Standards and Safety

New standards with new requirements – no problem, thanks to Rexroth

Whether the task involves machine tools, packaging and printing machines, assembly, handling or robot applications, the protection of personnel, machines and tools is absolutely paramount. Safety is therefore a topic of prime concern to users and manufacturers alike, and one which demands intensive cooperation between the automation partner and the machine manufacturer. As an all-around automation partner, Rexroth provides access to unique know-how across all drive and control technologies and complying with requirements such as “safe motion”, “safe processing of peripheral signals” and “safe communication.”

As a technology leader, Rexroth offers consistent functional safety on all automation levels: from components through to system solutions including software, Rexroth provides machine manufacturers and end users with high-quality products based on the newest safety engineering.

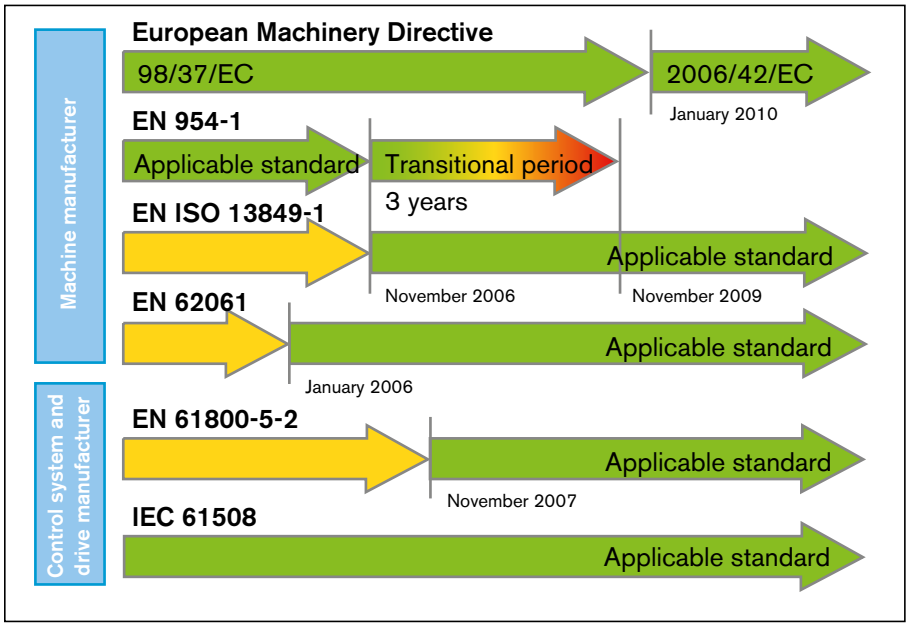
Every manufacturer of plant and machinery is responsible for ensuring that his products meet basic safety requirements. The new European Machinery Directive 2006/42/EC and the Machinery Safety Standards EN ISO 13849-1 – in the latest revision – and EN 62061 provide the framework: In an extensive evaluation with statistical parameters, machine manufacturers must proof protection of personnel under consideration of all components and systems installed into the machine or production system.

