IndraMotion MLD
Drive-based motion logic system
Application guide
The innovative automation solution is based on IndraDrive, Rexroth’s intelligent drive system. With the integrated motion control and standardized PLC, it allows you to automate simple single-axis and complex multi-axis applications of up to 10 axes quickly and cost-efficiently. Industry-specific technology modules and open communication standards simplify integration into your machine concept.

Benefits:
- compact system for modular, distributed architectures
- drive-integrated motion control and PLC
- electronic synchronization of up to 10 servo-axes
- extensive function libraries with industry-specific technology functions
- certified safety technology compliant with EN ISO 13849-1, category 3 PL d and EN 62061 SIL 2
- open interfaces for communication, safety and additional encoders
- easy connection to I/O peripherals and sensors

IndraMotion MLD is a particularly economical automation solution for single-axis and multi-axis applications. The system integrates motion control and PLC functionality in a compact drive, making it ideal for a wide range of applications.
Simple
- easy implementation of complex processes thanks to ready-to-start solutions
- rapid installation through integration in the drive
- integrated engineering framework for project planning, programming, visualization and diagnosis

Open
- simple integration of customer know-how
- standardized PLC programming compliant with IEC 61131-3 with PLCopen modules
- open communication interfaces such as SERCOS III, PROFINET IO, EtherNet/IP, EtherCat, SERCOS 2, PROFIBUS, CANopen, DeviceNet, analog and parallel interface

Cost-efficient
- process-optimized through function libraries and technology functions
- minimized energy consumption thanks to high-precision electronic cams
- enhanced productivity through intelligent monitoring function for preventative maintenance
- minimized downtimes thanks to drive-integrated safety technology

IndraMotion MLD is the scalable single-axis or multi-axis system for cost-efficient automation, because in many cases it eliminates the need for a separate control system.
With consistent engineering for simplicity

IndraMotion MLD and the IndraWorks engineering framework allow you to handle all your engineering tasks in a uniform software environment. The integrated framework guides you unerringly through all steps – from project planning and programming to visualization and diagnosis.

The free programming means you can customize your application flexibly to meet your requirements. Innovative drive functions, extensive function libraries and process-oriented technology functions combined to deliver the perfect automation solution.

You can configure all types of applications consistently and intuitively. Wizard support and context-sensitive help make project planning both simple and transparent. Your programming work is facilitated by an integrated help system. Integrated test and diagnostic tools accelerate the commissioning of the machine software. The system status and process data are presented in a clear, manageable form during production.
Flexible in application

IndraMotion MLD can be flexibly integrated into a wide variety of machines, plant and processes, ensuring maximum productivity and economy.

Typical areas of application:

- conveying and warehousing systems
- general automation
- food and packaging machines
- forming machines
- handling and assembly systems
- plastics machines
- print and processing machines
- woodworking machines
Cross cutter applications may be guillotines with a knife or rotary die cutters with a rotating cylinder and several knives. IndraMotion MLD synchronizes the blades in exact correlation with the continuous material web to ensure cuts of defined length. If wires are being cut, for instance, the knife synchronizes with the material for cut-off. Thereafter it quickly returns to the home position in order to minimize the formation of burrs on the cut edge and allow the product to be transported away sooner. In other applications, such as when cutting cotton buds, the knife moves at the maximum speed of the knife cylinder in the cutting area. In this case the process is usually referred to as parting rather than cutting.

Typical applications

- rotary die cutter
- guillotine

Typical profile for a short size length

<table>
<thead>
<tr>
<th>Cylinder rotation in °</th>
<th>Position [mm]</th>
<th>Speed [mm/s]</th>
<th>Acceleration [m/s²]</th>
</tr>
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<tbody>
<tr>
<td>0</td>
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<tr>
<td>360</td>
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</tbody>
</table>
Technical solution

The perfect system solution

- **IndraWorks**
  Uniform engineering framework with connection by Ethernet TCP/IP

- **IndraControl**
  Scalable, controller-based operating and visualization devices with connection by Ethernet TCP/IP or RS232

- **IndraDrive**
  Intelligent drives with integrated motion logic, technology and safety functions

- **IndraDyn**
  Highly dynamic servo motors for maximum productivity

- **Inline**
  Compact I/O modules for analog and digital signal processing

- **SERCOS III**
  Ethernet-based real-time communication between the drives and I/O modules

Benefits

- integrated system software for efficient engineering
- high-precision drive synchronization using SERCOS III ensures less scrap and lower costs
- greater flexibility thanks to open programming compliant with IEC 61131-3 and PLCopen
- enhanced productivity through format changeovers on the fly by means of electronic synchronization
- minimized energy consumption due to precise cams

