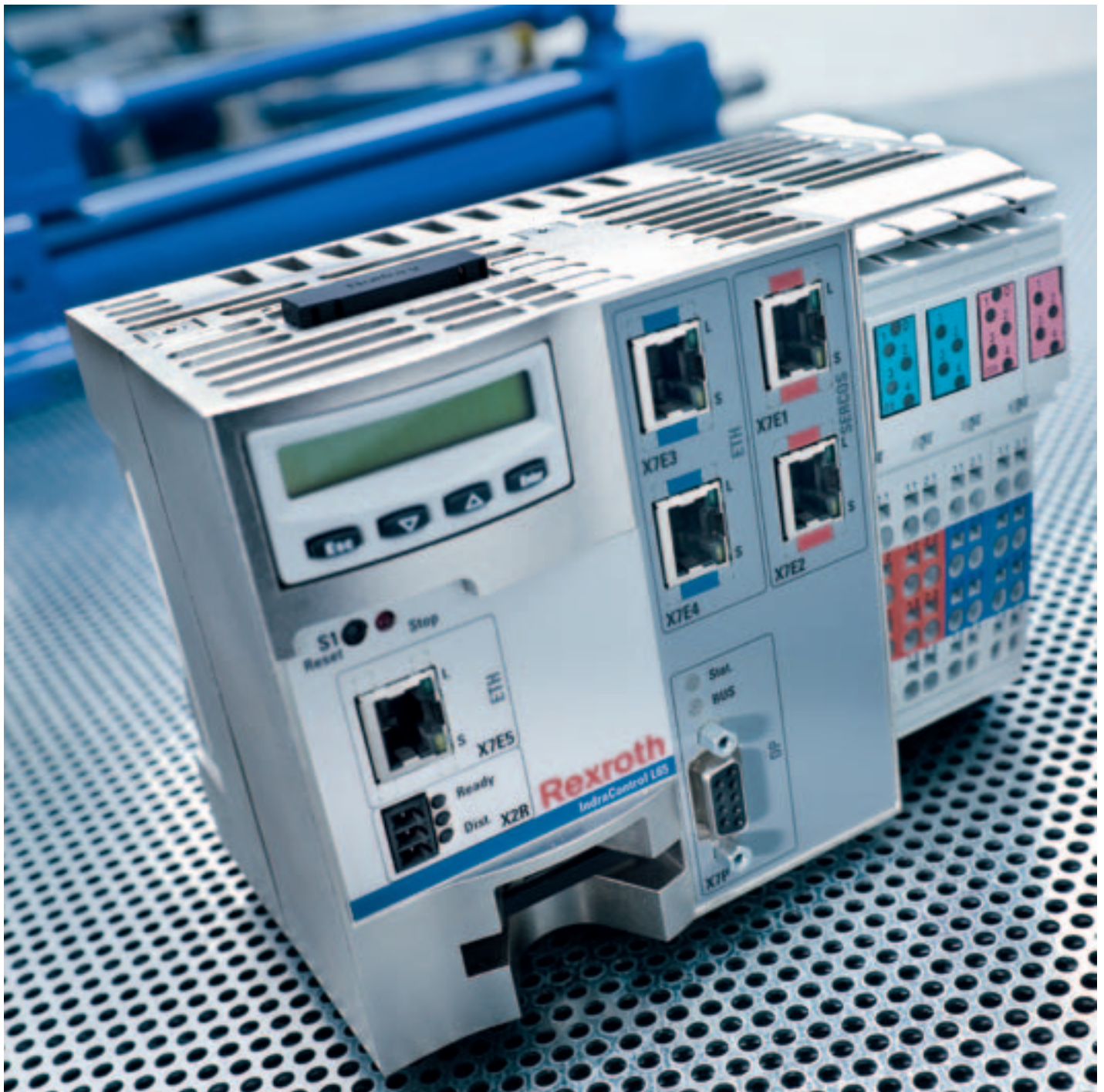
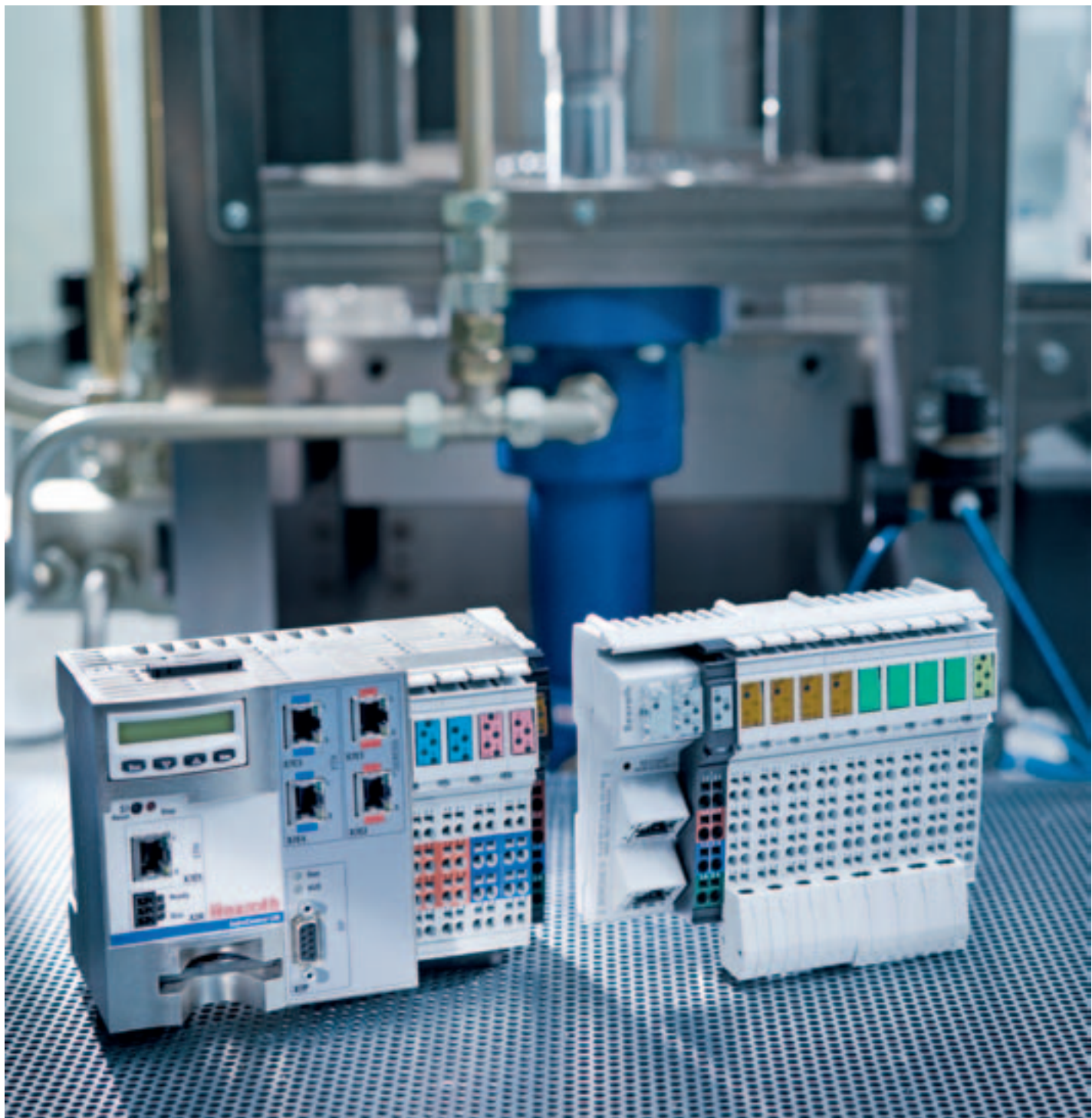


