Modular drive technology for packaging machinery
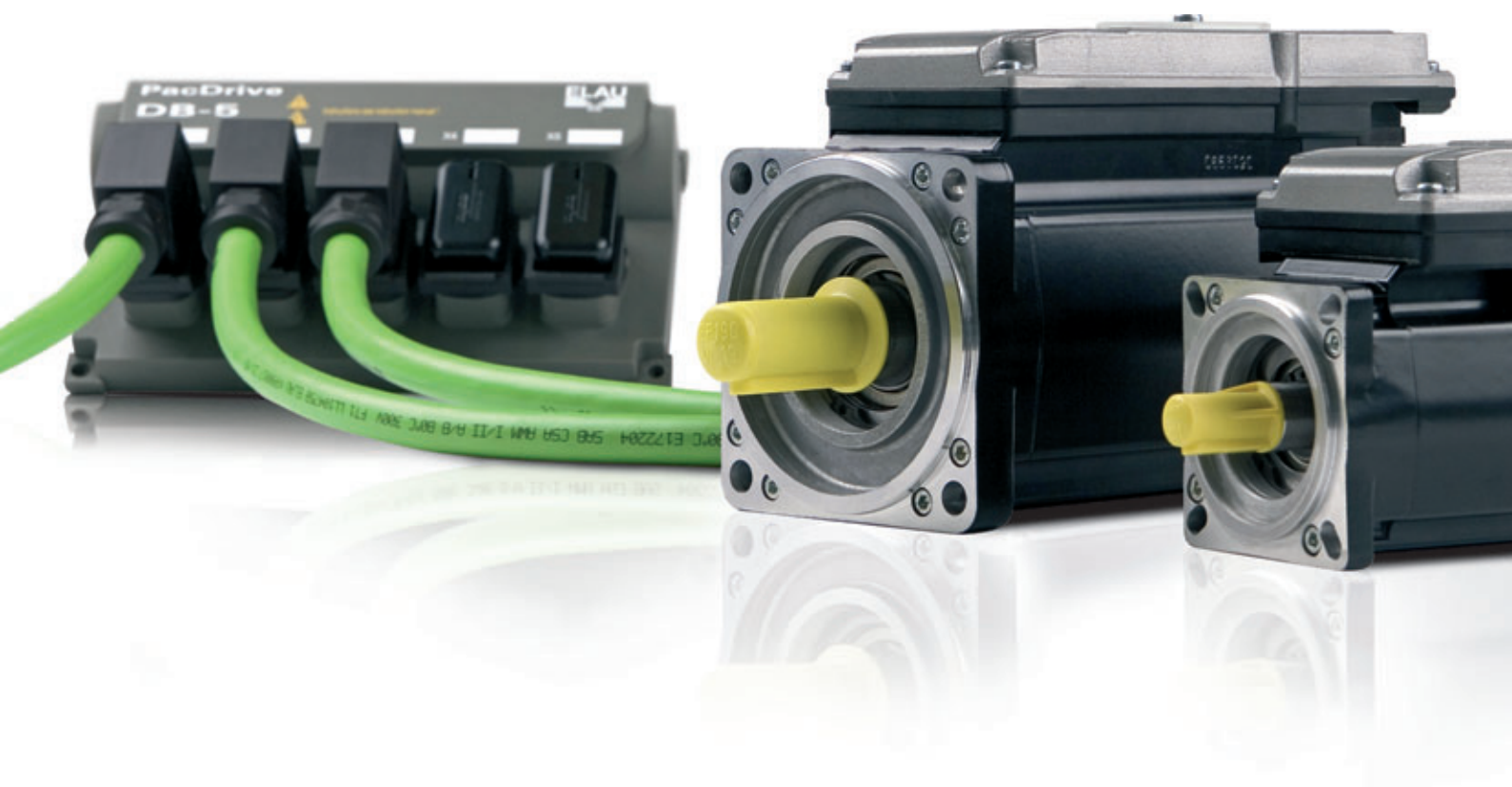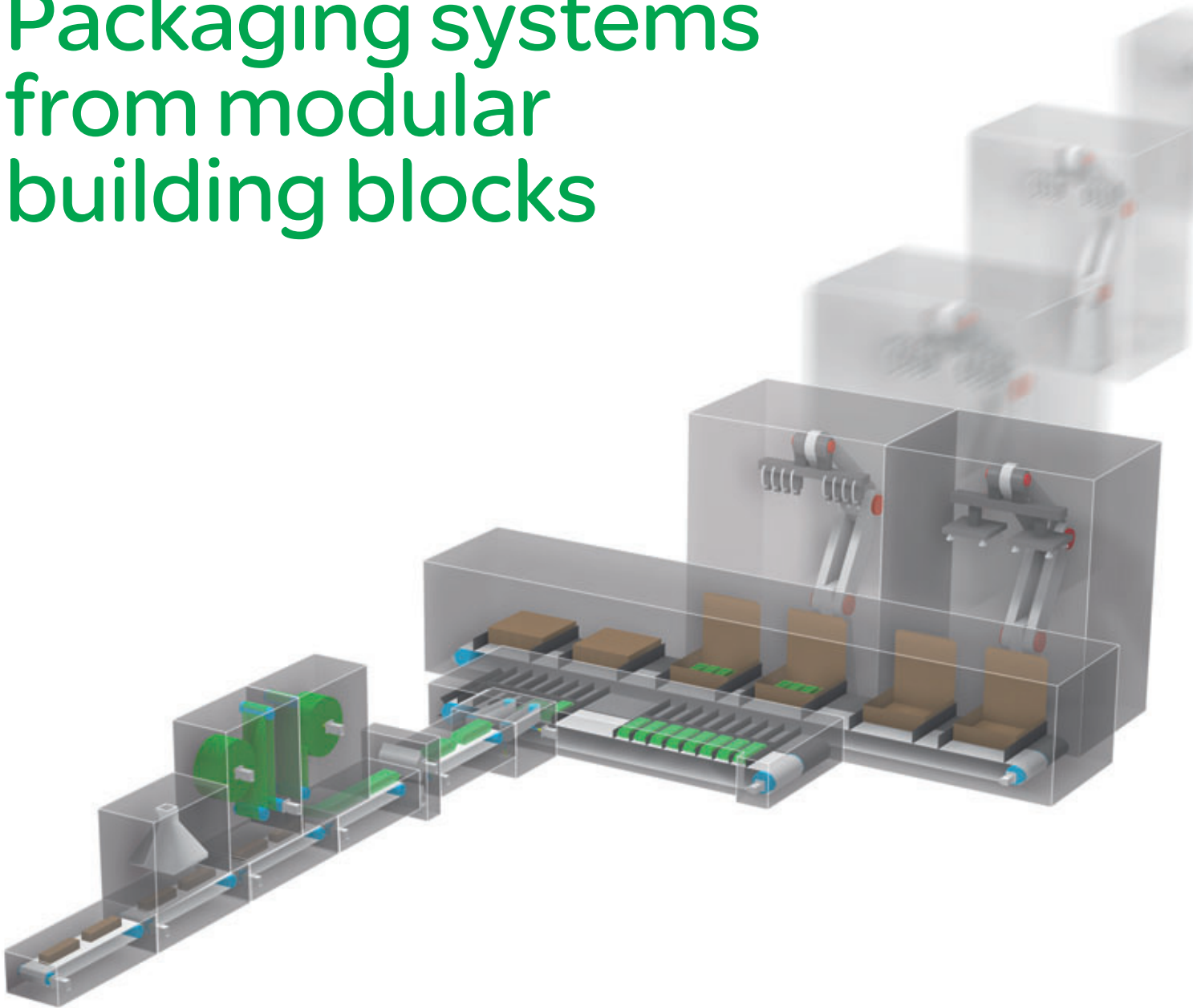
ELAU iSH
Intelligent Servo Modules

