

# VISUALMOTION

## Open Control and Drive System for Press Automation

Metal forming with system



# Best in Class Performance for Press Automation

**How do you make press automation faster, more flexible, and thus more effective?**

VISUALMOTION, the complete system solution from Rexroth, the market leader in automation technology.

VISUALMOTION is the innovative Motion Control solution with integrated PLC, high dynamic drives and fully scalable in its operating philosophy.

Supporting all common standards, the performance and functional scope of this modular system concept can be customized exactly to the requirements of your application

Whether you want to realize simple single-axis or complex multi-axes applications – VISUALMOTION will enhance flexibility and dynamics, thus increasing productivity.

Therefore, VISUALMOTION will open new perspectives in your applications, improving your economic efficiency:

- Cut to length lines
- Charging and discharging feeders
- Electronic controlled press transfer
- Tandem press lines
- Crossbar and in-die transfer systems
- Stacking devices

Benefit from the advantages of VISUALMOTION:

**Faster project planning thanks to:**

- Clear structured programming & easy implementation
- Short learning phase
- Flexibility

**Increased plant safety thanks to:**

- Secondary encoders creating redundancy protection
- Safety in case of mains failure by using regenerative techniques

**Increased productivity thanks to:**

- Programmable online collision monitoring
- Preventive maintenance scheduling

The unique modular system of VISUALMOTION comprises Motion Control, PLC, and Digital Drives, as well as numerous possibilities for networking.



### Open architecture – scalable performance

Because of the open system architecture, machines for the global market can be equipped with the bus systems commonly used in the respective country. With this concept, VISUALMOTION protects investments, standardizing manufacturing plants and makes production processes more transparent.

Thanks to this openness the integration between hardware and software solutions of different manufacturers is seamless.

Thus, the control communicates through internationally established standards e.g.:

- SERCOS interface\*
- PROFIBUS-DP
- DeviceNet
- INTERBUS
- ControlNet
- Ethernet
- RS232/RS485

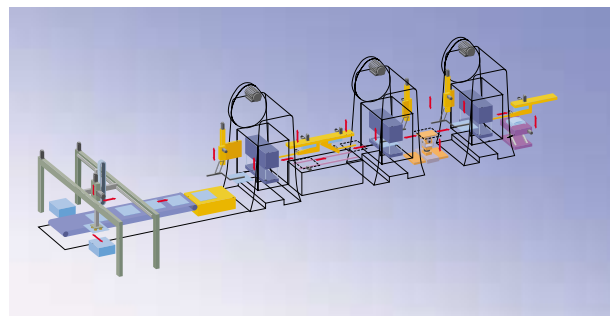
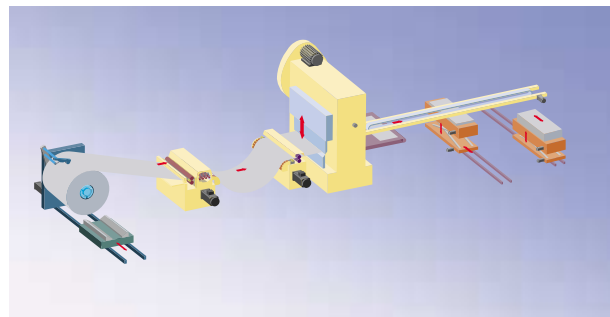
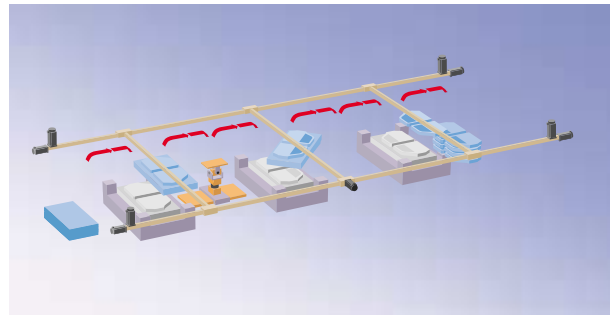
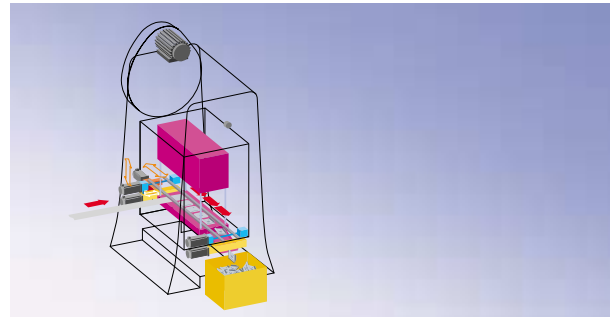
**SERCOS interface, the international standard drive interface (IEC 61491/EN 61491), provides simple interaction of digital drives and controls of different manufacturers, while ensuring optimum utilization of the characteristics of the individual products.**

Only the SERCOS digital interface between the control and drives can provide the high dynamic and precise servo movements necessary in press automation.

Through the modular VISUALMOTION control software you can control up to 40 axes whilst standardizing your specific functions which are transmitted easily and quickly to other machine units.

Fieldbus systems can be easily adapted by exchanging the interface cards and adjusting the configuration through a small number of parameterization steps.

Likewise our intelligent drives have a modular system and offer a scalable scope of functions, with a power spectrum of 0.1 kW to 650 kW catering for all the requirements of your application.



**VISUALMOTION opens new, economical and more efficient perspectives in all applications of metal forming.**

# Our Competence in your industry provides Superior Benefits

We know your industry as well as you do and we know how to protect your competitive edge – we've done so for more than 40 years. Based on our competence in this industry, we have included all the functions and advantages within our VISUALMOTION system solution to offer you the added value expected.

## Rigid mechanical parts replaced by flexible electronics

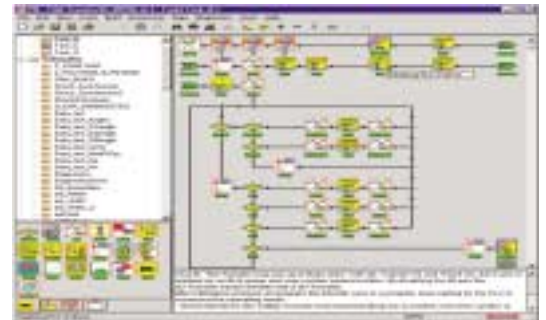
VISUALMOTION offers simply, high-precision synchronization of 40 servo drives per control through electronic cams. In larger-volume projects, synchronization is expanded via cross-communication to a maximum of 32 controls.

Depending on the system architecture, the cams can be produced on the PC with the integrated CAMBUILD tool, in the PLC program or in the Motion Control program.

