# Modular drive technology for packaging machinery

## ELAU iSH
## Intelligent Servo Modules

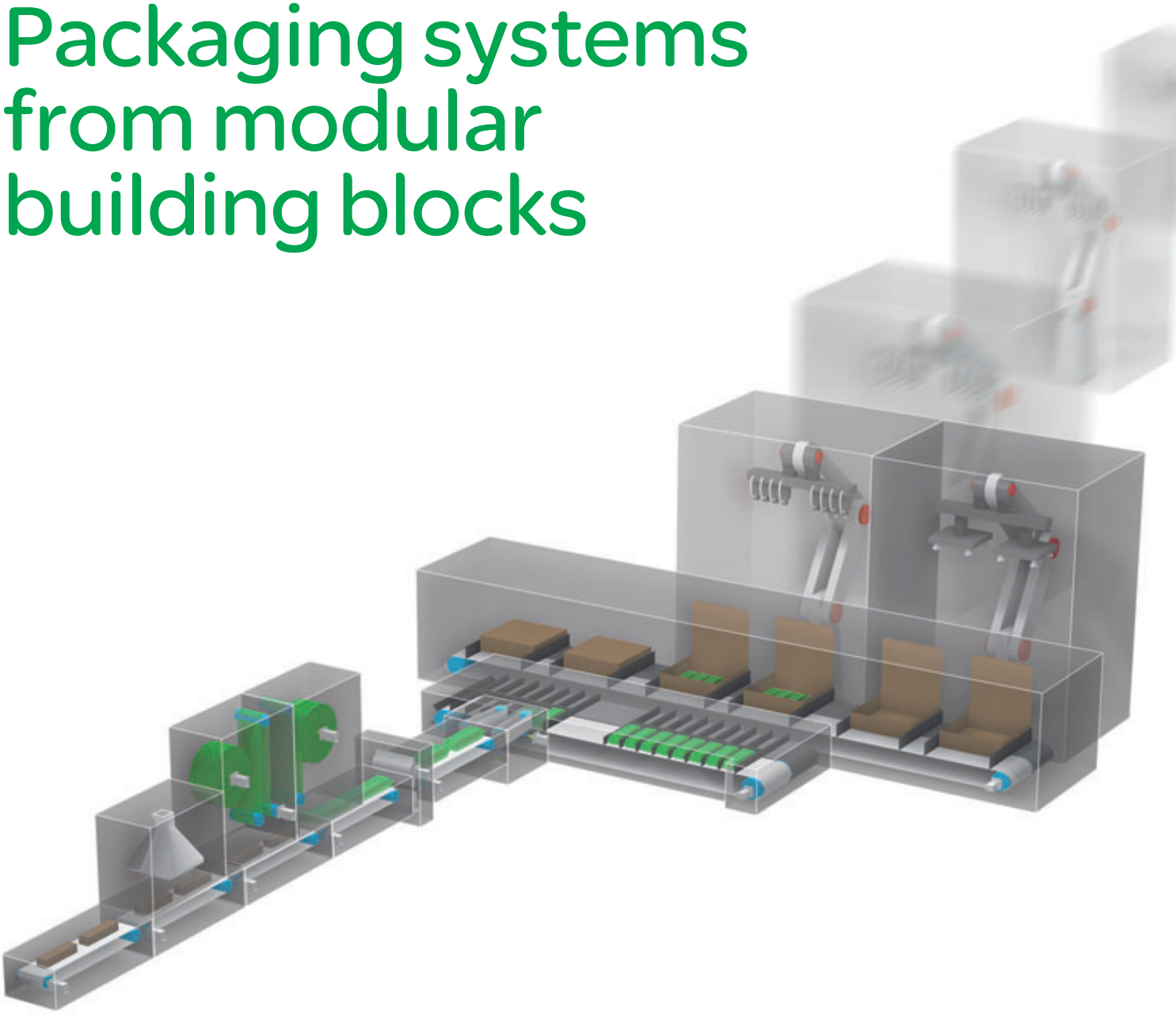
Enabling flexibility and efficiency


**ELAU** PACKAGING SOLUTIONS

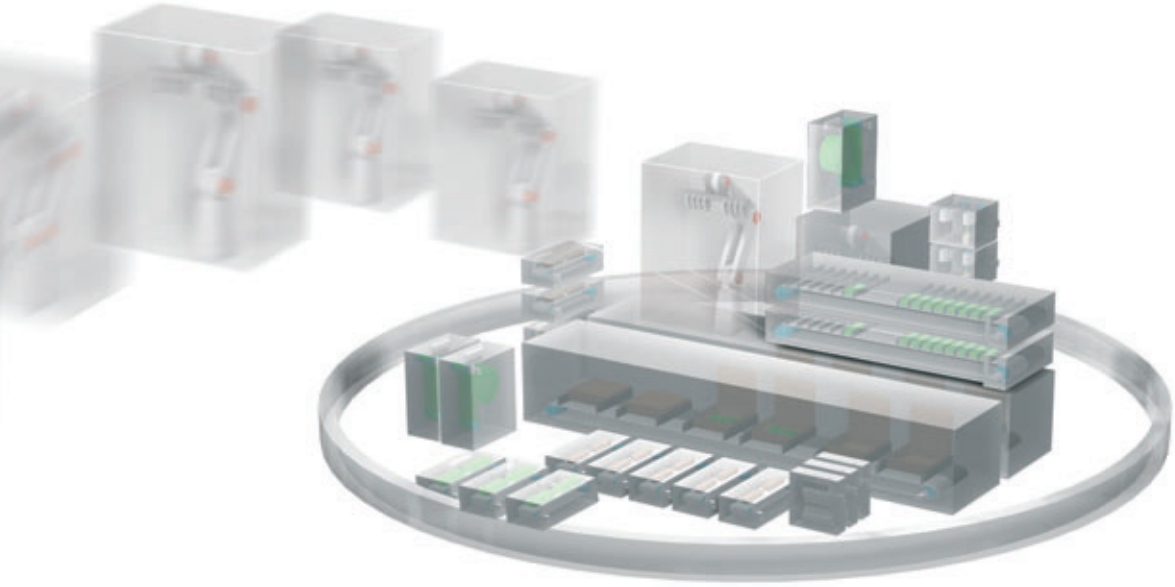
Schneider Electric

Vision

# Packaging systems from modular building blocks



## Modularity in Mechanics – Electronics – Software



**Pool of Machine Modules**
Many OEMs already base their designs on standardized, modular, reusable subsystems

Modularity is the key to achieving the next level of efficiency and flexibility in packaging machinery. Modularity allows packaging systems providers to deliver customized solutions from standard building blocks. Modules are pre-tested and consistent, reusable and reconfigurable. Modularity is to design what lean is to manufacturing, giving OEMs a new competitive advantage in the world marketplace.