Enabling flexibility and efficiency
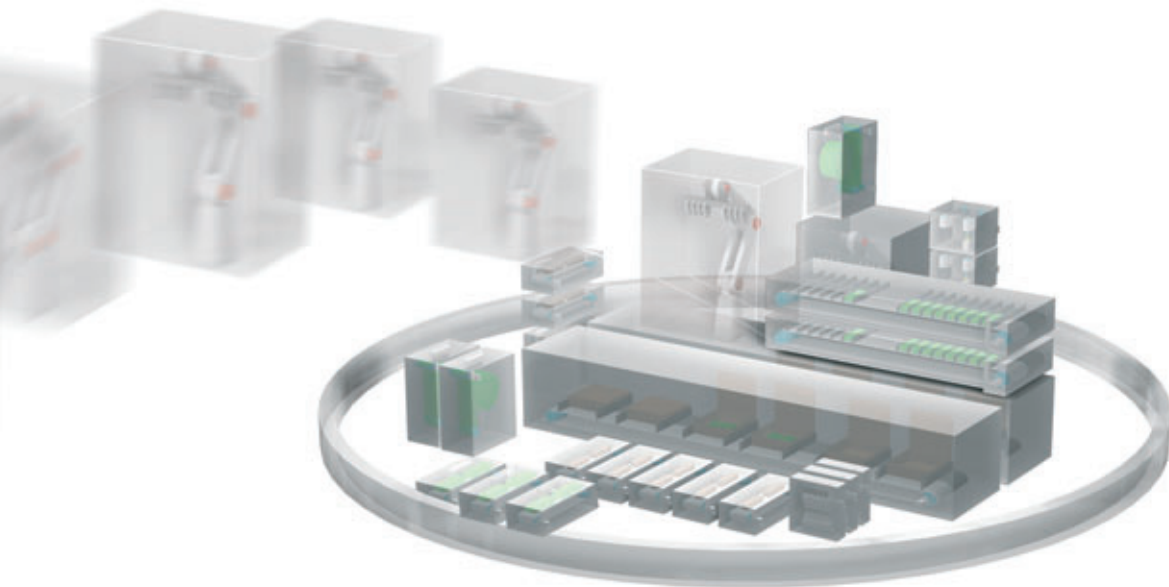
Schneider Electric