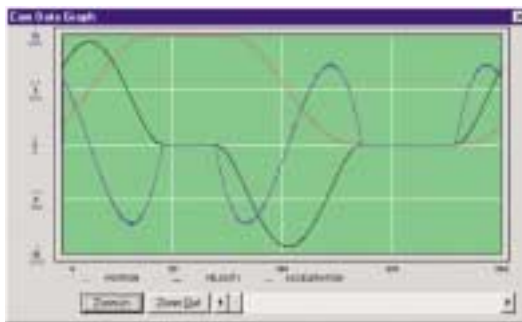
Target	Input Data	Output Data	Scale Output
	Degrees	Acceleration	Per repeating cam
			To percent
GPP7	0.000	0.000	0.000
GPP8	1.000	0.000	0.000
GPP9	2.000	0.000	0.000
Drive	3.000	0.000	0.000
Type	0.000	0.000	0.000
ACAM	12.000	0.150	2.500
PCAM	15.000	0.228	2.400
SCAM	18.000	0.571	2.813
VCAM	21.000	0.808	3.500
	24.000	1.132	4.500

## Greater transparency with graphical programming

Programming is done through a graphical environment or textual language. Graphical programming with defined icons reduces the familiarization period, speeds up program development and makes the manufacturing processes transparent.



With VISUALMOTION the machine manufacturer enjoys greater flexibility and the final customer receives optimum productivity by the flexibility of the motion control according to IEC 2143 or specific adaptations made for the customer.



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Graphic programming: easy, quick, and clearly structured.

Cam switches with on-line modification capability save additional costs of separate programmable limit switches.

### Pre-integrated logic

Often, it is possible to do without an additional PLC thanks to the centralized or distributed logic functionality offering analog and digital I/O devices. When your requirements are greater, an add-on PLC conforming to IEC 61131 communicates with the Motion Control via the back plane bus.



### Always the correct operating mode

- Electronic synchronization with a virtual or real master for press transfer systems equipped with loaders or feeders
- Contouring control system, e.g. for loaders with cartesian or non cartesian machine kinematics
- Single axis for advancing units or conveyor belts
- Electronic cam with downstream transformation of coordinates, e.g. for synchronization of loader and press

### Dynamic drives for increased productivity

Thanks to motors with low moments of inertia and high peak torques, the maximum possible number of press strokes can be realized. Extremely short feed times can be accommodated by the use of linear motors with excellent acceleration power.

### Safety for man and machine

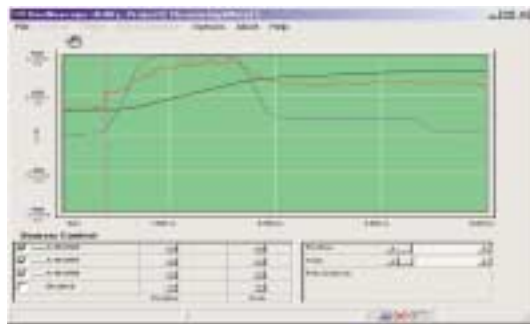
Our intelligent drive technology sets standards in operator safety too, internally generated functions such as safe stop operation, reduced feed rate and many other category III safety implementations, independent of the respective control. Redundant press and motor encoders ensure collision-free operation in case of encoder failure.

### Easy start-up and maintenance

Simplified drive parameterization through the



VISUALMOTION will guide you quickly and directly through all the start-up steps.



The integrated oscilloscope function helps you to optimize your system.

VISUALMOTION start-up assistant. All system relevant data and parameters as well as the user programs can be setup offline.

The integrated 4 channel oscilloscope helps you to check and optimize the control and drive parameters. Extensive diagnostic tools are included to assist service and maintenance personnel for troubleshooting and preventive maintenance.

# Intelligent Automation of Cut to Length Line

**VISUALMOTION is the complete solution, consisting of the Motion Control with integrated PLC, and the drives for cut to length lines.**

Equipping individual stations or automating a complete system from the uncoiler via the straightener to the feeder – whatever you want to do the modular system will meet all the requirements of your business.

The Motion Logic Integration in VISUALMOTION is a modern control architecture with successful implementations over a number of years at end users all over the world.

## Advantages

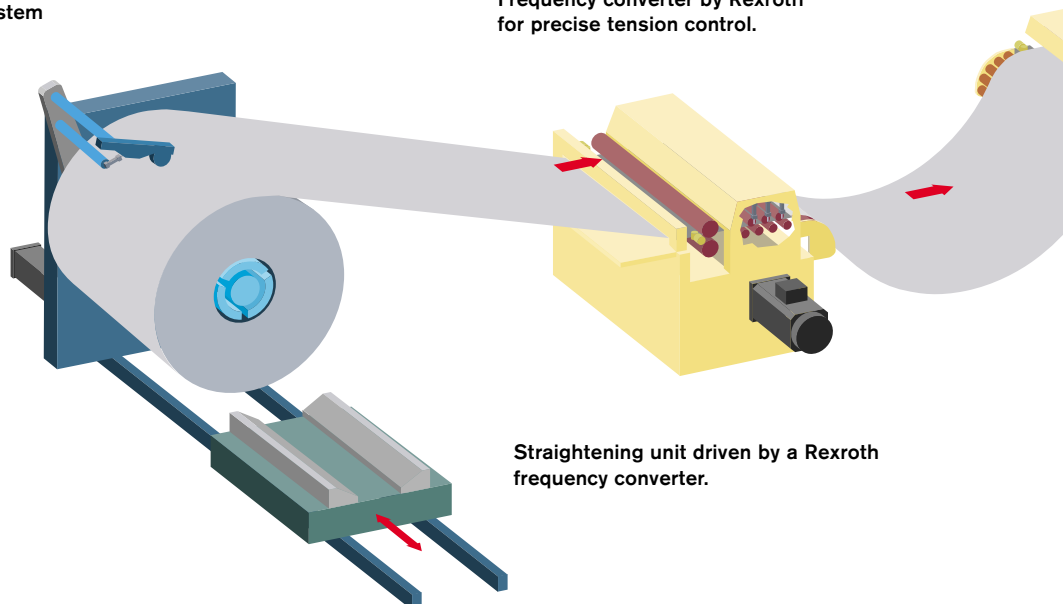
- Greater machine availability because of the reliable control and drive equipment and global support
- Higher stroke numbers due to the high dynamic servo axes and short system cycle times
- Protection of the mechanical system through selectable sequences of motion – high dynamic or soft motions depending on the respective part and material
- Fast product change thanks to shorter tooling setup times