## Trend in machine design – Gain competitive advantage through modularity

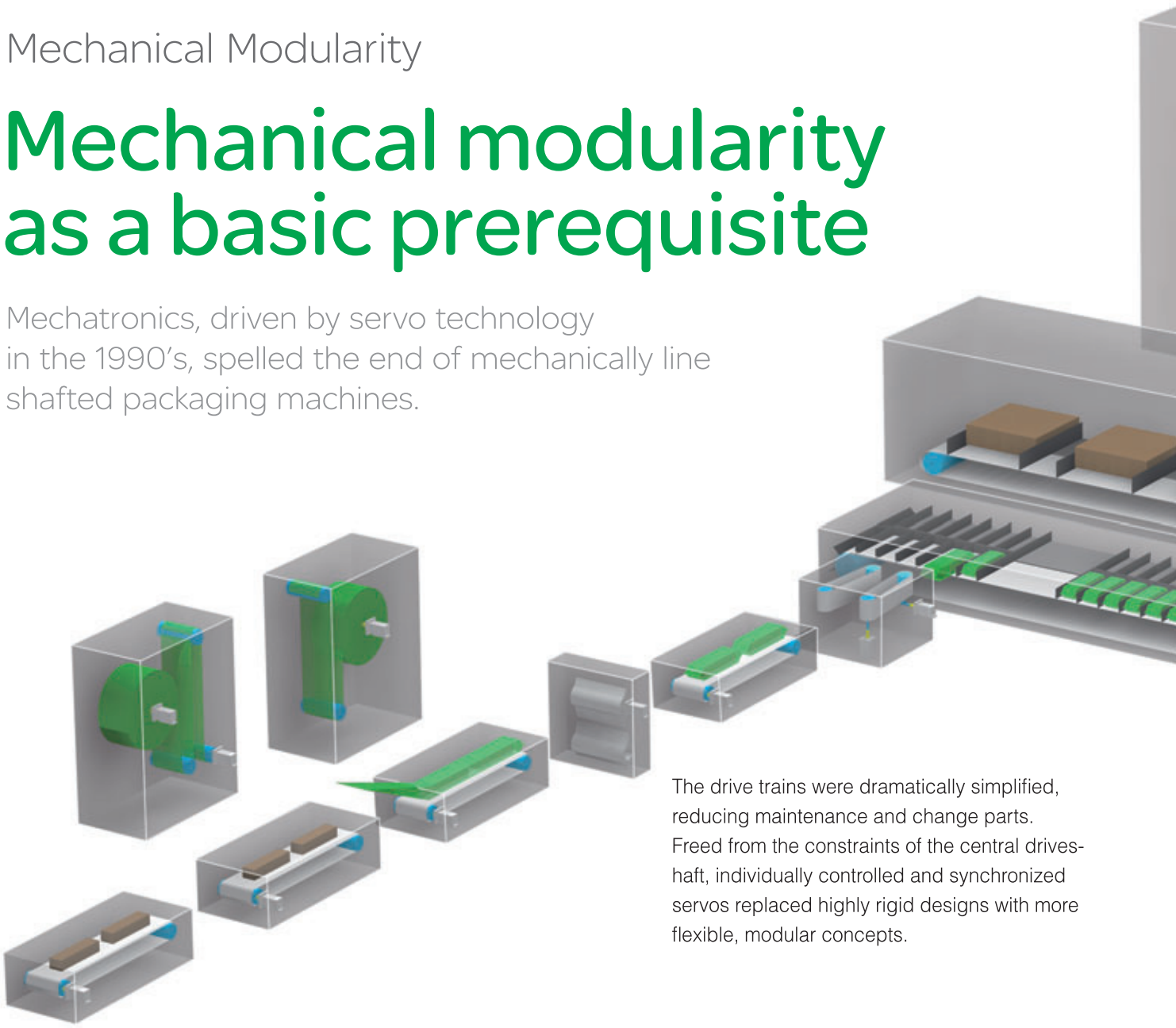
Shorter delivery times mean faster time-to-market for packagers whose products have increasingly short life cycles. Plug-and-play reconfigurations and changeovers mitigate capital risk and support asset management. Modularity reduces Total Cost of Ownership and turns packaging operations into a strategic business advantage. Modularity supports mechatronic design, a multidisciplinary approach that integrates mechanical, electronic and software engineering processes. To unlock the full potential of mechatronics, machinery designers will apply modular design principles across all three disciplines. Most recently, we've brought an unprecedented level of modularity to the software. What's been missing until now is a modular implementation for electronics.