IndraMotion MLC motion logic control for hydraulic drives





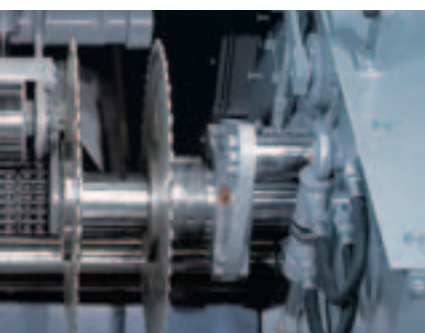
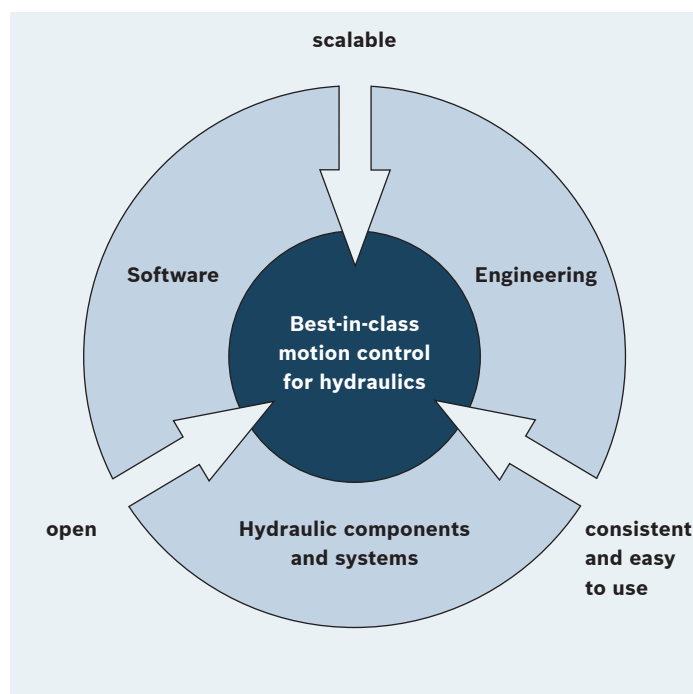
Technology optimized to hydraulics – experience from thousands of applications

Hydraulics features a unique power density and robustness for numerous applications. With a wide range of Motion Control systems Rexroth opens up modern automation to hydraulic drives. What counts here is the experience gained in many thousands of applications, for this know-how significantly simplifies engineering and brings about fast, flexible and reliable solutions.

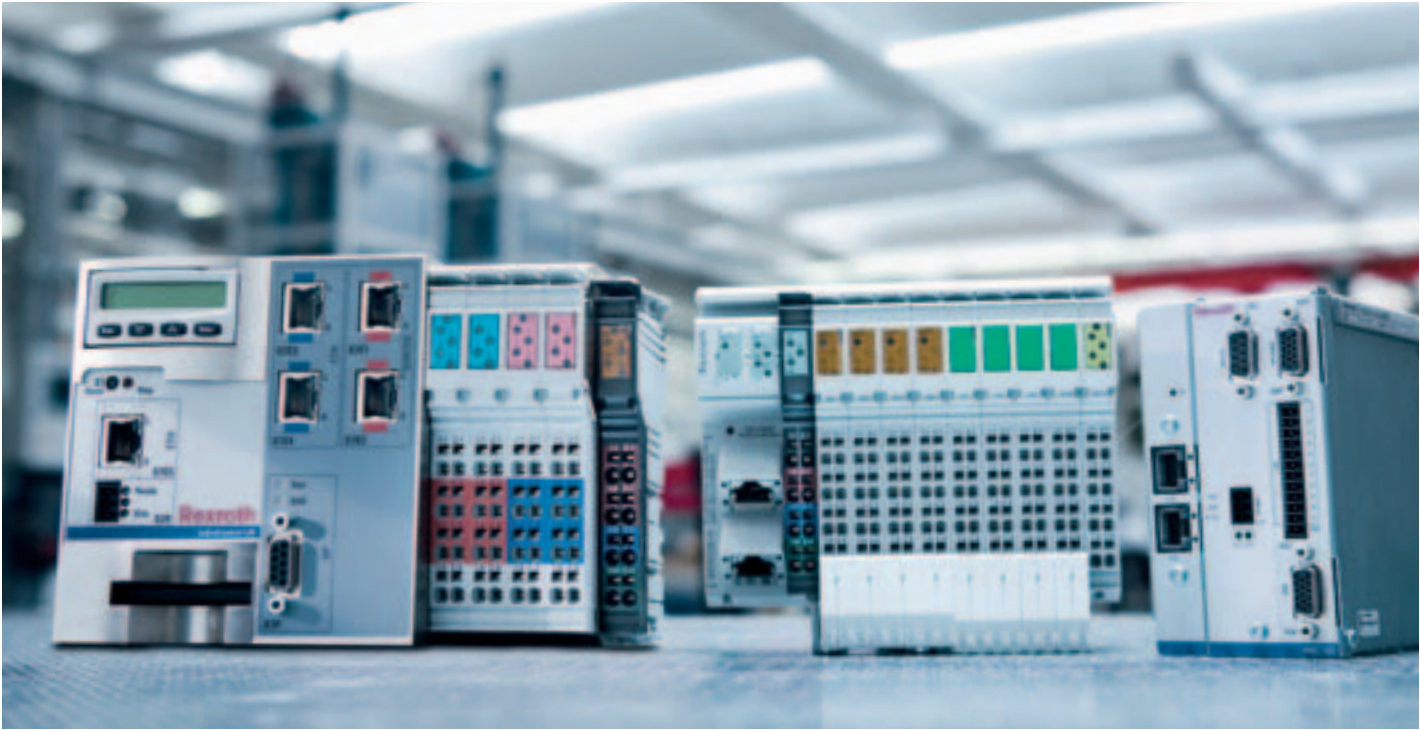
Consistent ease of application

The easy handling of Motion Control, the operator units and the drive decisively accelerates commissioning.