Packaging systems from modular building blocks

Modularity in Mechanics – Electronics – Software

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.

3

Mechanical modularity as a basic prerequisite

Mechatronics, driven by servo technology in the 1990's, spelled the end of mechanically line shafted packaging machines.
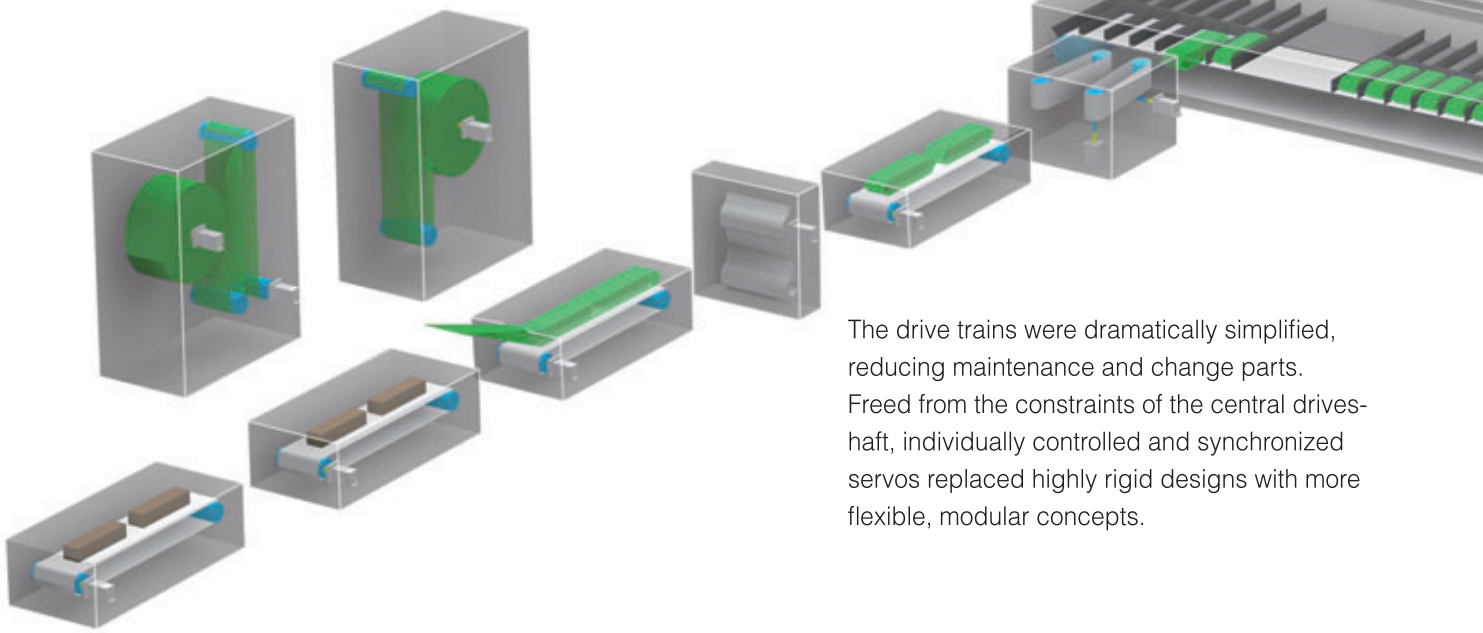
The drive trains were dramatically simplified, reducing maintenance and change parts. Freed from the constraints of the central drives-haft, individually controlled and synchronized servos replaced highly rigid designs with more flexible, modular concepts.