## Intelligent servo modules – Key technology for the future

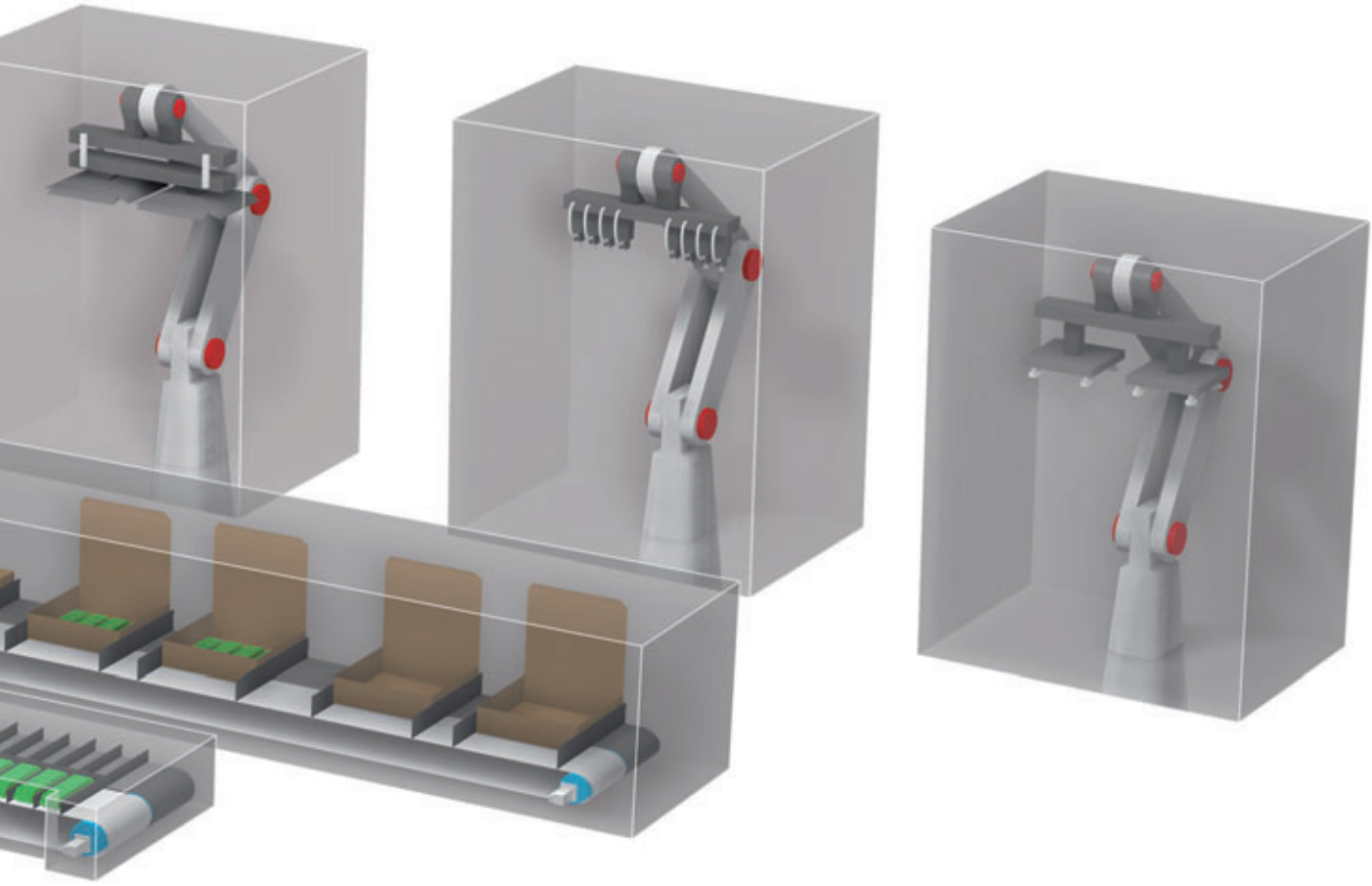
PacDrive Intelligent Servo Module technology reinvents how packaging machinery is networked, distributing I/O and servo drives out of electrical cabinets and onto individual machine modules. Electronic hardware and electromechanical actuators become one. The impact of this new modularity is truly game changing.

# Mechanical modularity as a basic prerequisite

Mechatronics, driven by servo technology in the 1990's, spelled the end of mechanically line shafted packaging machines.



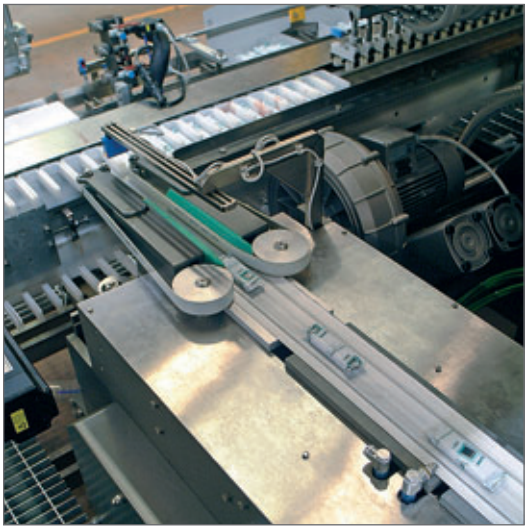
The drive trains were dramatically simplified, reducing maintenance and change parts. Freed from the constraints of the central drive-haft, individually controlled and synchronized servos replaced highly rigid designs with more flexible, modular concepts.



## The benefits are convincing:

Connected only by a maze of wires and cables instead of gears and jackshafts, machine sections could operate independently and synchronize with upstream and downstream operations. These modules could be reused instead of designed from scratch for each new machine, and modules could be commissioned as they were completed. Time and cost savings resulted.