Rexroth opens up the entire productivity potential of electric, hydraulic and hybrid drives for both, decentralized and central architectures. With industry- and application-specific function libraries you will achieve optimum production results more easily and faster. Associated motion control software covers the special aspects of hydraulics and separates drive physics from automation equipment. As a result, all drives behave identical for both, the control and the operator.



◀ Rexroth offers optimal control performance for nearly all industrial sectors in steelworks, forming and rolling mill technology, material handling and testing technology as well as in plastics processing, woodworking and paper-making or special machines.



Engineering



HMI



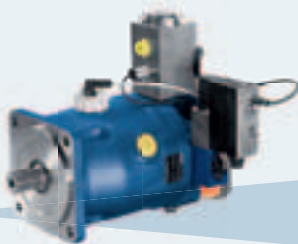
Logic Control (PLC)



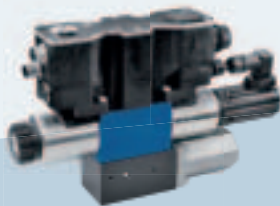
Motion Logic Control



Motion Control – integrated



DFEC
pumps with pressure and
flow control (p/Q)



IAC-P
valves with pressure and
flow control (p/Q)

I/O units (4 axes)



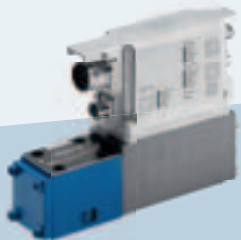
The perfect solution for your application: Motion controls for electrohydraulic drives

Scalable in hardware and software

From single-axis controls integrated in the drive and multi-axis controls installed in the control cabinet through to the complete machine control with integrated PLC, Rexroth always perfectly meets the requirements of any type of hydraulic application. The proven bundled I/O strategy covers a wide variety of interfaces to offer you the optimum solution for your specific application.

This fine scalability of hardware and software from Rexroth standardizes automation across all drive technologies.

Flexible parameterization, simple commissioning and transparent diagnostics of all drives via the control shortens commissioning times and cuts total cost of ownership for the user.



IAC-R
valves with p/Q and axis control

– standard



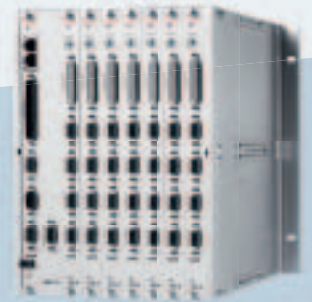
HACD-2X
standard axis control for control cabinet installation, 3 control loops

– programmable



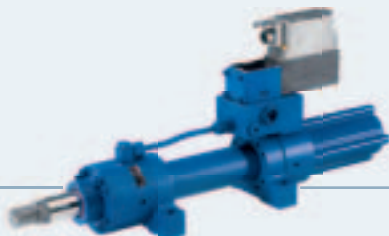
HNC100-3X
scalable, programmable NC axis control for 1 – 4 axes

– advanced



MAC-8
Modular motion control for 2 – 32 axes

Hydraulic axes



Open to any solution

Also with regard to control solutions for hydraulic drives Rexroth consequently counts on open interfaces and programming standards. Motion controls support all common field buses and Ethernet protocols and fit seamlessly into a wide variety of automation environments.

Motion logic system solution: Open for your ideas

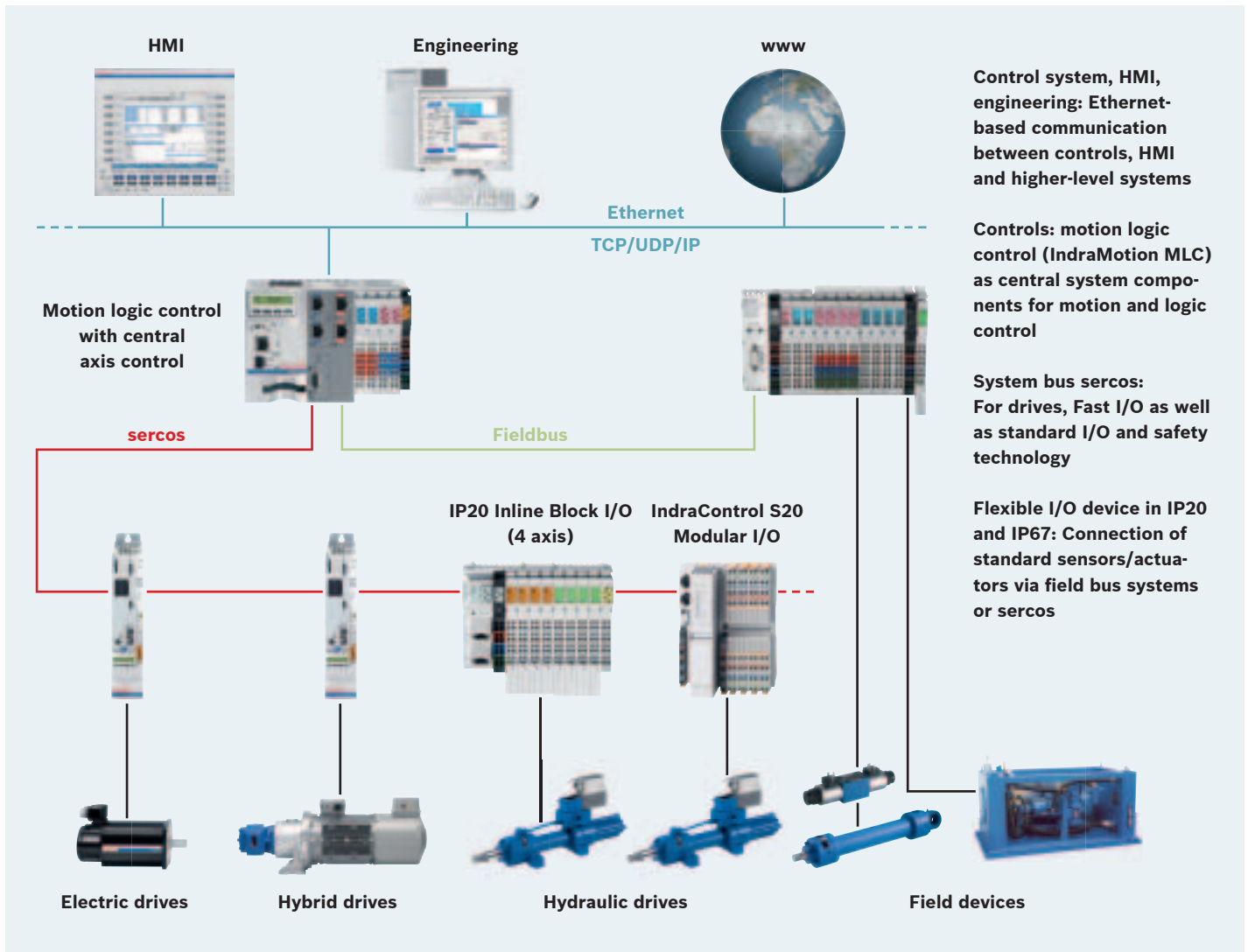
A complete control for hydraulic, electric and hybrid drives with compact and control-based hardware: The IndraMotion MLC integrates an open PLC according to IEC 61131-3 with a powerful motion control. Rexroth is the pioneer in utilizing the advantages of motion logic systems also for hydraulic and hybrid drives.