## Characteristics

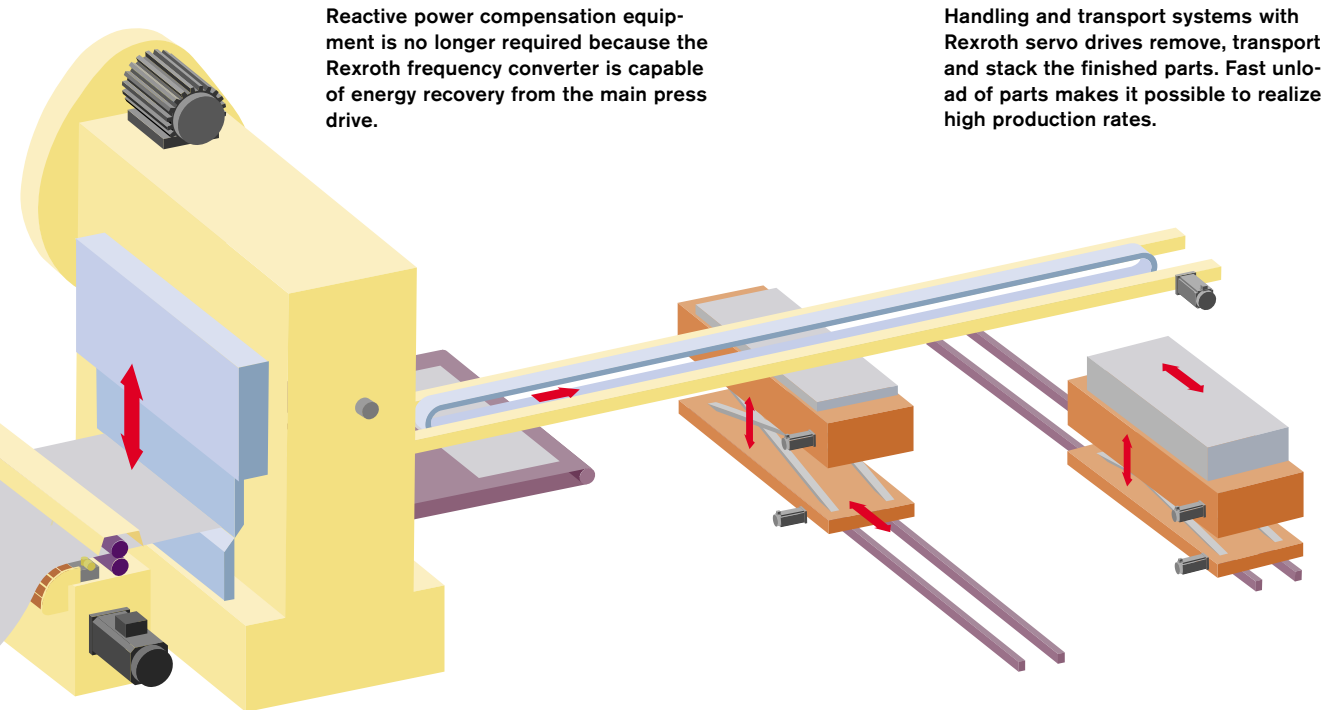
- Open system architecture supporting all common field bus systems, Ethernet, DDE and OPC, as well as the SERCOS interface
- Flexible, high performance Motion Logic integration
- System solution with continuity for all applications in the press plant
- Full range of high dynamic, robust rotary and linear motors

Hydraulic coil changing system by Rexroth.

Frequency converter by Rexroth for precise tension control.



Straightening unit driven by a Rexroth frequency converter.



Reactive power compensation equipment is no longer required because the Rexroth frequency converter is capable of energy recovery from the main press drive.

Handling and transport systems with Rexroth servo drives remove, transport and stack the finished parts. Fast unload of parts makes it possible to realize high production rates.

A high dynamic servo drive system feeds precisely and reliably the material into the press. The synchronization to the press is effected through cam switches or alternatively through electronic cams via a press encoder.

# Electronically Controlled Press Transfer – Systematic and Competent

**VISUALMOTION replaces expensive, high maintenance mechanical elements within in your press transfer system:** for example high-precision electric servo drives are used instead of cams or programmable limit switches. Thus, new machine concepts can be realized which ensure high precision synchronization of all processes – also between the electronically controlled press transfer and hydraulically controlled press.

## Advantages

- Higher stroke rates because of high dynamic servo axes and short system cycle times
- Shorter tool setup times due to the fast adjustment of all motion functions for the current part being manufactured
- Optimized, faultless part handling in all operating modes
- Protection of the mechanical system through selectable sequences of motion – highly dynamic or soft motions, depending on the respective part and material
- Avoidance of collision, downtime and repair costs

## Characteristics

- Open system solution with standardized interfaces to any PLC, PC or field bus.
- Expensive, inflexible mechanical cams are replaced by electronic cams
- Exact electronic synchronization of the press transfer for maximum press strokes
- Setting up transfer and tooling through a virtual master axis and checking for existence of obstacles
- Dynamic switching of press encoder and virtual master axis with cycle end and block restart
- Adaptable filtering of press encoder
- Integrated protective functions e.g. redundant motor and press encoders
- Strategic avoidance of collisions with power failure, including programmable error reaction



Rexroth frequency converter providing energy recovery offering maintenance free main press drives.