Characteristics and functions

- large size range: from 0.2 to 30 times the circumference of the cutting cylinder
- overspeed in the cutting area
- odometer encoder with slip and offset compensation for exact length measurement
- cosine beta correction for the precision cutting of thick material
- graphic operating interface for easy commissioning
- auto-tuning wizard
- integrated application examples with machine functions such as top/end cutting, cutting program, lock on/off and cut counter
Applications with power-controlled axes

In many modern assembly applications, press-fit and bonding technology is used to fit and assemble individual components. The bonding processes in assembly must be precise and reproducible. To that end a force sensor measures the precise press-fit force. IndraMotion MLD analyzes the measurements of the sensor and adjusts the necessary press-fit force accordingly.

**Typical applications**

- bonding systems
- press-fit systems
- feed systems on boring and grinding machines
- friction welding

**Automatic assembly station**

**Bonding process**

- Position [mm]
- Speed [mm/s]
- Press-fit force [N]
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Benefits

- reduced costs through simple project planning, commissioning and service
- simple commissioning with basic parameterization using prepared parameter sets
- transparent diagnostic for master/slave drive units and axis group
- IEC-compliant programming with PLCopen modules
- open communication across SERCOS III, PROFINET IO, EtherNet/IP, EtherCat, SERCOS 2, PROFIBUS, CANopen, DeviceNet, analog and parallel interface

Characteristics and functions

- high-precision power control up to 250 μs cycle time
- integrated evaluation of the force sensor
- enclosed stand-alone or sub-system solution
- wide power range of servo-drives
- widely supported field bus interfaces for higher level controllers
- easy-to-follow diagnosis of the overall system
- integrated PLC allows simple adaptation of the controller structure
Applications with axis coupling using cams

For banders, winders and coil-insulating machines, high-strength or insulation-capable strips are wound around rotors, coils or transformers at high speed. A servo-drive moves the rotor or coil with the product to be banded. It must follow the movement of the servo-drive that lays the banding strip according to a given pattern of movements. The two drives are coupled by means of a cam. IndraMotion MLD controls the whole process, selecting the appropriate cam for the product version.

Typical applications

- banders
- winders
- coil-insulating machines
Technical solution

The perfect system solution

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Characteristics and functions

- adjustable cam for axis coupling
- flexible position or torque coupling
- integrated position difference monitoring
- enclosed stand-alone or sub-system solution
- wide power range of servo-drives
- drives coupled in real time through cross communication with SERCOS III
- easy connection to higher-level controls using field buses, digital or analog interface
- easy-to-follow diagnosis of the overall system
Test stand applications

Test stands are used for the precise, reproducible testing of properties and mechanical loads on machines, machine parts and materials. The drive obtains the drive profiles from a higher-level control system. IndraMotion MLD controls the required torques and sets the necessary speeds. It also allows main drive pinions to be operated synchronously, e.g. with differential gearboxes, or facilitates damage management in the event of a shaft fracture.

**Typical applications**

- test stands for power unit, gearboxes and motors
- endurance and roller test stands
- strength and vibration test stands
Technical solution

The perfect system solution

- **IndraWorks**
  Uniform engineering framework with connection by Ethernet TCP/IP
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  Scalable, controller-based operating and visualization devices with connection by Ethernet TCP/IP or RS232
- **IndraDrive**
  Intelligent drives with integrated motion logic, technology and safety functions
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  Highly dynamic servo motors for maximum productivity
- **Inline**
  Compact I/O modules for analog and digital signal processing
- **SERCOS III**
  Ethernet-based real-time communication between the drives and I/O modules

Benefits

- reduced costs through simple project planning, commissioning and service
- simple commissioning with basic parameterization using prepared parameter sets
- simple adjustment in the event of product modifications
- transparent diagnostic for master/slave drive units and axis group
- IEC-compliant programming with PLCopen modules
- open communication across SERCOS III, PROFINET IO, EtherNet/IP, EtherCat, SERCOS 2, PROFIBUS, CANopen, DeviceNet, analog and parallel interface

Characteristics and functions

- precise torque and speed control
- electronic shaft through cross communication with SERCOS III
- rapid detection of shaft fractures with torque control
- integral evaluation of a torque measuring shaft
- enclosed stand-alone or sub-system solution
- wide power range of servo-drives
- easy connection to higher-level controls using field buses, digital or analog interface
- easy-to-follow diagnosis of the overall system
- integrated PLC allows simple adaptation of the controller structure
Applications for linear axis coupling

IndraMotion MLD realizes reliable, precise synchronization of individually-driven machine elements for gantries, pick-and-place robots, and equipment for inline machining. An electronic connection coordinates this movement between the drives – either as a position setpoint coupling or as a torque coupling. Position setpoint coupling (a gantry) is appropriate if the two axes are not rigidly coupled together mechanically. An absolute encoder measures the actual values and transmits these to the drive. If a mechanical connection exists, an electronic connection based on torque coupling is recommended.