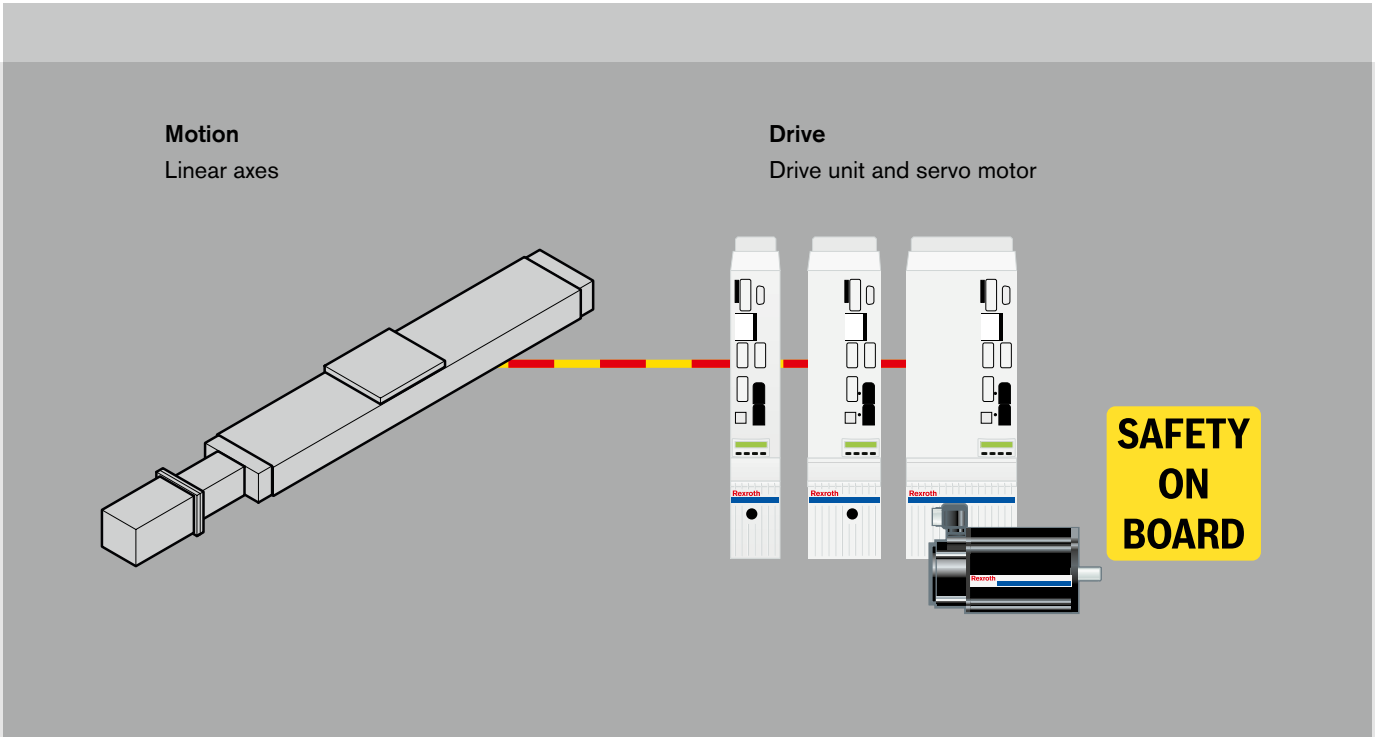
The goal is to identify and reduce risks. Intrinsically safe designs therefore always have higher priority over protective safeguards and warning notices in the documentation. If hazards are to be minimized by the use of safety-critical control components, the EN ISO 13849-1 comes to bear. The machine manufacturer must specify the required performance level, i.e. the reliability, of the safety functions.

Your tasks...

In order to comply with the standards, machine manufacturers and their suppliers must perform the following tasks:

- As per European Machinery Directive 2006/42/EC: Risk assessment and reduction of risks.
- As per ISO 13849: Estimation of the reliability of safety functions dependent upon, e.g.
  - the hardware-oriented structure
  - the mean time to dangerous failure (MTTFd)
  - the diagnostic coverage (DC) of a safety function.





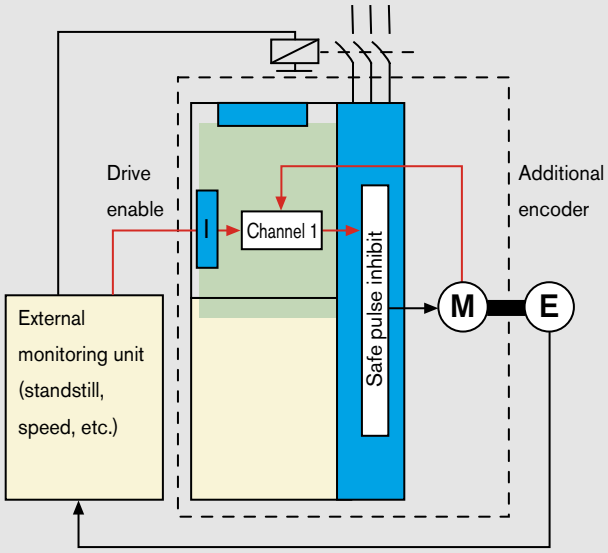
...our solutions

Rexroth provides perfectly matched certified control systems, controllers and motors with integrated functional safety, thereby making work easier for designers and machine manufacturers.