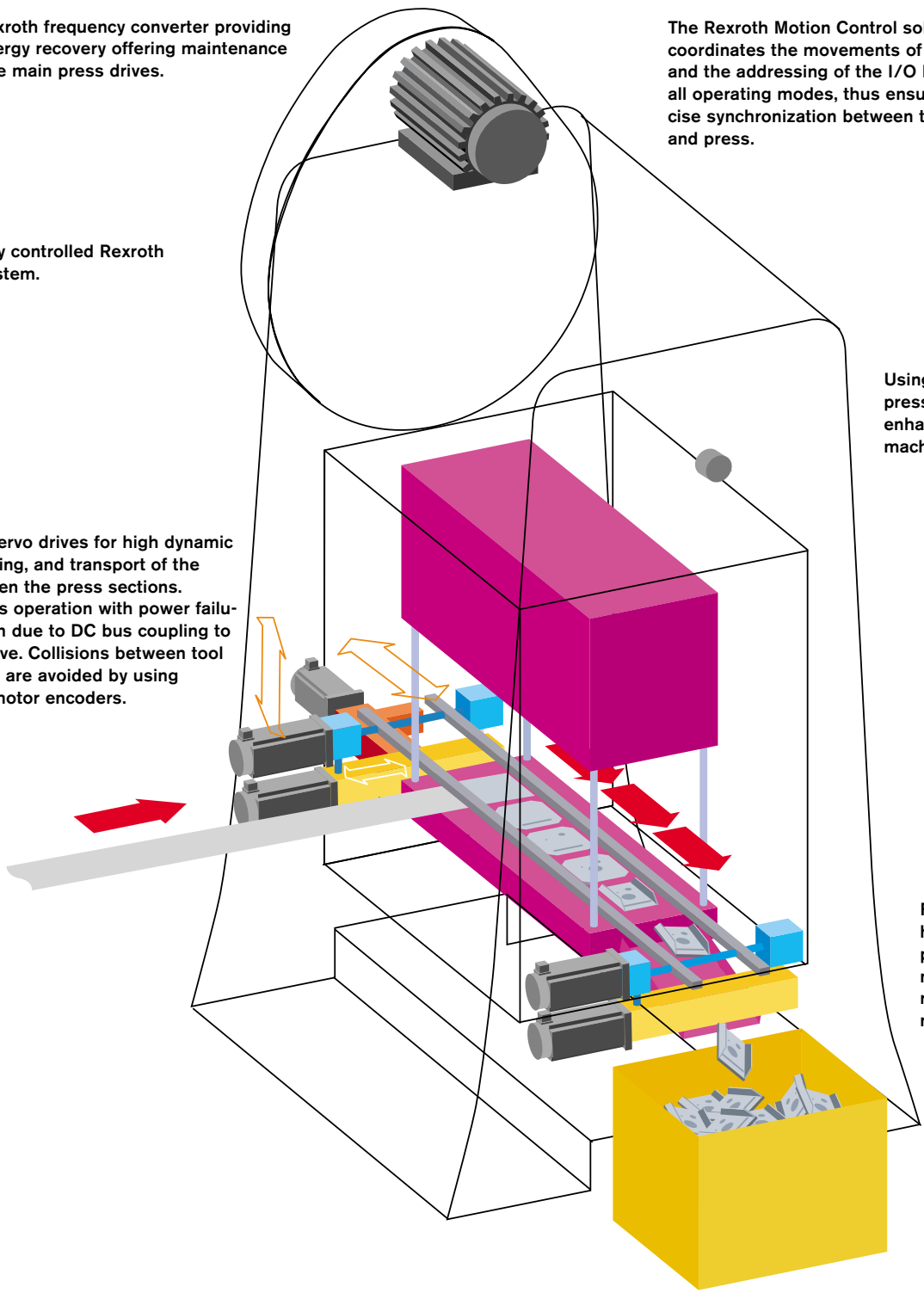
The Rexroth Motion Control solution coordinates the movements of all axes and the addressing of the I/O logic in all operating modes, thus ensuring precise synchronization between transfer and press.

Hydraulically controlled Rexroth coupling system.

Using redundant press encoder enhances machine safety.

Intelligent servo drives for high dynamic gripping, lifting, and transport of the parts between the press sections. Synchronous operation with power failure protection due to DC bus coupling to the main drive. Collisions between tool and transfer are avoided by using secondary motor encoders.

Finished parts of highest quality, produced with maximum stroke rates and minimum scrap.



# Modular, Flexible Automation of In-die Transfer Devices

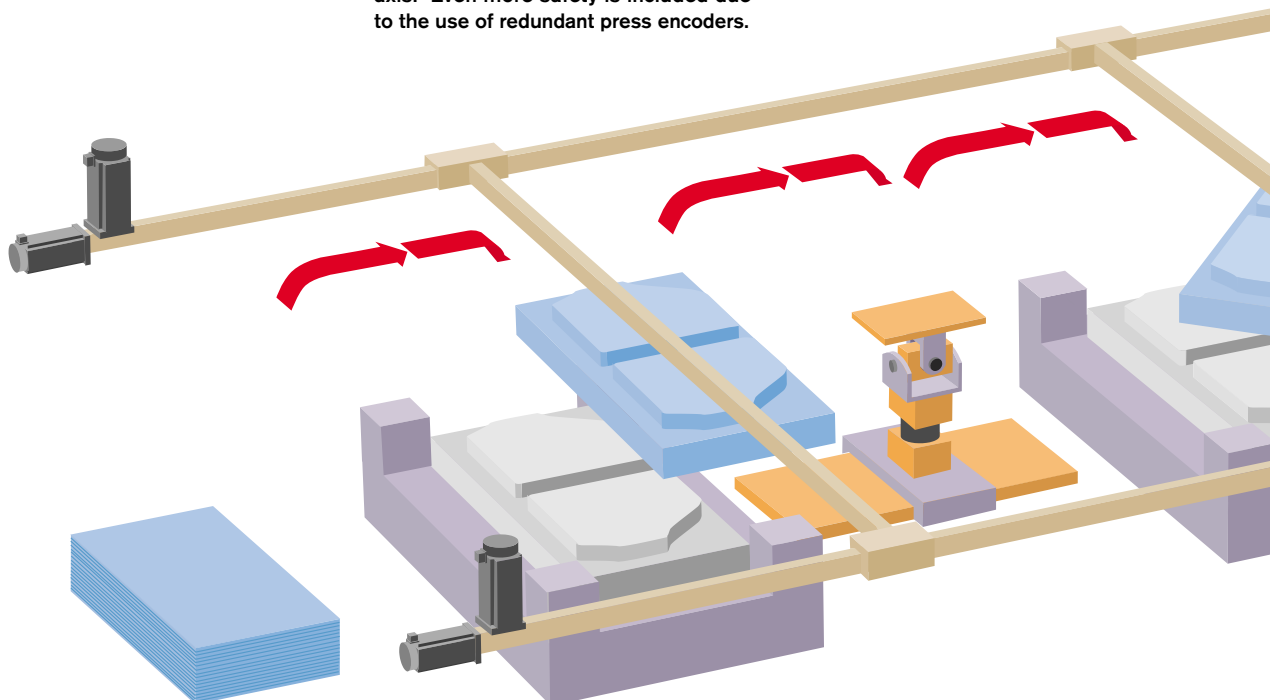
**VISUALMOTION** accurately, economically and efficiently synchronizes all axes of the in-die transfer system – from the unstacking device via tool cars and transfer axes to the stacking device and conveyor belts.

Thus, up to 32 controls synchronize with a maximum of 40 servo drives on each control. Faster start up, easier servicing and enhanced reliability thanks to the decentralized, modular system architecture.