This opens up new degrees of freedom in the modularization of your system, for IndraMotion MLC splits the drive physics from the automation. You can commission electric, hydraulic and hybrid drives equally conveniently and with the same engineering tools.

Internationally standardized programming and open support of all common field bus systems and Ethernet protocols, reduces complexity: Irrespective of the master communication used, IndraMotion MLC fits seamlessly, thus reducing the number of variants required.

Utilizing open programming standards, pre-defined function libraries and ready to use technology functions shorten your engineering times. Nevertheless, you can integrate own expertise securely at any time and thereby protect your competitive edge: IndraMotion MLC – open for your ideas.



Openness in programming



PLC to IEC 61131-3 with function libraries according to PLCopen

Openness in communication



Support of all common field buses and Ethernet protocols

Openness for specific control know-how



Open control interfaces simplify the implementation of application-specific functions such as command value generation or of individual control models through to the integration of complete simulation data.

Perfect implementation: Finely scalable for your application

Only as much automation as you require. Be it for the central control of up to 32 axes or the decentralized control of up to 64 drives: Due to the strictly modular design of the finely scalable IndraMotion MLC, Rexroth always offers the right performance that is actually required for the relevant application.

The proven bundled I/O strategy covers a wide variety of interfaces to offer you the optimum solution for your specific application. Even better, the use of Ethernet-based real-time communication sercos guarantees synchronous communication between the control, drives and I/O.

Rexroth integrated its comprehensive experience in the field of hydraulics in software. You can therefore benefit from the advantages of hydraulic drive technology such as high power density, robustness and efficiency for modern drive concepts in an optimum way. Special, motion logic integrated hydraulic, position, velocity, force and alternating control functions perfectly assume the implementation of your automation sequence.

► Controls

**Control hardware
IndraControl – scalable
in the number of axes,
computing power and
communication inter-
faces**

IndraControl L25

- With central drive control of up to 4 axes
- With decentralized drive control of up to 16 axes



IndraControl L45

- With central drive control of up to 8 axes
- With decentralized drive control of up to 32 axes



IndraControl L65

- With central drive control of up to 32 axes
- With decentralized drive control of up to 64 axes

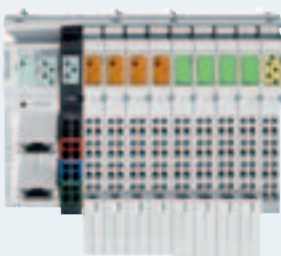




High-end control technology for hydraulic controls with sercos connectivity

I/O device (4 axes) for central drive control

- ▶ 12 analog differential inputs, 16 bit resolution.
Current: ± 10 mA; ± 20 mA;
0-20 mA; 4-20 mA.
Voltage: 0-10 V, ± 10 V
- ▶ 4 analog outputs, 16 bit resolution.
Current: ± 10 mA; ± 20 mA;
0-20 mA; 4-20 mA.
Voltage: 0-10 V, ± 10 V
- ▶ 4 SSI position encoder inputs
- ▶ Thermal short-circuit and overload protection, dielectric strength up to 28 V



High-end control technology for hydraulic controls with sercos connectivity

IndraControl S20 distributed I/O system in protection class IP20

- ▶ sercos bus coupler
- ▶ digital I/O
- ▶ analog I/O
- ▶ resistance temperature detector
- ▶ incremental encoder input
- ▶ SSI encoder input
- ▶ ...





Standardization of complete automation

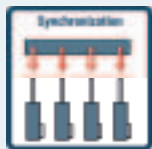
IndraMotion MLC integrates Best in Class fluid power control technology into automation. For commissioning and operation no in-depth knowledge of fluid power is required. Pre-defined blocks and functions automatically compensate for all special characteristics with high control quality. For positioning in processing machines with micrometer accuracy or for lifting extremely heavy loads in plants – motion controls optimizes hydraulic to meet the most exacting demands.

Hydraulic-specific functions



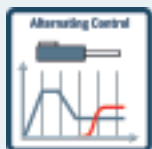
Best in Class controls

Central control for hydraulic axes



Synchronization controls

Central control for hydraulic axes, position active and force passive



Alternating control

Positioning with automatic transfer to force control and back



Position-dependent braking

Open-loop controlled positioning with braking to the target



Variable-speed pump drives Sytronix

Central control for hybrid axes

Standard functions (excerpt)



Logic control

according to PLC IEC 61131-3 with extensions



PLCopen

Standardized blocks for motion control



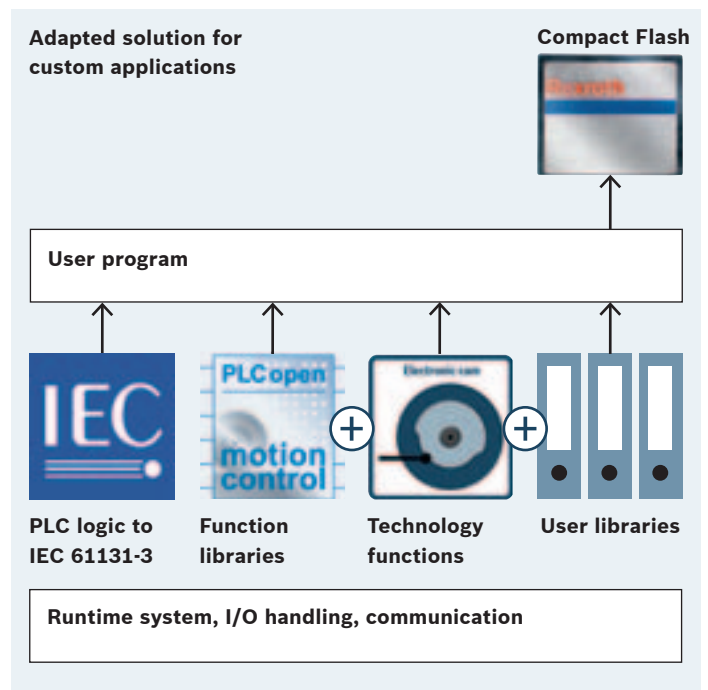
Libraries

Pre-defined function blocks

IndraMotion MLC is a control with standardized system software for controlling electric, hydraulic and hybrid drives.