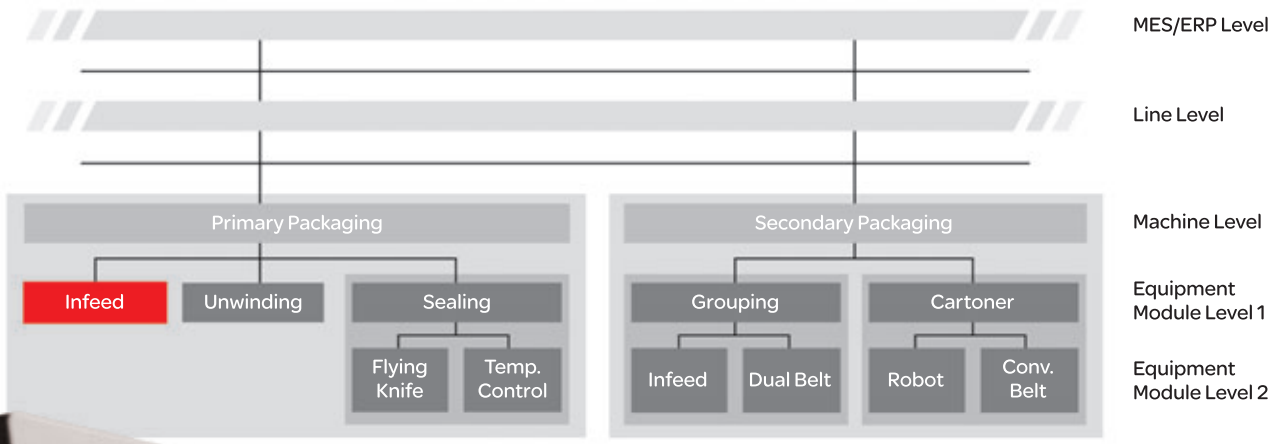
However, the prerequisites must be met as well: Only the transition in the design of independent, mechanical function units establishes the basis for comprehensive modularity.
At the same time, the previously practiced sequential engineering must give way to an interdisciplinary, mechatronic development process.

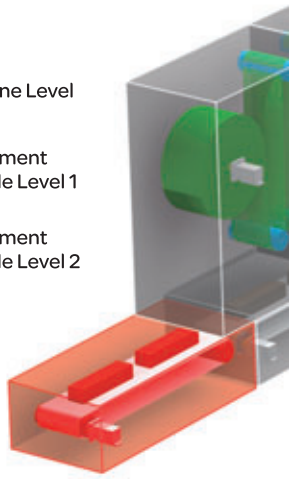


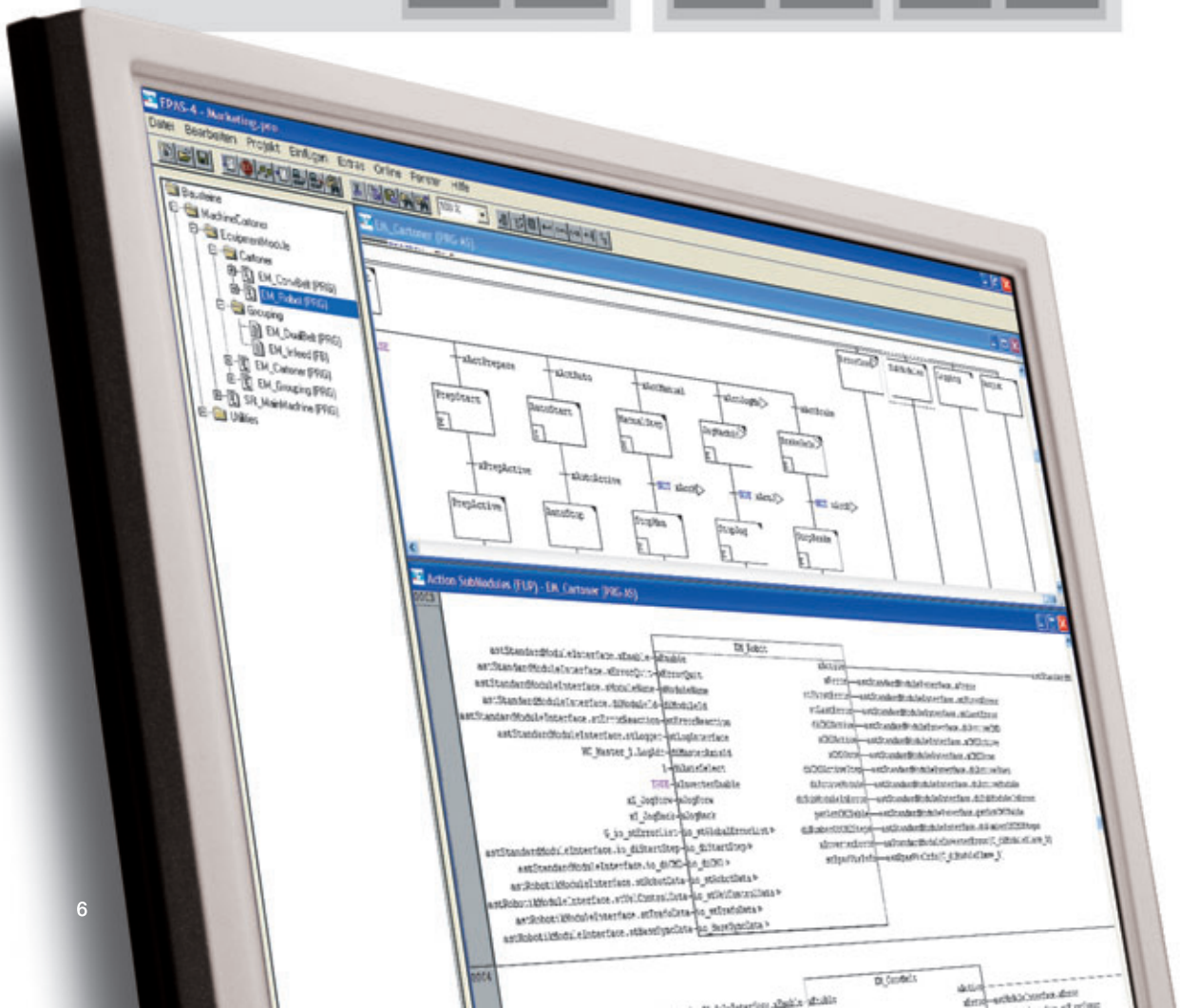
**Modularity in practice**
Individual mechatronic units can be reused in different machines