## Advantages

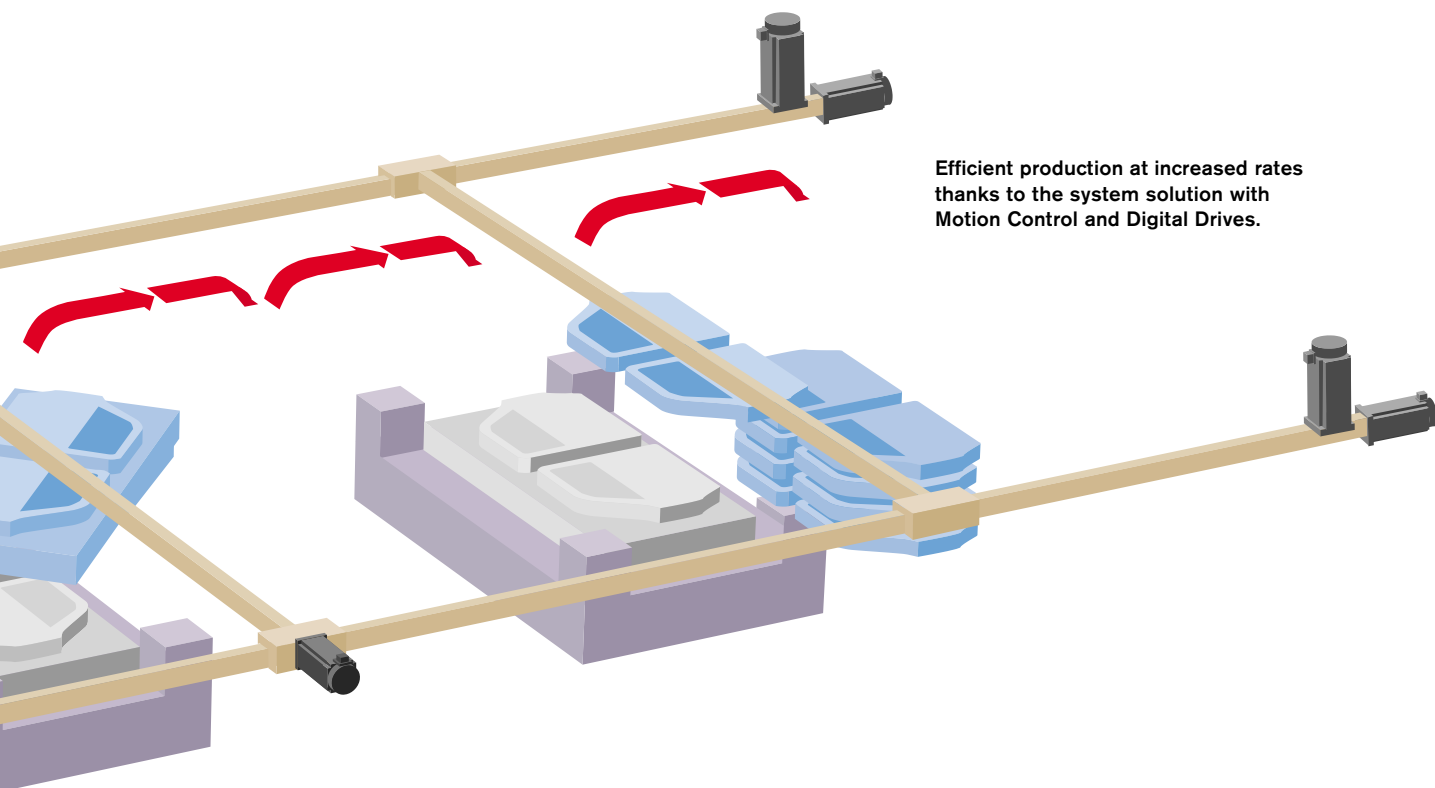
- Higher stroke rates due to the high dynamic servo axes and short system cycle times
- Shorter tool setup times due to fast adjustment of the motion functions of the currently manufactured part
- Optimized, faultless parts handling in all operating modes
- Protection of the mechanical system through selectable sequences of motion – highly dynamic or soft motion, depending on the respective part and material
- Avoidance of collision, downtime, and repair costs
- Faster start up, easier servicing, and high reliability thanks to the modular system structure

All movements of the servo axes are referenced to the press motion through electronic cams or via a virtual master axis. Even more safety is included due to the use of redundant press encoders.



### Characteristics

- Open system solution with standardized interfaces to any PLC, PC, or field bus.
- Expansion of the high precision synchronization up to 32 controls
- Expensive, inflexible mechanical cams are replaced by electronic cams
- Exact electronic synchronization of the transfer to the press with maximum press stroke rates
- Setting up of the press transfer and tooling through a virtual master axis and checking for existence of obstacles
- Dynamic switching of press encoder and virtual master axis with cycle end and block restart
- Adaptable filtering of press encoder
- Integrated protective functions as e.g. redundant motor and press encoders
- Strategic avoidance of collisions with power failure including programmable error reaction



Efficient production at increased rates thanks to the system solution with Motion Control and Digital Drives.

Reliable production due to well established strategies for collision avoidance.

# Interfacing of Press and Feeder – with Innovative Motion Logic Integration

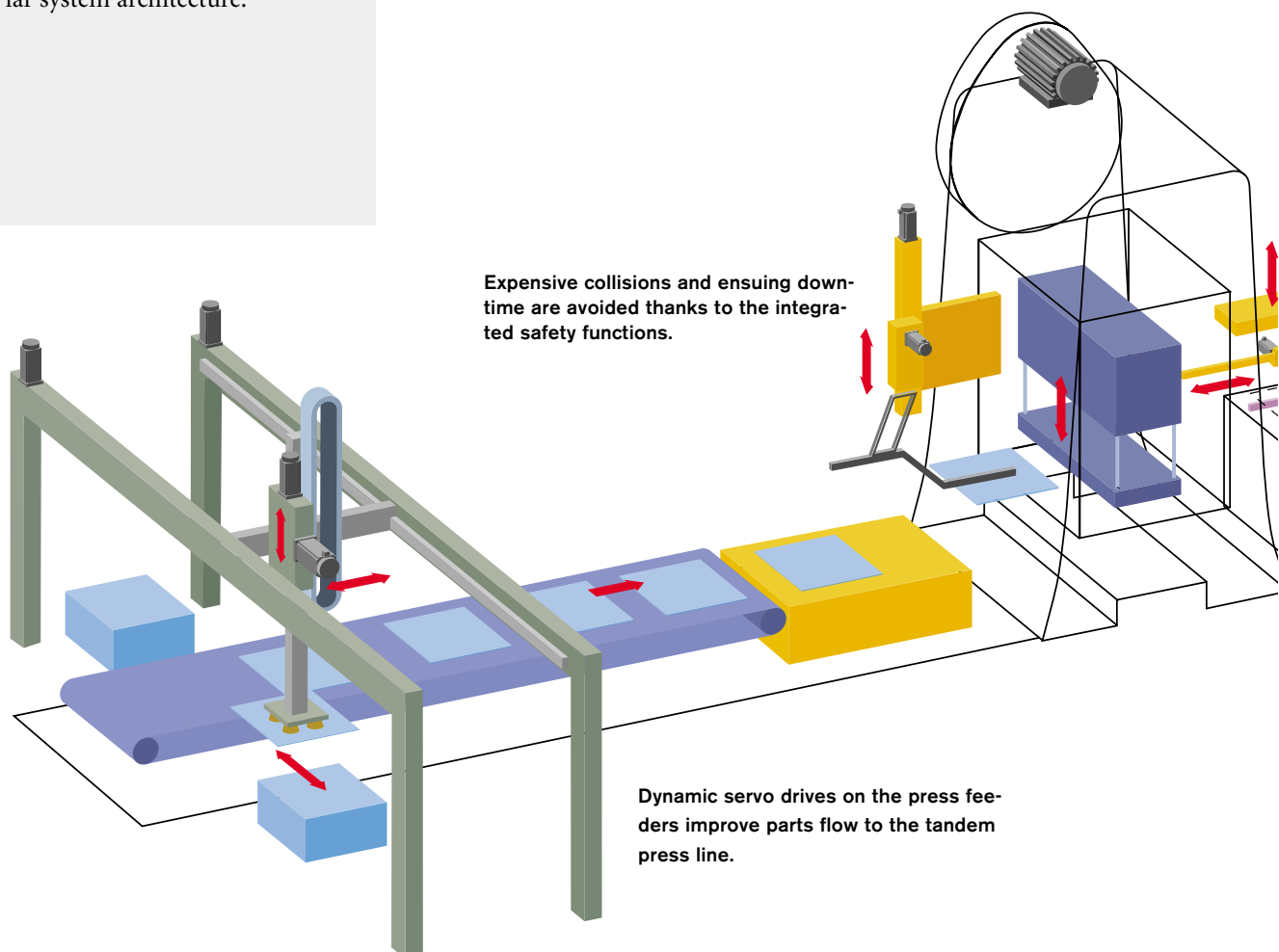
**VISUALMOTION ensures smooth transfer of parts between presses** at high rates and with state of the art safety characteristics. This includes control of unstacking and conveying devices, setting stations, orientation stations, part turning devices, tool changing devices, shuttles and the main press drives. Faster start up, easier commissioning and enhanced reliability thanks to the decentralized, modular system architecture.