You can concentrate on the actual automation task and realize your individual solution transparently using a modular software structure. Rexroth complements PLCOpen function blocks for position, velocity and force with industry-specific functions such as flying shears or belt tensioning control. You have a high degree of freedom for defining and implementing your own functions.

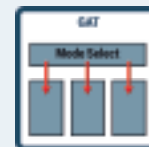
Standardization in hardware and software simplifies the entire system architecture and helps you to save costs and time in the entire engineering process.



Positioning



Multi axis synchronization



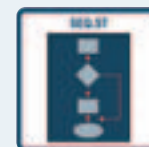
GAT
Generic Application Template, project creation wizard



Electronic gears



Motion profiles
Master axis related motion profiles



SEQ.ST
Structured Text with sequential processing



Electronic cams



Robot control
Editor and functions for coordinated motion



WinView
Multi-channel oscilloscope (Multiplot) and data logger

Reach your goal faster: Ease of engineering

From engineering and commissioning through to diagnostics, IndraWorks shortens the time from the idea to the finished solution. The consistent engineering environment for all IndraMotion systems simplifies handling of the PLC, motion and all drive technologies.



Whenever possible, Rexroth replaces complicated and time-consuming programming by parameterization. Of special importance for complex tasks: IndraWorks also supports multi-project management for simultaneous engineering with version and user administration.

Dialog-supported 'Agents' with comprehensive online help and tool tips simplify the configuration and handling of system peripherals. You can parameterize all drive types according to the physical situation with the help of uniform, user-friendly dialogs. The project explorer provides the required overview and serves as control center for all devices and functions of IndraMotion MLC.

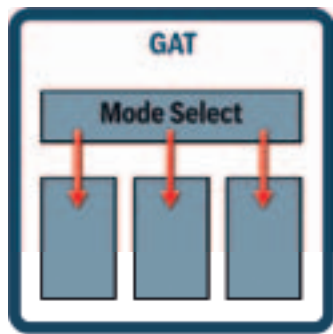
In this way, you will reach your goal faster, for one standardized engineering environment is sufficient for all your automation tasks.

Quickly programmable and easy to operate:
IndraWorks offers a standardized framework for all engineering and operation tasks.

Everything under control

The more demanding the task, the more efficient must be the diagnosis options. The Rexroth tool WinView integrated in IndraWorks records all PLC and process variables in real time in up to 100 channels and saves them continuously on a PC. This allows long-term records for a machine, simplifies analyses of sporadic errors, thus accelerating a restart after malfunction.

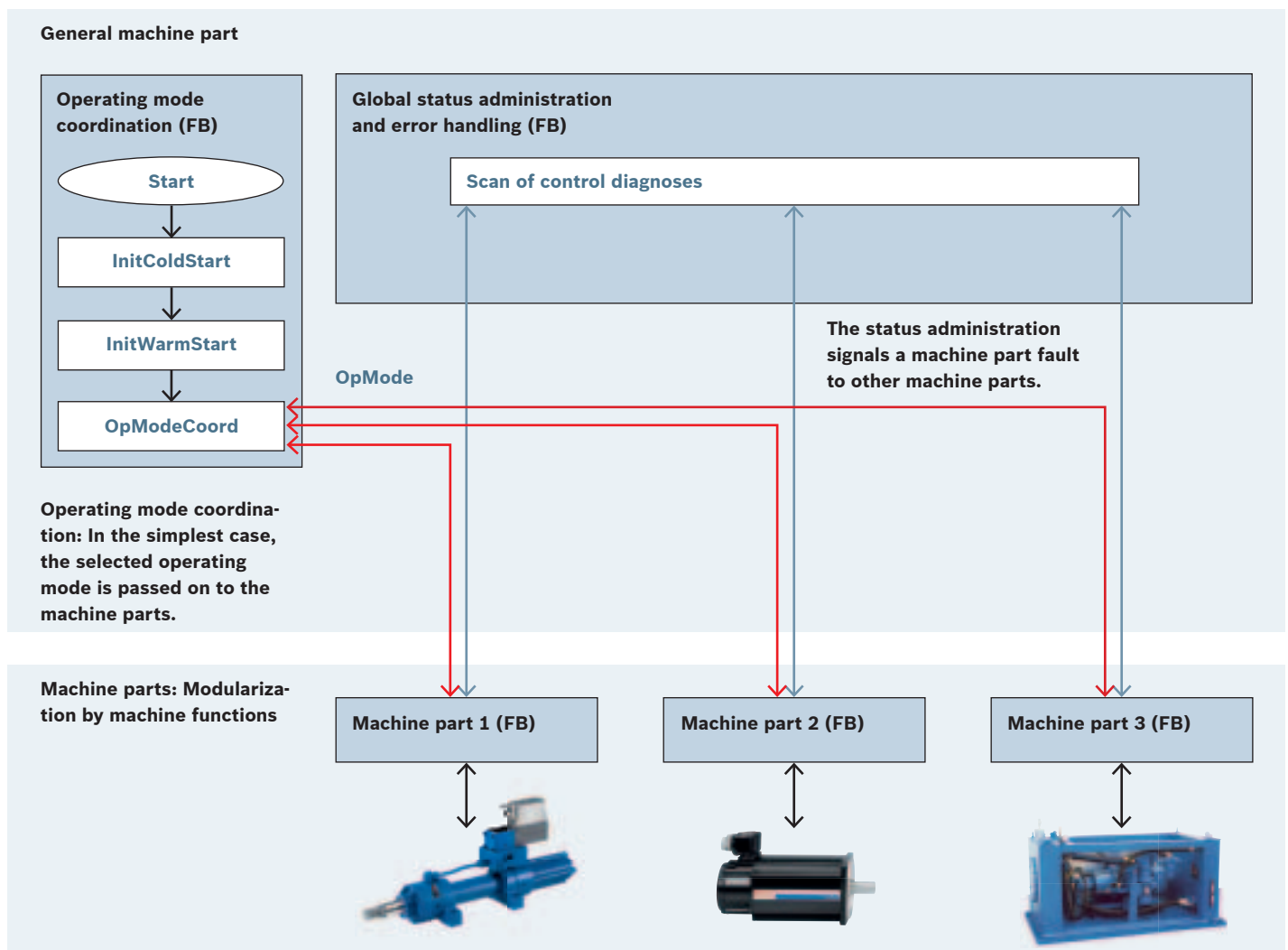




Fast and structured: Short programming times

On the basis of numerous automation solutions Rexroth examined typical application and developed a 'wizard', which creates all essential parts of an application interactively and significantly reduces the engineering effort. It assumes time-consuming routine tasks. Moreover, it promotes the standardization of the program structure and shortens the time of getting familiar with the project in the case of a project hand-over or when repairs are must be carried out.

The pre-defined program frame with the machine sequence control increases the modularization of software, and application-specific templates simplify the project start and error handling. For the layout of the user interface, Rexroth provides templates that ensure ease of programming.