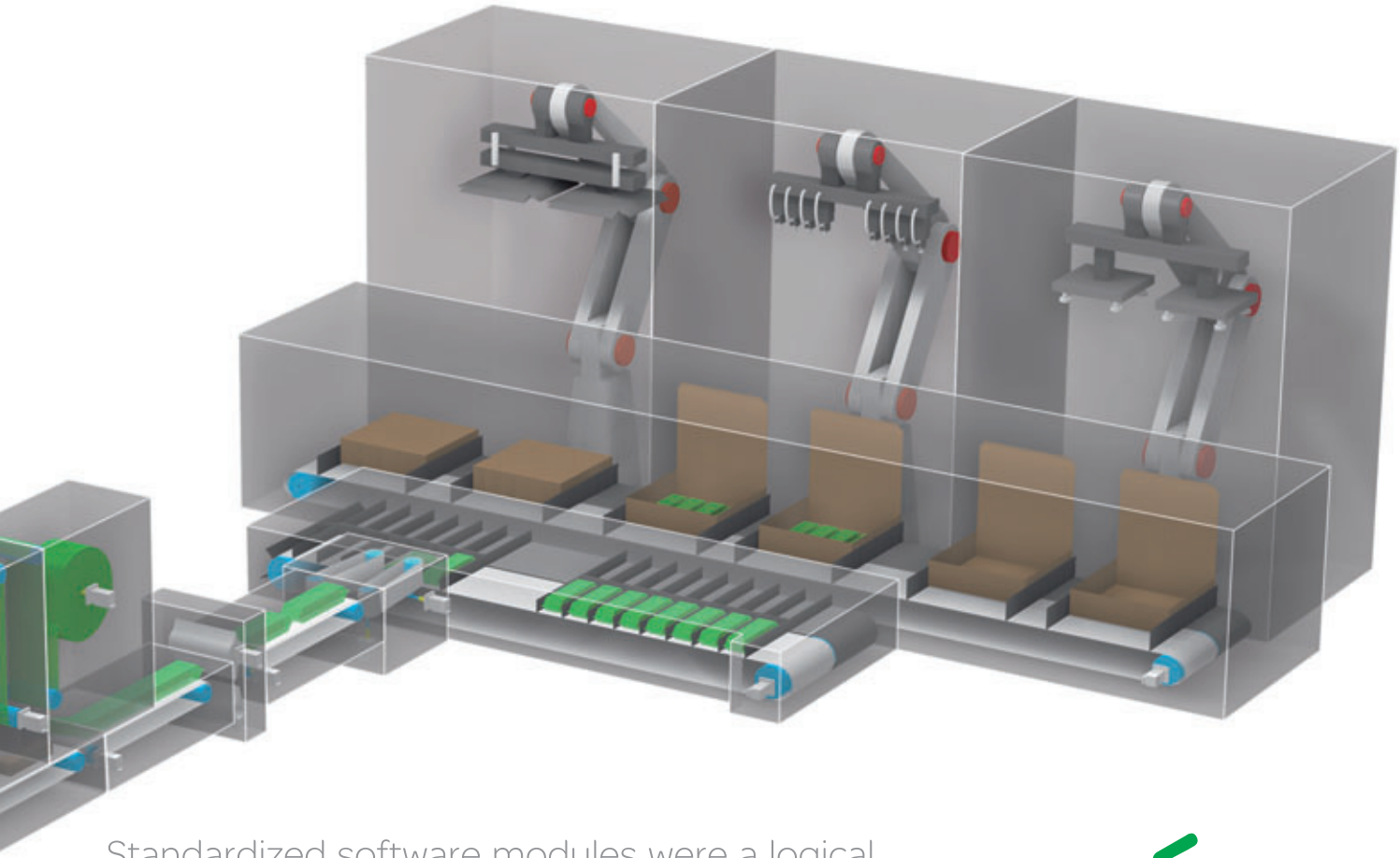
This means: Mechanics can no longer be developed separate from software and electronics.

# Modularity represented in Software as well







Machine modules are mapped to the software as equipment modules

Standardized software modules were a logical progression and an alternative to programs containing hundreds of lines of custom code to write and debug. By the late 1990's, ELAU had developed a software template and a library of software objects to control the basic functions of packaging machinery.

## The ELAU Template is foundation for consistent modularity

Today the library contains software modules corresponding to complete equipment modules, such as form/fill/seal, capping and robotic packing.

The result is vastly simplified software development and documentation. Writing a new program or recipe consists of configuring the new parameters in a software object rather than programming. Packaging system providers can use the object contained in the library and encapsulate their intellectual property in their own objects. Likewise, ELAU's template also promotes continuity to ensure well structured code from project to project. Moving forward, software modularity is now an absolute requirement, and not only to make development more efficient. It makes code much more economical to own, as programs are readily visualized, faults are easy to locate, and the training for one machine can be applied to subsequent machines.

**The future**
will only bring more servos and cabling to packaging systems

Status Quo

# Overcoming the last hurdle: Modularity in the electronics as well?

What wasn't readily apparent at first now presents the next challenge. Ten, twenty or more servos are not uncommon on a packaging machine today to provide fully automated operation for push button format changes, multiple filling and capping heads, collators, continuous material replenishment and more. These are all emerging requirements of packaging operations.

It just makes sense. Servo technology is the cost effective alternative to grinding new cams, extensive changeover downtime, and living with inconsistent quality caused by 'dialing in' manual adjustments that are different for every operator. So there's no going back to the status quo.