## Advantages

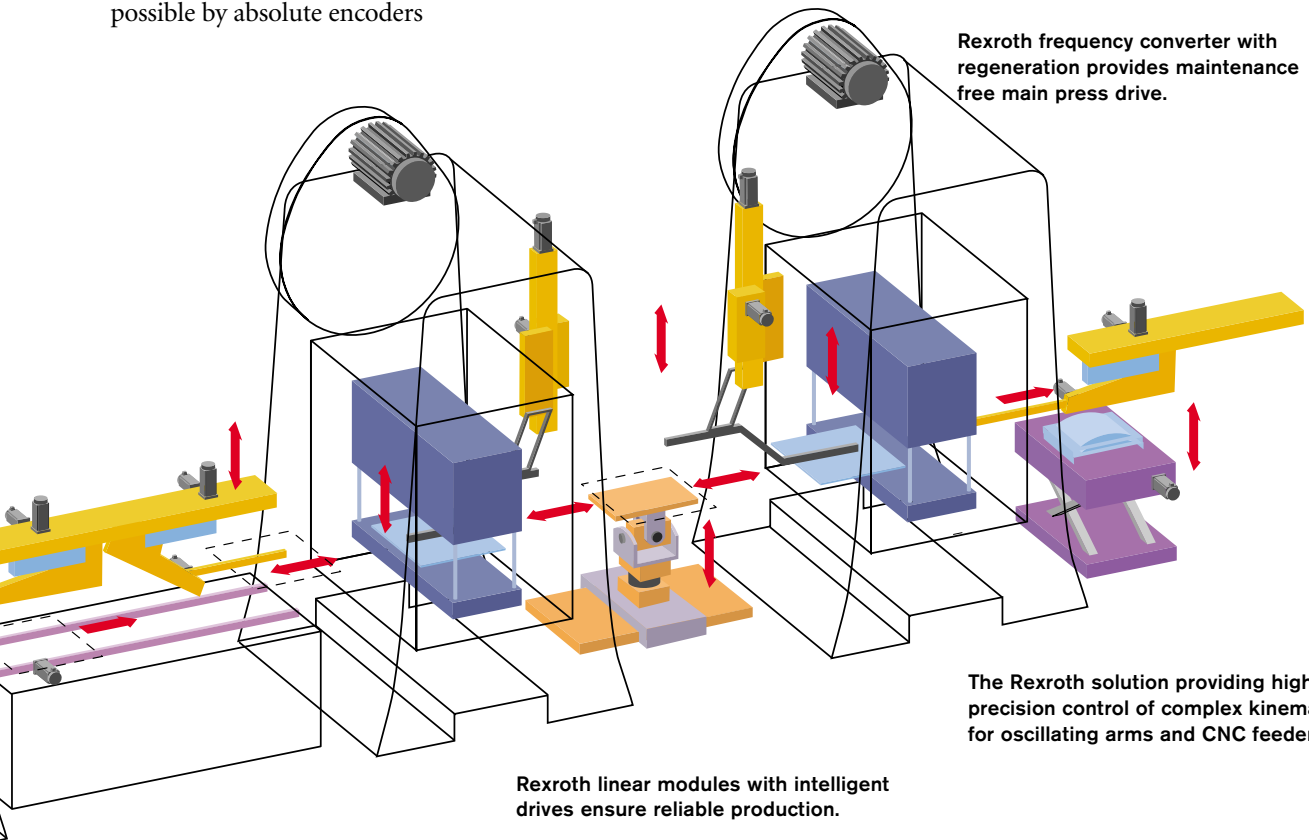
- Higher stroke rates due to high dynamic servo axes and short system cycle times
- Greater machine availability
- Faster start up, easier servicing and high reliability thanks to modular system architecture

## Characteristics

- Precise coordinated movements from setting stations to the complex kinematics of part loading robots
- Electronic cams for programming smooth motion processes
- High performance, flexible programming system for online warning and collision avoidance



- Preventive maintenance of the plant through programmable diagnostic outputs and oscilloscope function
- Fast restarts without resetting of zero or reference points is made possible by absolute encoders
- Higher press stroke rates due to dynamic and precise servo drives



The Rexroth solution providing high precision control of complex kinematics for oscillating arms and CNC feeders.