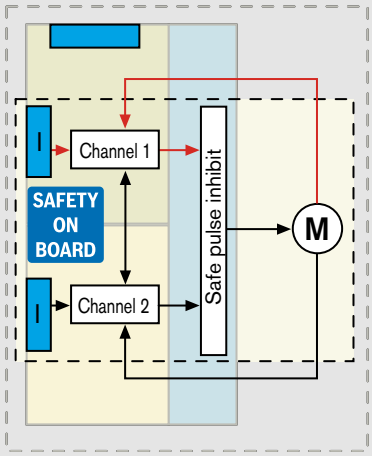
The benefits for you are:

- **reduced development effort** to comply with the new standards, e.g. through automation products with certified safety functions, certified components and tested circuits;
- **simplified design process** for safe machinery through single-source drive and control technologies;
- **effective protection of personnel** through safe movements in all drive technologies and the fast reaction of monitoring functions.

Conventional safety solution involving external relays



IndraDrive drive-integrated safety technology



Standards and Safety

Our drives and controls – your safety

The safety technology is exclusively available for linear axes with MSK motors and IndraDrive.
The appropriate products carry a “SAFETY ON BOARD” label.

SAFETY ON BOARD

Safety on Board merges drive-based and controller-based safety solutions to form a smart comprehensive safety concept.

These safety solutions in our drive systems (IndraDrive) and controllers assure a high level of diagnostic coverage and hence a high availability of the safety functions.

Your advantages:
- Maximum protection for personnel
- Maximum safety and reliability
- Safety components tested and certified in accordance with the latest safety standards
- Functional and legal assurance
- Reduced downtime
- Increased availability
- Simplified start-up and validation
- Minimized cost and effort for validation
- Easy upgrading of standard components to full-fledged safety components
- Flexible use as stand-alone safety components or as part of a system solution

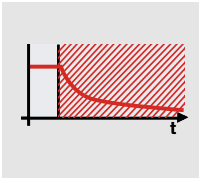
SafeMotion

The drive-integrated safety technology in IndraDrive from Rexroth monitors movements where they are generated. The results are very rapid response times of just 2 milliseconds upon triggering of the internal monitors.
Even in the case of a power failure, a hydraulic feed axis with mechanical clamping can come to a safe stop within milliseconds.
Rexroth provides these intelligent drive solutions as certified safety components with all the necessary proofs. SafeMotion is thus the first step in the realization of safe machine concepts.

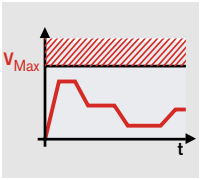
Your advantages:
- Effective protection of personnel
- High reliability thanks to certified and integrated solution
- Maximum assurance against tampering through drive-integrated monitoring system
- Reduced design effort through savings on time and money spent on certification
- Increased availability through reduced downtimes
- Increased machine productivity as a result of shorter special mode times
- No unnecessary idle times because the line circuit breaker does not have to be opened when undertaking work on the machine
- No need for re-synchronization of coupled axes after intervention work on the machine
- Savings on limit switches, measurement and analysis units and control cabinet size
- Fault detection without the need for any periodic machine shutdown
- Can be integrated into any kind of system architecture
- Easy start-up
- Easy to service

For more information, refer to the brochure
“Safety on Board – Functional Safety in Automation Technology,” R911 322 823.