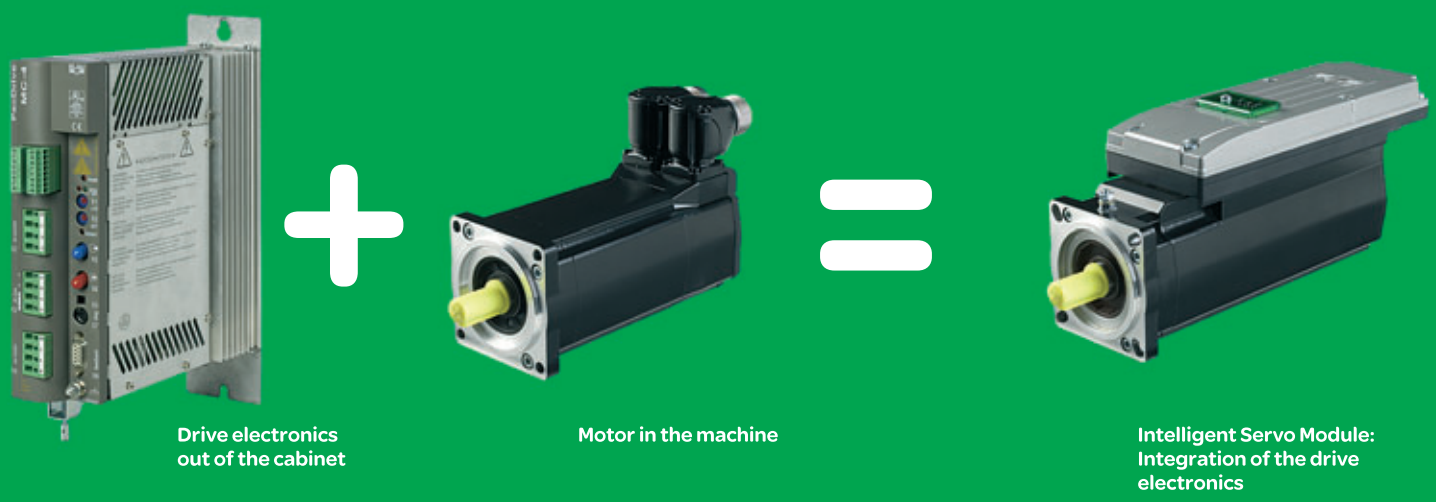
As a result, electrical cabinets are growing in size. Servo cables are growing in number with two per motor snaking from the electrical cabinet out to each motor. To streamline servo installation and maintainability, the time is right for the third breakthrough in modularity – electronic modularity.

Electronic Modularity

# iSH consistently moving toward machine modularity

**Take up less cabinet space**
The drive electronics make their way out to the motor. Cabinet size and cabling are cut by 90%

Using a 16-axis packaging system as a benchmark, this **reduces cabinet space by an impressive 90%**. At the same time, packaging system providers who've adopted the servo modules report **cabinet wiring time savings of up to 90%**. There is no down side for packaging system builder or owner. Even initial **component costs are reduced 15%** compared to conventional servos.




The PacDrive Intelligent Servo Module is a deceptively simple concept that is game-changing in its execution: The servo drive is merged with the motor out on the machine frame. Now, the only PacDrive components in the electrical cabinet are a common power supply for up to 25 Intelligent Servo Modules and the PacDrive automation controller.

**90%**
**less cabinet space**

**90%**
**less wiring time**

**15%**
**reduction in hardware cost**

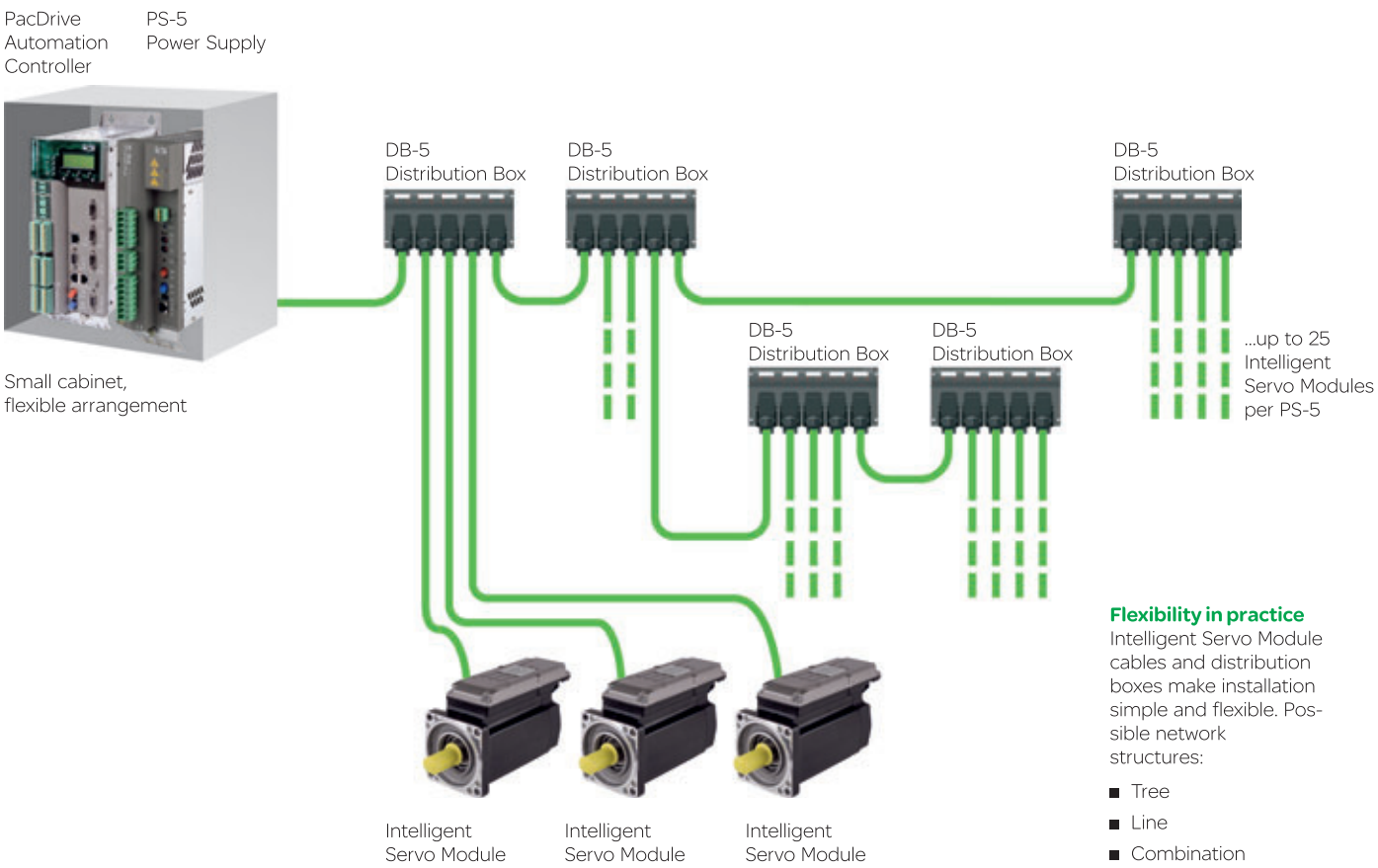
# 70%

## less cable

There's never been such a servosystem, combining minimum cable runs with maximum freedom of application. And these are not the previous generation of integrated motor/drives. This is a fully synchronized multi-axis motion system with all the capabilities of a conventional PacDrive automation system.