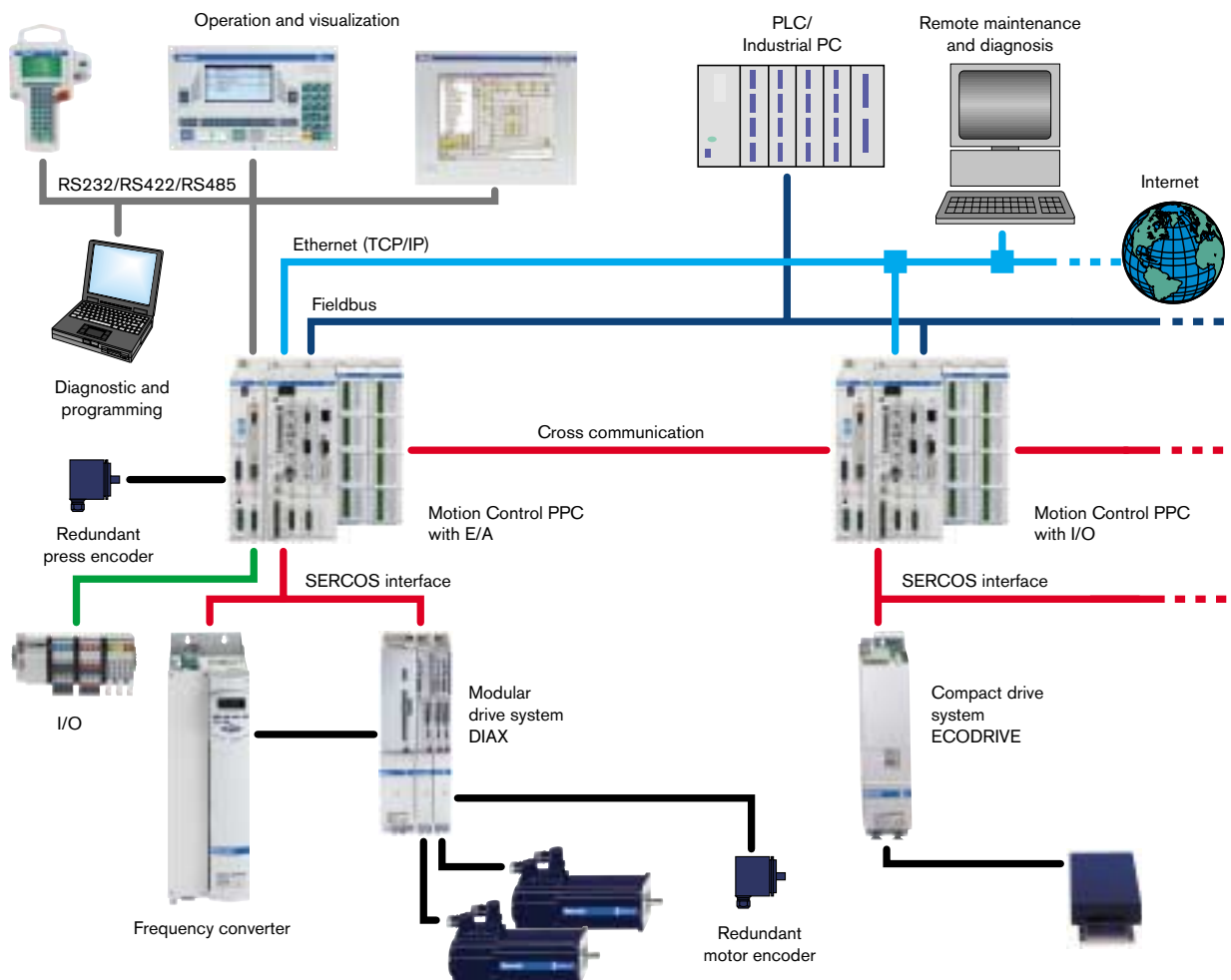
Complex part positioning with a multi axes orientation station – perfectly coordinated with VISUALMOTION.

# The Appropriate System Solution For Every Application

**Rexroth VISUALMOTION meets all control and drive requirements for press automation.** The scalable system concept allows for automation of all types of presses from simple independent machines to complex production plants.

System integration into existing plants is easy thanks to the open control structure and the support of standardized bus systems. The flexibility of the system is further increased by optional expansion e.g. a programmable dynamic limit switch, cross communication of controls for interference free transmission via optic fibers.

The central or distributed logic functionality with analog and digital peripheral I/O rounds off the system and often act as a substitute for an additional PLC. With the optional PLC the Motion Control can cater for more complex requirements.



**VISUALMOTION is the complete system solution for all applications in press automation.**

# The Right Components For Every System Solution

## User friendly HMI devices



- Clearly structured visualization and diagnostics of all system data
- Operating philosophy with complete continuity
- Extensive range of products from simple LCD operator interfaces to comfortable hand held terminals to PC based operator terminals

## Modular control hardware



- Plug in control cards in a variety of versions:
  - offering enough processor performance to suit standard applications for drives or control units and ISA bus and/or PC-104 version:
  - or maximum processor performance for complex applications such as a card rack
- Various plug in cards for Peripheral I/O

- Local diagnostics possible via integrated indicators
- Bus system connection: PROFIBUS, INTERBUS, DeviceNet and ControlNet

## High performance DIAX drive system



- Intelligent modular drive system with full load power up to 75 kW
- Power supply module with mains regeneration and direct mains connection capacity
- One and two axes controllers in extra narrow mounting style
- Long Travel high resolution rotary and linear motors

## Economical & efficient drive system ECODRIVE



- Compact drive system with full load power up to 24 kW
- Controllers with integrated mains section with small footprint
- Full range of rotary and linear motors
- Removable programming and parameterization modules
- Additional functions, e.g.:
  - programmable limit switch
  - fast inputs
  - analog I/O
- Alternatively, to be used as an independent single axis positioning drive with field bus or parallel interface

## Flexible frequency converter RD500



- Full load power up to 650 kW
- Direct mains connection with mains regeneration
- DC bus coupling with DIAX drives