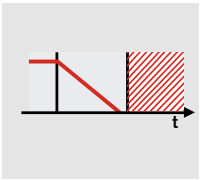
SafeMotion – Certified safety functions



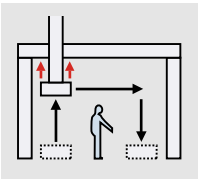
Safe Torque Off (STO)
Stop category 0 in accordance with EN 60204-1: Safe drive torque cut off



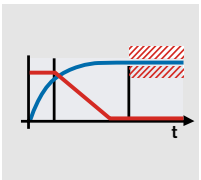
Safe Maximum Speed (SMS)
The maximum speed is safely monitored irrespective of the mode of operation



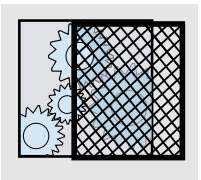
Safe Stop 1 (Emergency Stop) (SS1)
Stop category 1 in accordance with EN 60204-1: Safely monitored stop, control or drive controlled with safe drive torque cut off



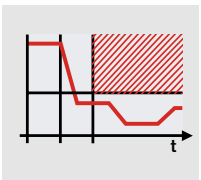
Safe Braking and Holding System (SBS)
The safe braking and holding system controls and monitors two independent brakes



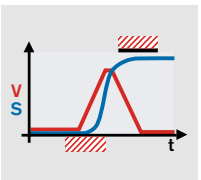
Safe Stop 2 (SS2)
Safe Operating Stop (SOS)
Stop category 2 in accordance with EN 60204-1: Safely monitored stop with safely monitored standstill at controlled torque



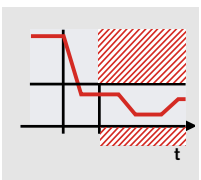
Safe Door Locking (SDL)
When all the drives in one protection zone are in safe status, the safety door lock is released



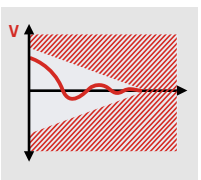
Safely Limited Speed (SLS)
If enable signal is given, a safely limited speed is monitored in special operating mode



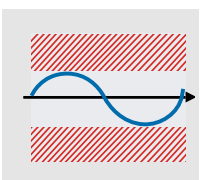
Safely Limited Increment (SLI)
If enable signal is given, a safely limited increment is monitored in special operating mode



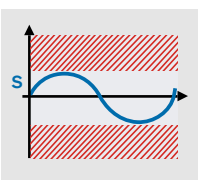
Safe Direction (SDI)
A safe direction (clockwise, counter-clockwise) is also monitored in addition to safe motion



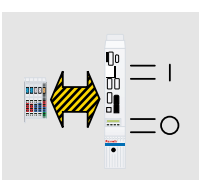
Safely Monitored Deceleration (SMD)
Safely monitored deceleration ramp when stopping



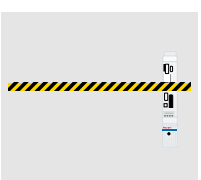
Safely Monitored Position (SMP)
A safe absolute position range is also monitored in addition to safe motion



Safely Limited Position (SLP)
Monitoring of safe software limit switches



Safe Inputs/Outputs (SIO)
Dual-channel safety peripherals can be connected to the drive and made available to the controller via the safety bus



Safe Communication (SCO)
Selection/deselection of safety functions and transfer of process data (e.g. actual position values) via safety bus

All safety functions are certified as compliant with standards ISO 13849-1:2006[1)], IEC 61800-5-2:2007[1)], IEC 61508:1998-2000[1)], IEC 62061[1)], ISO 13849-1:1999, EN 954-1:1996, ISO 13849-2:2003, IEC 60204-1:1997, EN 50178-1:1997, IEC 61800-3:2004, UL 508C R7.03, C22.2 No. 0.8-M86 (R2003), CAN/CSA C22.2 No. 14-95, NFPA 79:2007 ER1 through TÜV Rheinland, TÜV Rheinland North America Inc. and SIBE Switzerland.