**Typical machines**

- pick-and-place and assembly robots
- gantries
- discontinuous belts
Technical solution

The perfect system solution

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Benefits

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- simple commissioning with basic parameterization using prepared parameter sets
- simple adjustment in the event of product modifications
- transparent diagnostic for master/slave drive units and axis group
- IEC-compliant programming with PLCopen modules
- open communication across SERCOS III, PROFINET IO, EtherNet/IP, EtherCat, SERCOS 2, PROFIBUS, CANopen, DeviceNet, analog and parallel interface

Characteristics and functions

- flexible position or torque coupling
- integrated position difference monitoring
- connection of decentralized I/O modules and HMI devices
- enclosed stand-alone or sub-system solution
- wide power range of servo-drives
- drives coupled in real time through cross communication with SERCOS III
- easy connection to higher-level controls using field buses, digital or analog interface
- easy-to-follow diagnosis of the overall system
Safe and efficient solutions deliver cost effectiveness

Technology functions

When expanded with the industry-specific technology functions, IndraMotion MLD is tailored exactly to the requirements of modern production lines. The technology functions accelerate programming and facilitate the multiple use of your application program thanks to clearly defined structures and interfaces. That in turn enables you to cut engineering costs to a minimum and slash the time to market.

The individual basic functions can be combined and expanded to suit your individual user program, or you can just use them as a parameterizable function. To implement a technology, several function modules are grouped together to form technology packages. This allows you to easily realize machine or line functions by means of software.

Examples of technology functions:

- bell crank kinematics
- crank kinematics
- cross cutter with cross-seal function
- flying shear
- print mark control
- tension control
- touch probe
Safety on Board

Safety on Board is the name given to the certified safety technology from Rexroth – the pioneer in this field. The drive-integrated safety technology effectively protects man, machine and tool. With more than 18 safety functions conforming to safety category EN ISO 13849-1, category 3 PL d and EN 62061 SIL 2, it means you are always on the safe side.

- Safe Torque Off
- Safe Stop 1 and 2
- Safely Limited Speed
- Safe Direction
- Safely Monitored Position
- Safe Maximum Speed
- Safe Braking and Holding System
- Safe Door Locking
- Safe Communication
- etc.

Energy Efficiency

In its 4EE concept, Rexroth has developed solutions aimed at reducing energy consumption in production processes and in plant and machinery. IndraMotion MLD consistently turns this concept into reality, helping you secure a competitive edge by keeping energy consumption to a minimum. The key factors are innovative drive technology, a user-friendly configuration tool and energy-optimized motion design.

- optimum combination of drive control, motor, transmission and mechanics with the help of the IndraSize configuration tool
- energy exchange between motorized and regenerative drives through DC bus link
- use of efficiency-optimized IndraDyn motors that exceed the requirements of IE3 motors
## IndraMotion MLD – technical data

### Automation system IndraMotion MLD

<table>
<thead>
<tr>
<th>1</th>
<th>Control</th>
<th>Single-axis</th>
<th>Multi-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MLD-S</td>
<td>MLD-M</td>
</tr>
</tbody>
</table>

#### 1. Hardware options

<table>
<thead>
<tr>
<th>1.1</th>
<th>Control unit IndraDrive C/M – BASIC UNIVERSAL</th>
<th>MPB firmware</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control unit IndraDrive C/M – ADVANCED</td>
<td>MPH/MPC firmware</td>
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#### 1.2 Communication

<table>
<thead>
<tr>
<th>1.2.1</th>
<th>Master communication</th>
<th>SERCOS III slave (control unit option SE)</th>
<th>–</th>
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<tbody>
<tr>
<td></td>
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<td>PROFINET I/O slave (control unit option ET)</td>
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<tr>
<td></td>
<td></td>
<td>EtherNet/IP (control unit option ET)</td>
<td>–</td>
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<td></td>
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<td>EtherCat (control unit option ET)</td>
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<tr>
<td></td>
<td></td>
<td>SERCOS 2 slave (control unit option SE)</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td>PROFIBUS slave (control unit option PB)</td>
<td>–</td>
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<td></td>
<td></td>
<td>CANopen slave (control unit option CO)</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td>DeviceNet slave (control unit option CO)</td>
<td>–</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2.2</th>
<th>Cross communication</th>
<th>SERCOS III master (control unit option CCD)</th>
<th>–</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1.2.3</th>
<th>Other communication</th>
<th>Ethernet TCP/IP (HMI, control unit option CCD)</th>
<th>–</th>
</tr>
</thead>
</table>