# Functional Capabilities

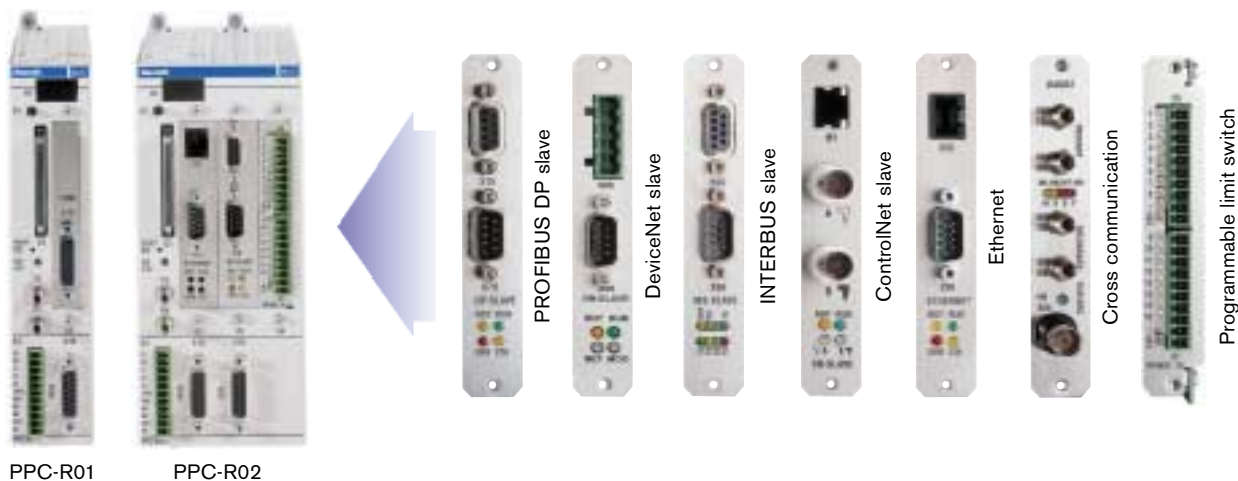
Control functions	VISUALMOTION
<b>1 Control hardware</b>	
1.1 PPC-R01 (Rack)	●
1.2 PPC-R02 (Rack)	●
1.3 PPC-P (PCI plug-in card)	●
<b>2 Control options</b>	
2.1 PROFIBUS-Slave	●
2.2 DeviceNet-Slave	●
2.3 INTERBUS-Slave	●
2.4 ControlNet-Slave	●
2.5 Ethernet (TCP/IP)	●
2.6 Cross communication	●
2.7 Dynamic hardware programmable limit switch	16/32 Bit
<b>3 Graphical programming</b>	●
<b>4 Textual programming</b>	●
<b>5 Debugging</b>	●
5.1 Program flow analysis (online)	●
5.2 Analysis of program structure and recording analysis	●
5.3 Single step operation (trace mode)	●
<b>6 User programs</b>	10
6.1 Sequence tasks per program	4
6.2 Number of subroutines	200
6.3 Subroutine pass word protection	●
6.4 Initialization tasks per program (SERCOS phase 2)	1
<b>7 Logic task for I/O (2 ms or 4 ms equidistant processing)</b>	1
7.1 And/Or logic	●
7.2 Counter function	●
7.3 Timer function	●
7.4 Trigger function	●
7.5 Shift register	●
7.6 Edge trigger flag	●
<b>8 Interrupt controlled programs</b>	●
8.1 Time triggered	●
8.2 Tracer triggered (Register input)	●
8.3 Triggered depending on link (positioning and path interpolation)	●
8.4 I/O triggered	●
<b>9 Maximum number of axes per control</b>	40
<b>10 Single axis modes</b>	●
10.1 Positioning axes	●
10.2 Rate controlled axes	●
10.3 Torque controlled axes	●
<b>11 Electronic line shaft (ELS)</b>	●

Control functions	VISUALMOTION
11.1 Phase synchronized axes	●
11.2 Velocity synchronized axes	●
11.3 Electronic cams (drive)	●
11.4 Virtual masters	2
11.5 Real masters	3
11.6 Link ring masters (cross communication)	1
11.7 Number of masters which can be activated simultaneously (incl. group masters)	6
11.8 ELS groups	8
11.9 Superimposition of cams	●
11.10 Electronic cams (control)	40
11.11 Maximum number of axes for each control cam	32
11.12 Dynamic synchronization between real and virtual masters	●
11.13 Clocked coupling and decoupling of synchronized axes	●
11.14 Monitoring of leading axis encoder	●
11.15 Online cam computation	●
11.16 Online computation of process dependant cams (CAM indexer)	●
11.17 Synchronization monitoring	●
<b>12 Kinematics function</b>	●
12.1 Kinematics transformations	●
12.2 Linear interpolation	●
12.3 Circular interpolation	●
12.4 Absolute space coordinates	●
12.5 Relative space coordinates	●
12.6 Protection zones	●
12.7 Teach function	●
<b>13 Cam switches (control)</b>	2 x 16
13.1 Online modification capability	●
13.2 Lead time functionality	●
<b>14 Diagnostic log (number of diagnostic messages)</b>	100
<b>15 Oscilloscope</b>	●
15.1 Number of channels (control)	4
15.2 Number of channels (per axis)	2
<b>16 PC based end-user tool for diagnosis, archiving, etc.</b>	●
<b>17 Modem support</b>	●
17.1 TAPI interface (Microsoft-Telephone Application Interface)	●
17.2 RS232/RS485	●



# Open Hardware Options

Control hardware	Description
Processor	Motorola Power PC
Program and data memory	1 MB FLASH (PSM PC card) 48 KB non volatile RAM
Expansion cards (optional)	1 for PPC-R01 3 for PPC-R02
Watchdog relay	Make contact element $U_n = 24 \text{ V}$ , $I_{max} = 150 \text{ mA}$
Programming interface (PROG)	RS232/RS422/RS485 Maximum data rate 115 kB (D-SUB, 15 pole, socket) electrically isolated
Serial interface (COM)	max. 2 RS232/RS422/RS485 Maximum data rate 115 kB (D-SUB, 15 pole, socket)
Degree of protection	IP20, EN 60529, VDE 0470
Real-time clock	Optional (with additional battery)
To be mounted in the control cabinet	with RECO module carrier RMB02.2 on DIN rail TS 35 x 27 x 15
Supply voltage	24 VDC (- 15 ... + 20 % acc. to EN 61131-2) max. power input 0,7 A (PPC-R01) 1,2 A (PPC-R02)
Noise immunity to electromagnetic environment	Criterion B acc. to EN 61000-4-2 (ESD) Criterion B acc. to EN 61000-4-4 (Burst) Criterion B acc. to EN 61000-5-5 (Surge)
Digital inputs for software interrupts	3
Miscellaneous	Four-digit status and diagnosis display SERCOS interface (up to 32 axes)



Depending on the number of the required expansion cards, the compact control hardware can be selected with one or three slots. Various commonly used field bus systems, cross communication and programmable limit switch interfaces are available as expansion cards.

# Flexibility in the I/O Periphery

I/O control units	Designation	Description
Card rack	RMB02.2-04	with 4 slots
SERCOS coupler	RMK02.2-LWL-SER	Decentralized SERCOS connection for I/O card rack
Digital inputs	RME02.2-16-DC024	16 inputs (24 VDC) in two electrically isolated groups
	RME02.2-32-DC024	32 inputs (24 VDC) in four electrically isolated groups
	RME02.2-16-AC115	16 inputs (115 VAC/60 Hz) in two electrically isolated groups
Digital outputs	RMA02.2-16-DC024-200	16 outputs (24 VDC/2 A) in two electrically isolated groups
	RMA02.2-32-DC024-050	32 outputs (24 VDC/0.5 A) in four electrically isolated groups
	RMA02.2-16-AC230-200	16 outputs (230 VAC/2 A) in two electrically isolated groups
Relay	RMA02.2-16-RE230-200	16 relays (switching capacity 200 W) separated into two electrically isolated groups
Analog inputs and outputs	RMC02.2-2E-1A	2 electrically isolated inputs with additional constant current source (2.5 mA) 1 analog output (voltage output $\pm 10$ V or current output (0 - 20 mA))



- Up to 4 card racks can be combined:
- with PPC-R01, up to 15 I/O control units
  - with PPC-R02, up to 14 I/O control units
  - with SERCOS coupler RMK02.2-LWL-SER for each decentralized unit, up to 15 I/O control units

# Compact Dimensions