1) In preparation

A Solution to Many Problems

The tasks

- Driving
- Actuating
- Positioning
- Pressing / Joining
- Forming
- Dispensing

Maximum travel

Load ratings

Maximum load

Travel speed

System complete with drive unit

Switch mounting arrangements

Accessories

Up to 1,500 mm

Load capacity C up to 29,000 N

Up to 29,000 N

Up to 1.6 m/s

AC servo motor
with motor mount, coupling or timing belt side drive;
complete with controller and control system

Electronical switches
adjustable over the entire travel range

Mounting elements

The solution

Rexroth Electromechanical Cylinders

Product Overview

Electromechanical Cylinders EMC

Because of the actuator choices that electromechanical drive solutions offer, they are becoming more and more widespread as an alternative to fluid driven technology. The Electromechanical Cylinder EMC from Rexroth is a powerful alternative to pneumatic cylinders while providing significant benefits in terms of energy efficiency, a prime goal in engineering today. It also offers clear conceptual advantages, allowing travel to any intermediate target position as well as creating greater flexibility through higher thrust and variable speeds. Combinations of the various technologies can also result in new application possibilities.

The mechanics are based on established rolled precision ball screw drives available in all current diameter and lead combinations. Performance characteristics such as positioning accuracy, thrust or speed can be optimized to meet the requirements of each specific application.

Through the use of generously sized angular-contact thrust ball bearings LAN, the load rating of the ball screw drive is used to its maximum potential. There are also many choices and possibilities when it comes to drive configurations and mounting elements.

System advantages

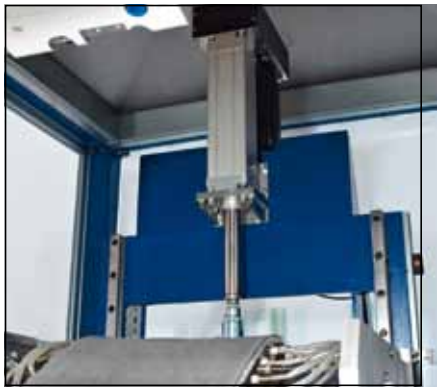
- Many sizes to choose from
- Integrated ball screw drive ensures exact positioning and powerful thrust capability
- Motor attachment via motor mount and coupling or via belt side drive
- Compact construction
- Dynamic drive
- Extensive series of attachments to match every application area
- Quick assembly
- Compatible with other products from Bosch Rexroth
- Stainless steel piston rod
- Optional attachment of Rexroth standard components
- Particularly efficient in applications with a small number of axes
- Preferred stroke lengths: 100, 200, 320 and 400 mm with shorter delivery times
- Low maintenance
- High mechanical efficiency

Ball screw drives used

EMC size	Ball screw							
		Lead P						
	d_0	5	10	16	20	25	32	40
32	12	■	■					
40	16	■	■	■				
50	20	■	■		■			
63	25	■	■			■		
80	32	■	■		■		■	
100	40	■	■		■			■

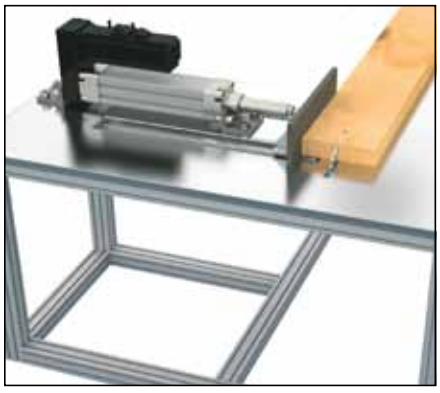
Application examples

There are many application areas where an EMC can be used, either as a replacement for, or in conjunction with pneumatic and hydraulic technology.