Sequential programming: Simple and transparent

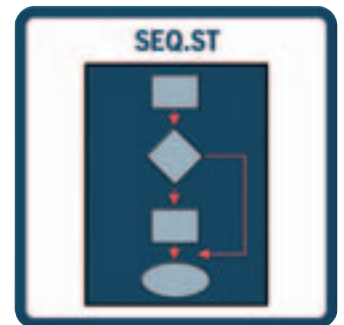
```

(*-----*)
(* press cycle (example) *)
(*-----*)
// acceleration and deceleration always constant
Seq[AXIS1].Acc := 1000; // acceleration [mm/s^2]
Seq[AXIS1].Dec := 1000; // deceleration [mm/s^2]
While (input_Start = True) Do // repeat as long input is set
  (*-----*)
  (* activation of force limitation, command continues immediately *)
  (*-----*)
  Seq[AXIS1].ForceRamp(Force := 100, // force [kN]
    Ramp := 0, // force ramp [kN/s]
    Mode := MODE_CONT);

  (*-----*)
  (* Move axis to press position with profile: fast then slow speed *)
  (*-----*)
  // Movement fast speed
  arPos[1] := 300; // position array element 1 [mm]
  arVel[1] := 200; // velocity array element 1 [mm/s]
  // Movement press speed
  arPos[2] := 350; // position array element 2 [mm]
  arVel[2] := 30; // velocity array element 2 [mm/s]
  // start Movement, command continues immediately
  Seq[AXIS1].MoveProfile(
    Pos := arPos, // position array
    Vel := arVel, // velocity array
    Count := 2, // amount of elements
    Mode := MODE_CONT);

  (*-----*)
  (* wait until axis in press position or limitation force reached *)
  (*-----*)
  WAIT(Seq[AXIS1].InPos OR Seq[AXIS1].InForce);
  (* wait press time *)
  (*-----*)
  SeqBase.WaitTimeMs(500);
  (* move axis to home position, command ready, if position reached *)
  (*-----*)
  Seq[AXIS1].Vel := 500; // velocity [mm/s]
  Seq[AXIS1].MoveAbsolute(Pos := 0, Mode := MODE_IN_POS);
End_While
(* press cycle end *)
(*-----*)

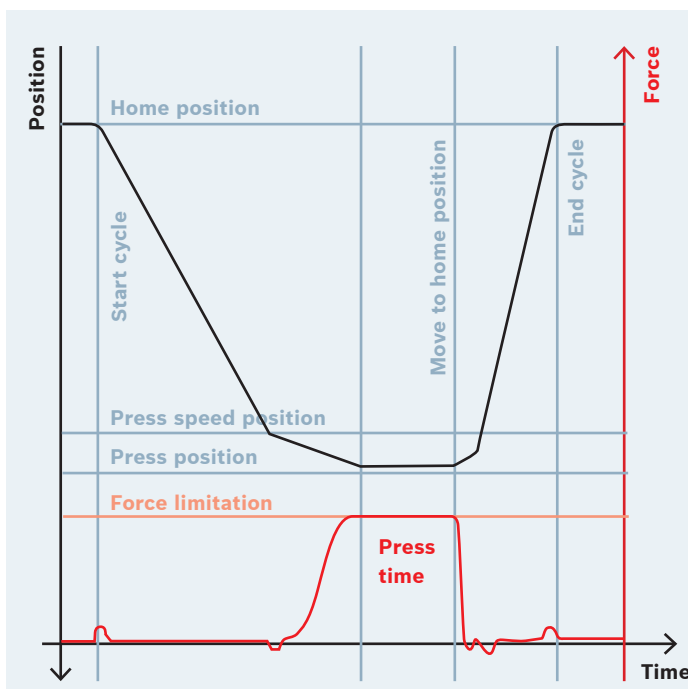
```



With sequential programming, Rexroth offers an engineering tool, with the help of which users can realize cyclical and sequential tasks with a common language. With a clear separation of PLC- and motion control tasks, this tool is based on Structured Text (ST). In addition, it utilizes a common syntax and user interface, administrates common variables and resources and offers an integrated debugger. Sequential programming dedicated to electrohydraulic system solutions, simplifies even complex projects while offering extremely high transparency.

This complement to IEC 61131-3 allows easy and clearly arranged programming of motion sequences within the framework of an ST program for sequential processing.

The example of a press cycle shows, how a sequence can be created using sequential programming with only a few efficient commands. While executing a 'MoveProfile' command, the press first moves at rapid speed and then at pressing speed to the given pressing position. During this, the set pressing force ('ForceRamp' command) is monitored and, if required, limited. The graphic shows that the pressing force is achieved and starts the pressing time. Then, the press returns to the home position due to a 'MoveAbsolute' command.



Tailored hydraulic controls: Unique wealth of experience

Rexroth has unparalleled knowledge and experience in the application of hydraulics in motion control. On this basis, control strategies for hydraulic and hybrid drives can be easily optimized and integrated with ready-to-use software. Enjoy the benefits of the Rexroth experience!