Cabling

# Network concept: versatile and simple




**Flexibility in practice**
Intelligent Servo Module cables and distribution boxes make installation simple and flexible. Possible network structures:

- Tree
- Line
- Combination

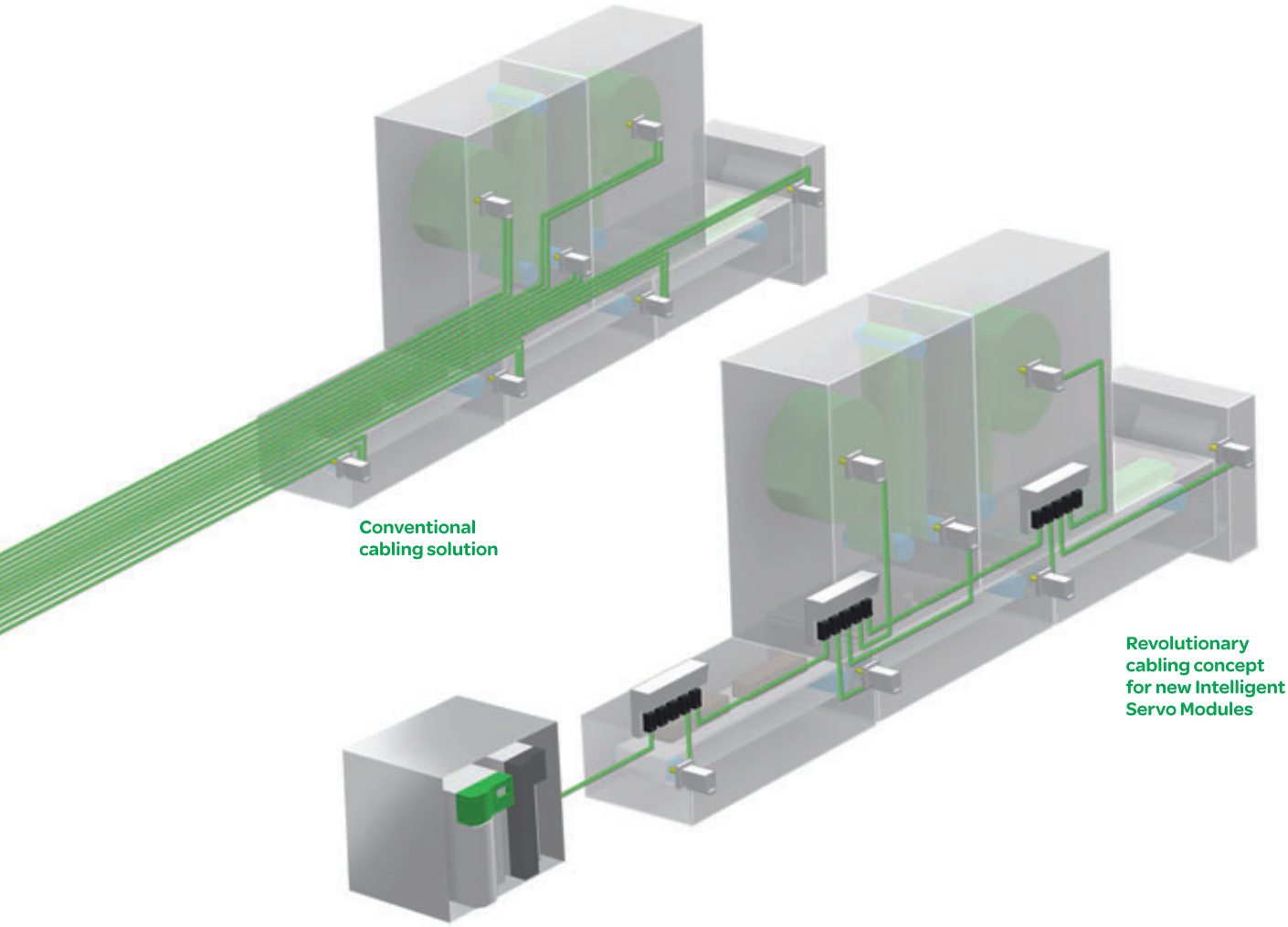
A single cable runs from the control cabinet to the first distribution box. From there, a single cable drops down to each Intelligent Servo Module mounted out on the machine, where the actuator is needed. Then, another interchangeable cable runs from that distribution box to the next. The distribution box concept enables great flexibility, serving as the hub for each equipment module.

There's just one cable path for up to 25 Intelligent Servo Modules. There's no daisy chaining, no ring back to the cabinet, and no single point of failure at the servo module. Instead, there's the flexibility of a tree or line topology, or a combination of the two – and **70% less cable** than conventional servosystems.

Plug & Play

# As easy as: insert and snap

The Intelligent Servo Modules' multifunctional cable comes with an equally functional quick-connect, snap-fit connector on each end. Plug it in, snap it closed and the green signal LED lights up.




## Pure plug & play

There are no junction boxes to open, no wires to connect. Add any of the I/O options on the following pages, and there's no need to add a separate device network.