Joining and pressing

Application of contact pressure

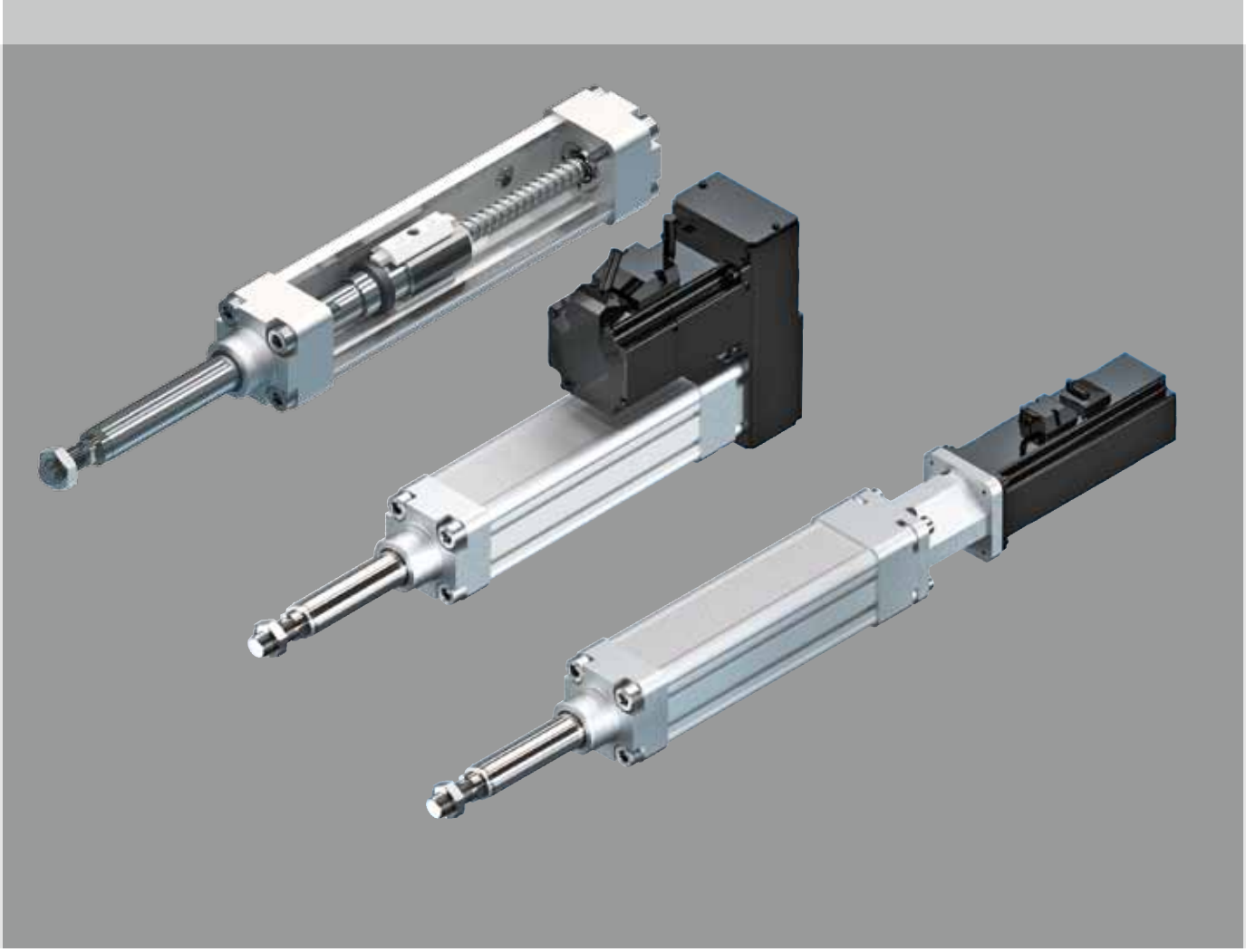


Machine tools or woodworking machines

Adjustable mechanical stop for a saw

Dispensing systems

Valve timing



Further application areas:

- Material handling and feed systems
- Test rigs and laboratory applications
- Actuator drives (brush rollers / sensor units / grinding wheels, etc.)
- Welding, bonding, thermoforming
- Volumetric filling

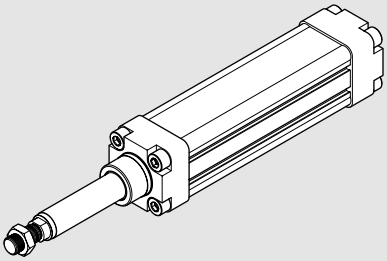
At www.boschrexroth.com/emc, you can use the online configurator to select and order your EMC and generate CAD models.