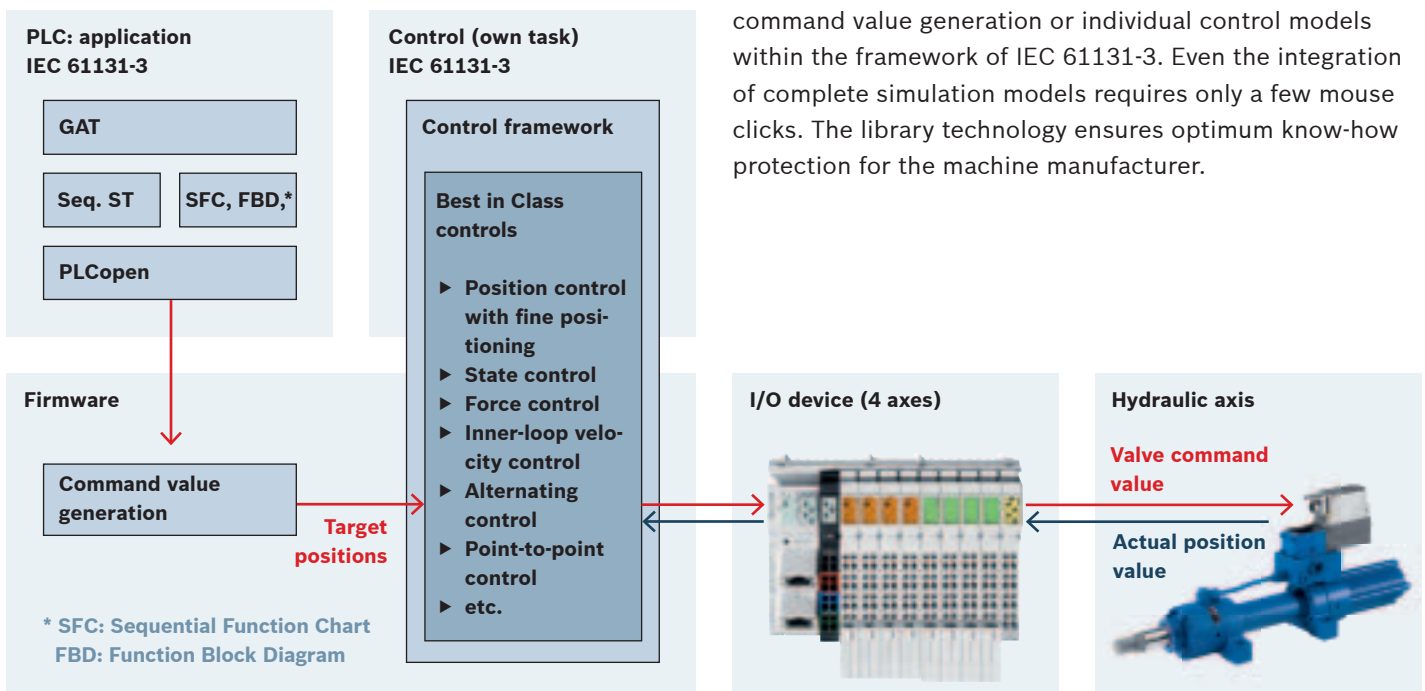


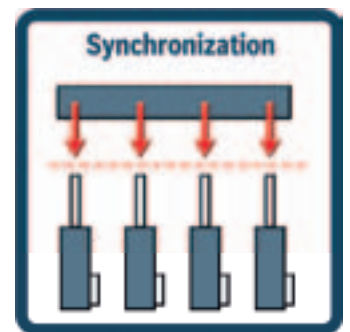
Central and fast

In addition to decentralized drive controls, Rexroth offers a fast, central control for hydraulic drives with IndraMotion MLC. Peripherals hooked up via sercos and fast I/O modules exchange data with the control in real time. This offers unrestricted and cyclical access to all process variables and parameters. The result: Highly dynamic controls in real time.

Your know-how reliably protected

Machine manufacturers can simply integrate their own command value generation or individual control models within the framework of IEC 61131-3. Even the integration of complete simulation models requires only a few mouse clicks. The library technology ensures optimum know-how protection for the machine manufacturer.



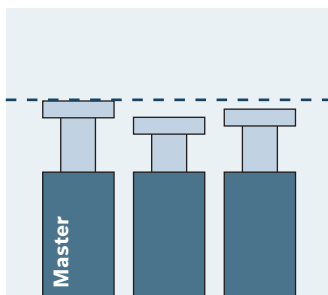


Synchronization of your choice

Be it in presses, in plastics processing machines or in plant engineering: The perfect synchronization of several hydraulic cylinders and drives is one of the basic requirements.

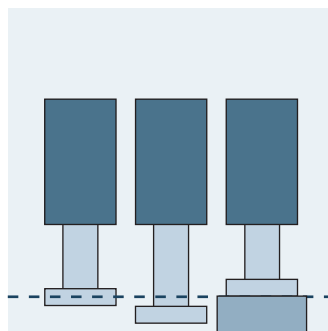
Rexroth developed tailored synchronization algorithms, which the user simply has to select. These algorithms cover all synchronization tasks: They control the synchronicity of positions as well as the distribution of loads for active and passive variants. But even more: Like no other control, IndraMotion MLC is ideal for realizing mixed synchronization groups consisting of electric, hydraulic and hybrid drives.

Variant examples



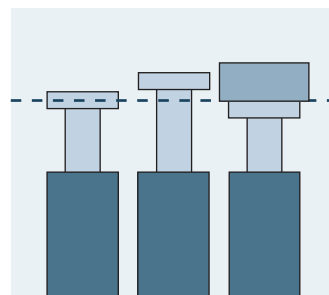
**Master principle
(active synchronization)**

All axes follow the master axis. For master axis applications.



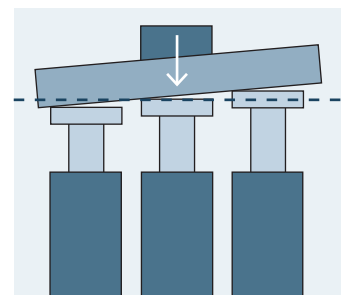
**Maximum value principle
(active synchronization)**

The axis with the greatest actual position value is the master axis. For vertical axes and encoder setting 'Max. value up', such as, for example, for downstroke presses.



**Minimum value principle
(active synchronization)**

The axis with the smallest actual position value is the master axis. For vertical axis and encoder setting 'Max. value up', such as, for example, for lifting platforms and elevators.



**Average value principle
(passive synchronization)**

Alternating control: the axes follow the average position of all axes. For parallel-holding (displacement synchronization).



Hydraulics with IndraMotion MLC: Powerful, intelligent, energy-efficient



Simplified: Position/force control

Fast positioning with dynamic transition into force control and defined force command value curve: This function sets the standard for hydraulic controls and used to require complicated programming in the past. Rexroth simplifies this comprehensive function and reduces it to convenient parameterization. Controls developed by Rexroth automatically handle the transition from position to force control – in highest quality.



For robust solutions

Position-dependent braking has proven as robust control with high availability in many applications. With IndraMotion MLC, Rexroth opens up additional combination options with position controls or alternating controls. Beyond PLCopen, this motion control offers further, hydraulics-specific blocks for traversing axes.



Rexroth combines know-how across technologies with competence in controls and hydraulics to create system solutions in all drive and control technologies for nearly all industrial sectors. Your advantage: The open Rexroth system solutions fit easily into your concept and shorten your 'time to market'. Consistently simple engineering tools help you realize your concepts. And proven technology functions ensure perfect results.



Up to 80 percent more energy-efficient

Thanks to variable-speed pump drives Sytronix, Rexroth cuts the energy consumption of hydraulics by up to 80 percent. These hybrid drives reduce the speed in partial-load operation and, at the same time, lower noise emission by up to 20 dB(A).

The drive software takes account of all special requirements of fluid power technology. Three scaleable variants Sytronix FcP 5000, DFE 5000 and SvP 7000 cover a wide range of dynamic and automation requirements.



Control technology from Rexroth – scalable, consistent and easy to use, open

Rexroth controls communicate consistently with integrated, standardized interfaces and are based on open standards. Our control competence offers users extendable complete solutions and individual packages at the highest technical and economic level to ensure successful automation.

