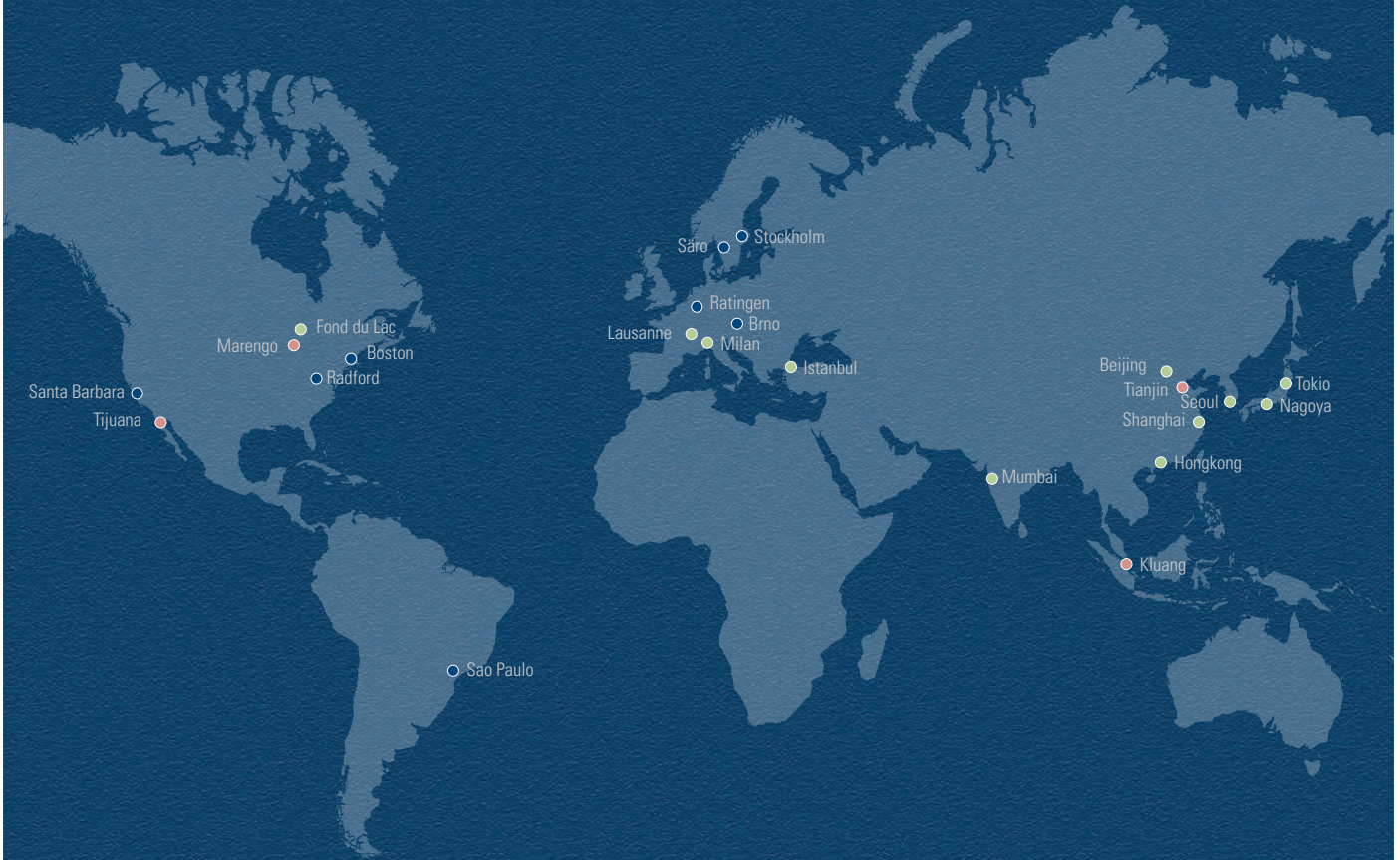


## About Kollmorgen

Kollmorgen is a leading provider of drive systems and components for machine engineering. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For assistance with your application needs, visit [www.kollmorgen.com/deu](http://www.kollmorgen.com/deu) for a global contact list.

- Application Centers
- Worldwide Development and Production Locations
- Worldwide Production Locations



**KOLLMORGEN**<sup>®</sup>

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