Product Overview

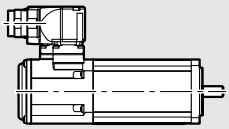
Motor Selection

Based on drive controllers and control system

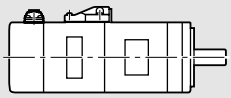
A choice can be made between several different motor/controller combinations to achieve the most cost-effective solution for each customer application.When sizing the drive, always consider the motor-controller combination. For more detailed information on motors and control systems, please refer to the catalogs “IndraDrive Cs for Linear Motion Systems” and “IndraDrive C for Linear Motion Systems.”



SAFETY ON BOARD

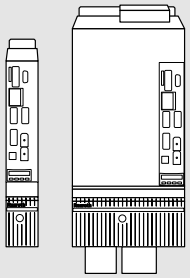


Digital AC Servo Motor MSK

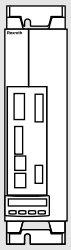


Digital AC Servo Motor MSM

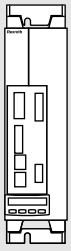
SAFETY ON BOARD



Digital controller
IndraDrive C
Power unit HCS 02
Control unit CSH



Digital controller
IndraDrive Cs
HCS 01
Compact and dynamic solution
for lower power ranges



Digital controller
IndraDrive Cs
HCS 01
Compact and dynamic solution
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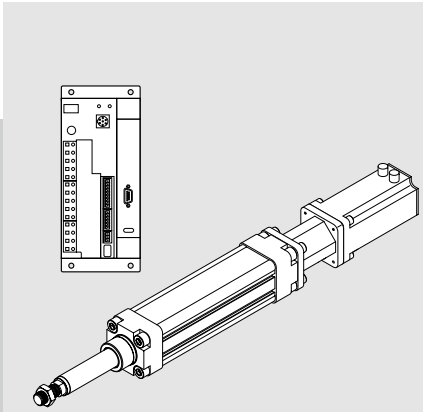
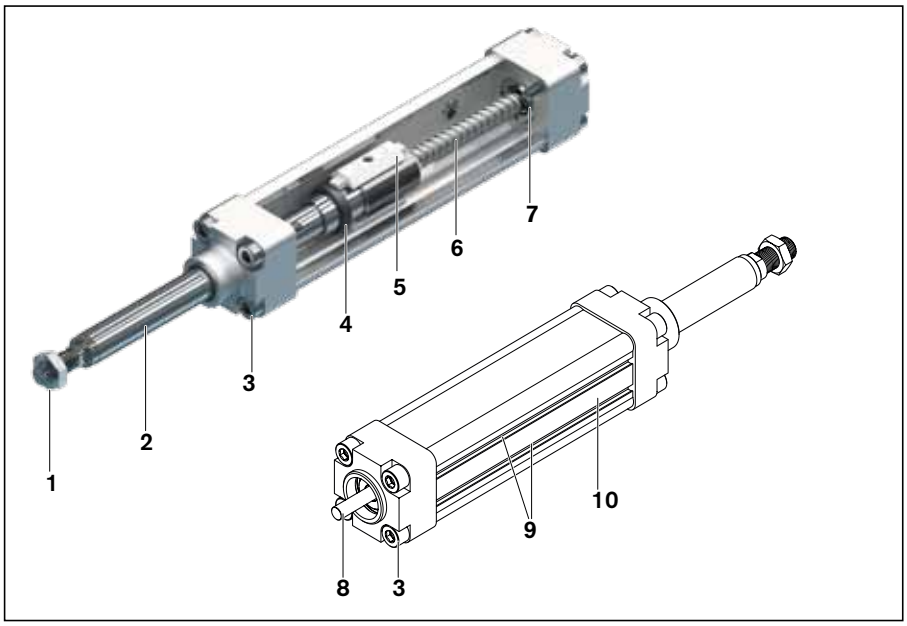


The Electromechanical Cylinders can be supplied complete with motor, controller and control unit.

Structural Design

1 Hex nut
2 Piston rod (stainless steel)
3 Round-neck nut (for attachment of mounting elements and motor attachments)
4 Magnet
5 Anti-twist feature
6 Ball screw
7 Angular-contact thrust ball bearing
8 Drive journal
9 T-slot for switches
10 Protective profile



Attachments

11 Motor
12 Motor mount and coupling
13 Timing belt side drive