IndraMotion MLC – scalable motion logic system

- ▶ Highest performance for synchronizing up to 64 drives per control
- ▶ Ease of extension by means of function modules for communication and technologies
- ▶ Direct connection of local Inline I/O, 8 fast I/O on board
- ▶ Communication interfaces sercos, PROFIBUS, PROFINET IO, EtherNet/IP, DeviceNet, Ethernet TCP/IP and RS232
- ▶ Simple replacement of devices, because all data is saved on removable storage devices
- ▶ Future-proof due to long hardware availability



IndraControl V – visualization devices and industrial PC

- ▶ Control-based, small operator terminals ranging from 7.6 cm (3") to 26.4 cm (10.4") – from the keypad through to a touch screen
- ▶ Embedded PC-based terminals with touch screen of up to 38.1 cm (15")

- ▶ Embedded PC-based, hand-held control unit for mobile use
- ▶ Complete industrial PC portfolio – from the panel PC via cabinet-mounted PC with separate display through to complete PC operator units

Flexible I/O systems in IP20 und IP67

- ▶ I/O systems for central or decentralized connection
- ▶ Finest granularity of digital modules with 2, 4, 8, 16 or 32 channels
- ▶ Comprehensive portfolio with digital, analog, function, relay and supply terminals

- ▶ Field bus coupler for sercos and all standard field bus systems
- ▶ IP67 variant with M8 and M12 connection technique

Technical data

System software		IndraMotion MLC		
Hardware variant		L25 ¹⁾	L45 ¹⁾	L65 ¹⁾
1	Number of axes			
1.1	Maximum number of closed-loop controlled axes	16	32	64
1.2	Centrally controlled axes	4	8	32
2	Performance (average values)			
2.1	1,000 bit commands	20 µs	30 µs	5 µs
2.2	1,000 word commands	20 µs	30 µs	5 µs
2.3	1,000 combined commands	35 µs	30 µs	5 µs
3	Supported drives			
3.1	Electrical axes	●	●	●
3.2	Hydraulic axes	●	●	●
3.3	Pneumatic axes	●	●	●
3.4	Hybrid axes (Sytronix)	●	●	●
4	On-board interfaces			
4.1	sercos	●	●	●
4.2	Ethernet (TCP/IP)	●	●	●
4.3	PROFINET IO (master/slave)	–	□	□
4.4	EtherNet/IP (scanner/adapter)	–	□	□
4.5	PROFIBUS DP	–	□	□
4.6	DeviceNet (master)	–	▼	▼
5	Function modules			
5.1	Number of modules	2	4	4
6	Digital inputs/outputs			
6.1	On-board I/O	–	8/8	8/8
6.2	Inline (local) I/O (64 byte)	max. 512.	max. 512.	max. 512.
6.3	Via PROFIBUS DP	○	●	●
6.4	Via DeviceNet	○▼	▼	▼
6.5	Via PROFINET IO	○	●	●
6.6	Via EtherNet/IP	○	●	●
6.7	Via sercos	●	●	●
7	Functionality (selection)			
7.1	Single-axis positioning (PLCopen)	●	●	●
7.2	Torque-controlled single axes	●	●	●
7.3	Electronic gear	●	●	●
7.4	Master axis, angle-synchronous	●	●	●
7.5	Master axis, velocity-synchronous	●	●	●
7.6	Cams	●	●	●
7.7	Segmented curve profiles	●	●	●

● Standard

▼ In preparation

– Not available

○ Optional

□ Depending on variant

¹⁾ Control-based control hardware

Technical data

System software		IndraMotion MLC		
Hardware variant		L25 ¹⁾	L45 ¹⁾	L65 ¹⁾
7	Functionality (selection)			
7.8	Master axes virtual/real	●	●	●
7.9	Kinematics	2	4	8
7.10	Maximum number of axes per kinematics	8	16	16
7.11	Interpolation linear, circular, PTP	●	●	●
8	Functionality (hydraulics-specific)			
8.1	Best in Class controls	●	●	●
8.2	Synchronization controls (active/passive)	●	●	●
8.3	Alternating control	●	●	●
8.4	Force ramps/curves	●	●	●
8.5	Position-dependent braking	●	●	●
8.6	Sytronix controls	●	●	●
9	Engineering tool IndraWorks			
9.1	Multiple project management	●	●	●
9.2	Connection to version management systems (VCS)	●	●	●
9.3	Online language selection	●	●	●
9.4	Project navigator for logic- and motion control	●	●	●
9.5	Generic Application Template (GAT)	●	●	●
9.6	Motion- and logic programming:	●	●	●
9.6.1	IEC 61131-3	●	●	●
9.6.2	PLCopen function blocks	●	●	●
9.6.3	SEQ.ST – sequential programming (based on ST-Code)	●	●	●
9.6.4	IL – Instructions List	●	●	●
9.6.5	ST – Structured Text	●	●	●
9.6.6	LD – Ladder Diagram	●	●	●
9.6.7	FBD – Function Block Diagram	●	●	●
9.6.8	CFC – Continuous Function Chart	●	●	●
9.6.9	SFC – Sequential Function Chart	●	●	●
9.6.10	Library administration	●	●	●
9.7	Drive parameterization/wizards	●	●	●
9.8	Peripherals configurators	●	●	●
9.9	Cam editors	●	●	●
9.10	HMI project planning	●	●	●
9.11	Machine operation	●	●	●
9.12	Firmware management	●	●	●
9.13	Diagnosis tools	●	●	●
9.14	Remote diagnosis (web-based)	●	●	●

● Standard

▼ In preparation

– Not available

○ Optional

□ Depending on variant

¹⁾ Control-based control hardware

IndraMotion MLC for hydraulic drives – the solution for demanding applications worldwide

Like your success, motion logic systems from Rexroth are distinguished in the field of hydraulics. Rexroth products are developed with the support of a global network of product, application and service specialists and used around the world. In conjunction with IndraMotion MLC for hydraulic drives, Rexroth offers tailored training courses, application-related programming and commissioning on site. Chart the way for success with this unique application know-how and support!



Be it in presses, steelworks and rolling mill technology, material handling or special machinery – Rexroth offers the optimum motion logic systems.

Presses

- ▶ Ejector controls
- ▶ Glass presses
- ▶ Internal high-pressure forming
- ▶ Laboratory presses
- ▶ Metal/ceramic powder presses
- ▶ Tube forming presses
- ▶ SMC/IMC presses
- ▶ Brick presses
- ▶ Deep drawing presses/ die cushions



Steelworks and rolling mill technology

- ▶ 3-roll bending machines
- ▶ Curved-mold continuous casting machines
- ▶ Flying shears
- ▶ Ladle cars
- ▶ Mold oscillation



- ▶ Sand molding plants
- ▶ Segment adjustment
- ▶ Continuous casting machines
- ▶ Roll stands
- ▶ Turntable cooling beds

Material handling

- ▶ Belt feed
- ▶ Container cranes
- ▶ Quay cranes
- ▶ Train lifts
- ▶ Truck lifts



Special machines

- ▶ Thick plate turnover device
- ▶ Automatic rotary tables
- ▶ Screw conveyors
- ▶ Bending and pushing devices
- ▶ Coal distributors
- ▶ Motor turning plants
- ▶ Stretch bending machines



Woodworking machines
and many more

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