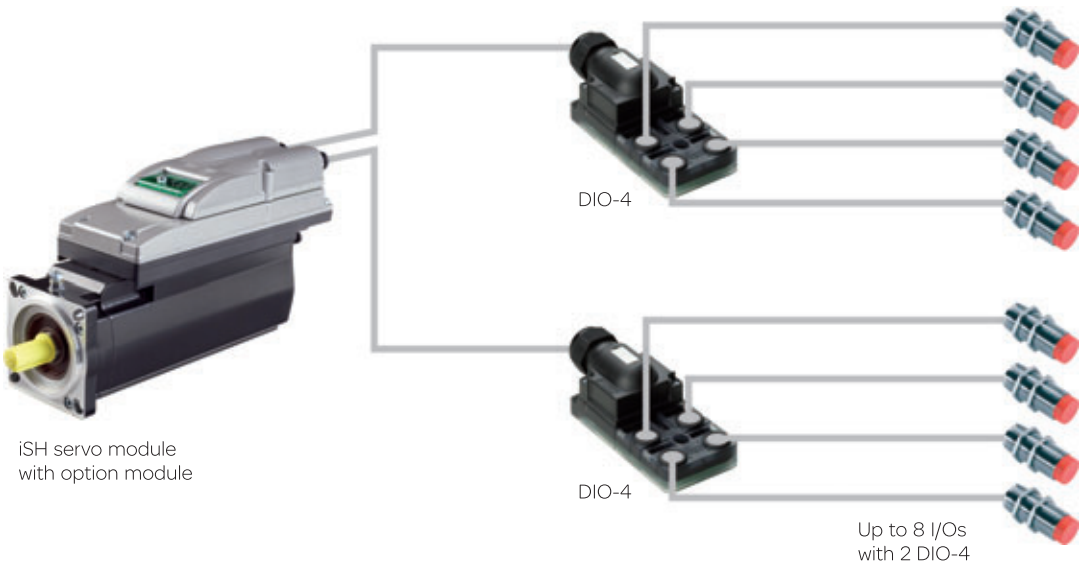
Now imagine that you want to add a leaflet inserter module to a cartoner. Or swap a hot melt labeling station for a pressure sensitive station. Or add a second robot module to double the throughput of your case packer. You just activate the appropriate software module as a recipe change in the PacDrive automation controller, wheel the new equipment module in place, plug it in and start packing. **The cabling requirements of the machine are reduced by 50 %.**

Will the future bring capacity expansion, a new product mix, or more automated operation of the existing line? It doesn't matter if you can just plug in what's needed. Intelligent Servo Modules are the ultimate in future-proofing for packaging systems.

I/O communication
via motion bus

I/O Option Modules

# Simplified cabling for sensors and actuators




## Communications: DIO-4 I/O option module

Experience shows that sensors and actuators are normally located in the immediate vicinity of a servo drive. That's why there's an I/O option module that mates right onto the Intelligent Servo Module. It offers a cost-effective, integrated, distributed I/O function for both standard and high speed inputs and outputs.

Thanks to the system's single cable, there's no need to add a device or field bus network to relay I/O signals between the field devices and PacDrive automation controller. Instead, up to eight sensors or other devices can communicate with the controller over the motion network. It's simple, economical and eliminates an entire network.

Technical Data

# Purpose-built for packaging

Intelligent Servo Modules are the latest answer to the challenges facing packaging systems designers. Leveraging the performance of ELAU's purpose-built packaging automation system, these new servo modules are up to the task.

The available 70mm, 100mm and 140 mm flange sizes cover the majority of packaging application requirements. Still, we realize the need for higher power to handle high inertia loads, lower power for format change mechanisms, and specialized servo modules for capping and labeling functions. Rest assured that Intelligent Servo Modules can be used in combination with the full family of PacDrive automation controllers, servo modules, servo motors and drives.

### Options

- Holding brake
- Feathered key groove
- Multi-turn encoder with ratings plate
- IP 65 shaft seal
- I/O module

## Technical Data

| Types | Standstill torque $M_0$ [Nm] | Peak torque $M_{max}$ [Nm] | Inertia of the rotor $J_M$ [kgcm²] | Rated Speed $n_N$ [min⁻¹] | Dynamics [Nm/kgcm²] | Power density [Nm/dm³] | Flange size [mm] | Length mm without / with brake | Height mm without / with option module | Safe Stop 1 | Safe Torque Off |
|---|---|---|---|---|---|---|---|---|---|---|---|
| iSH-070 / 60 011 | 1.1 | 3.5 | 0.25 | 6000 | 14.0 | 1.28 | 70 | 212 / 219 | 107 / 127 | ✓ | ✓ |
| iSH-070 / 60 017 | 1.7 | 7.6 | 0.41 | 6000 | 18.5 | 1.84 | 70 | 226 / 252 | 107 / 127 | ✓ | ✓ |
| iSH-070 / 60 022 | 2.2 | 8.7 | 0.58 | 6000 | 15.0 | 2.02 | 70 | 259 / 293 | 107 / 127 | ✓ | ✓ |
| iSH-100 / 30 025 | 2.5 | 9.6 | 1.40 | 3000 | 6.9 | 1.40 | 100 | 215 / 243 | 137 / 157 | ✓ | ✓ |
| iSH-100 / 30 044 | 4.4 | 18.3 | 2.31 | 3000 | 7.9 | 2.08 | 100 | 249 / 280 | 137 / 157 | ✓ | ✓ |
| iSH-100 / 30 058 | 5.8 | 28.3 | 3.22 | 3000 | 8.8 | 2.34 | 100 | 285 / 315 | 137 / 157 | ✓ | ✓ |
| iSH-140 / 30 075 | 7.5 | 27.0 | 7.41 | 3000 | 3.6 | 1.76 | 140 | 254 / 292 | 181 / 201 | ✓ | ✓ |
| iSH-140 / 15 085 | 8.5 | 27.0 | 7.41 | 1500 | 3.6 | 1.99 | 140 | 254 / 292 | 181 / 201 | ✓ | ✓ |
| iSH-140 / 20 125 | 12.5 | 55.0 | 12.68 | 2000 | 4.3 | 2.34 | 140 | 309 / 347 | 181 / 201 | ✓ | ✓ |

Constantly updated data available at www.elau.com/servodrives

Subject to modifications

# Contact

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