### 2. Inputs and outputs

<table>
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<tr>
<th>2.1</th>
<th>On board</th>
<th>●</th>
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</thead>
</table>

### 3. HMI

<table>
<thead>
<tr>
<th>3.1</th>
<th>IndraControl VCP, VCH (controller-based)</th>
<th>Ethernet TCP/IP</th>
<th>–</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>3.2</th>
<th>IndraControl VEP, VEH (embedded PC-based)</th>
<th>Ethernet TCP/IP</th>
<th>–</th>
</tr>
</thead>
</table>

### 4. Drive systems

<table>
<thead>
<tr>
<th>4.1</th>
<th>IndraDrive C/M</th>
<th>Single-axis control units with MPB/MPH/MPC firmware</th>
<th>●</th>
</tr>
</thead>
</table>

### 5. Firmware functions

<table>
<thead>
<tr>
<th>5.1</th>
<th>Runtime system</th>
<th>Integrated Motion Logic system</th>
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</table>

<table>
<thead>
<tr>
<th>5.2</th>
<th>Logic control</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>IndraLogic V1 kernel</td>
<td>Conforming with IEC 61131-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freely configurable tasks</td>
<td>Cyclic, free-running, event-controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External event tasks</td>
<td>Synchronous with SERCOS cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Synchronous with master communication (FKM-synchronous task)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>System-specific (task acc. to position controller cycle)</td>
</tr>
</tbody>
</table>

- Default
- Optional
- Not available

1) In combination with control unit IndraDrive C/M – ADVANCED
5.2.4 Status/setting of cycle times
E.g. SERCOS cycle (1/2/4/8 ms)

<table>
<thead>
<tr>
<th></th>
<th>MLD-S</th>
<th>MLD-M</th>
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</table>

5.2.5 Program organization
According to IEC 61131-3

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<tbody>
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<td>5.2.5</td>
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</table>

5.2.6 Motion commands according to PLCopen (choice)
MC_MoveAbsolute, MC_MoveRelative, MC_TorqueControl, MC_MoveVelocity, MC_Home, MC_CamIn, MC_CamOut, MC_GearIn, MC_GearOut

<table>
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<tr>
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</thead>
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<td>5.2.6</td>
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</table>

5.2.7 Extended motion commands (choice)
MB_ReadListParameter, MB_WriteListParameter, MB_GearInPos, MB_PhasingSlave, MC_Reset

<table>
<thead>
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</table>

5.3 Motion control

5.3.1 Number of axes
Real/virtual
1/1
10/1

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5.3.2 Synchronization (ELS – Electronic Line Shaft)
Multi-axis

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<td>5.3.2</td>
<td>●</td>
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5.3.3 Positioning
Single-axis

<table>
<thead>
<tr>
<th></th>
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<td>5.3.3</td>
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5.3.4 Electronic gears

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5.3.5 Electronic cam

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5.3.6 Torque control

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5.3.7 Velocity control

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<td>5.3.7</td>
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<td>●</td>
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</table>

5.3.8 Diagnostics
Status, warnings, errors

<table>
<thead>
<tr>
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5.4 Technology functions (choice)

5.4.1 Print mark control

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5.4.2 Flying shear
In connection with IndraDrive firmware option: MA

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<tr>
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5.4.3 Probe

<table>
<thead>
<tr>
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<tr>
<td>5.4.3</td>
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5.4.4 Cross cutter
In connection with IndraDrive firmware option: MA

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5.4.5 Winder
In connection with IndraDrive firmware option: MA

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5.4.6 Tension control
In connection with IndraDrive firmware option: MA

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6 Engineering framework IndraWorks

6.1 General
Multilinguality of framework/projects, export/import of texts of the PLC projects, firmware management, deactivating/parking drives in the project, automatic detection of drives, real-time logic analyzer, oscilloscope function

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6.2 Configuration and project planning
System configurator, device library for controls, visualization and peripherals, commissioning wizards, project navigator, I/O configurator, fieldbus configurator, project archiving, offline parameterization of controls and drives, cam editor

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6.3 Programming
Graphical editors, textual editors, data types, special editor features, library management, libraries, online debugging and commissioning, offline programming

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