4
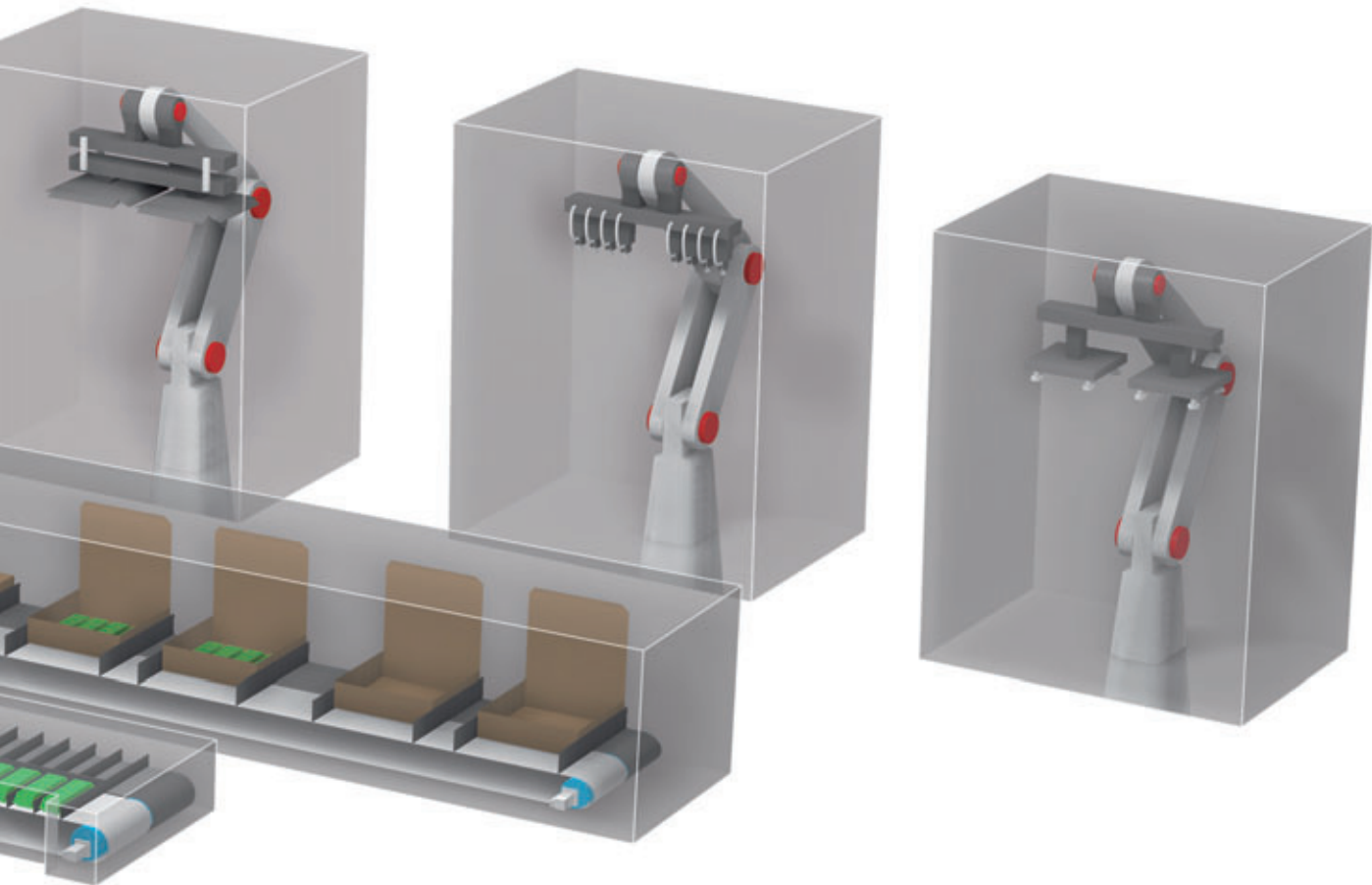
The benefits are convincing:

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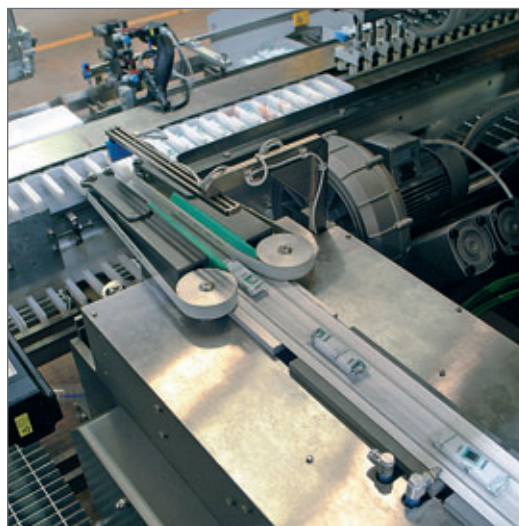
Modularity in practice
Individual mechatronic units can be reused in different machines

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

Software Modularity

Modularity represented in Software as well

	MES/ERP Level
	Line Level
Primary Packaging / Secondary Packaging	Machine Level
Infeed, Unwinding, Sealing / Grouping, Cartoner	Equipment Module Level 1
Flying Knife, Temp. Control / Infeed, Dual Belt, Robot, Conv. Belt	Equipment Module Level 2
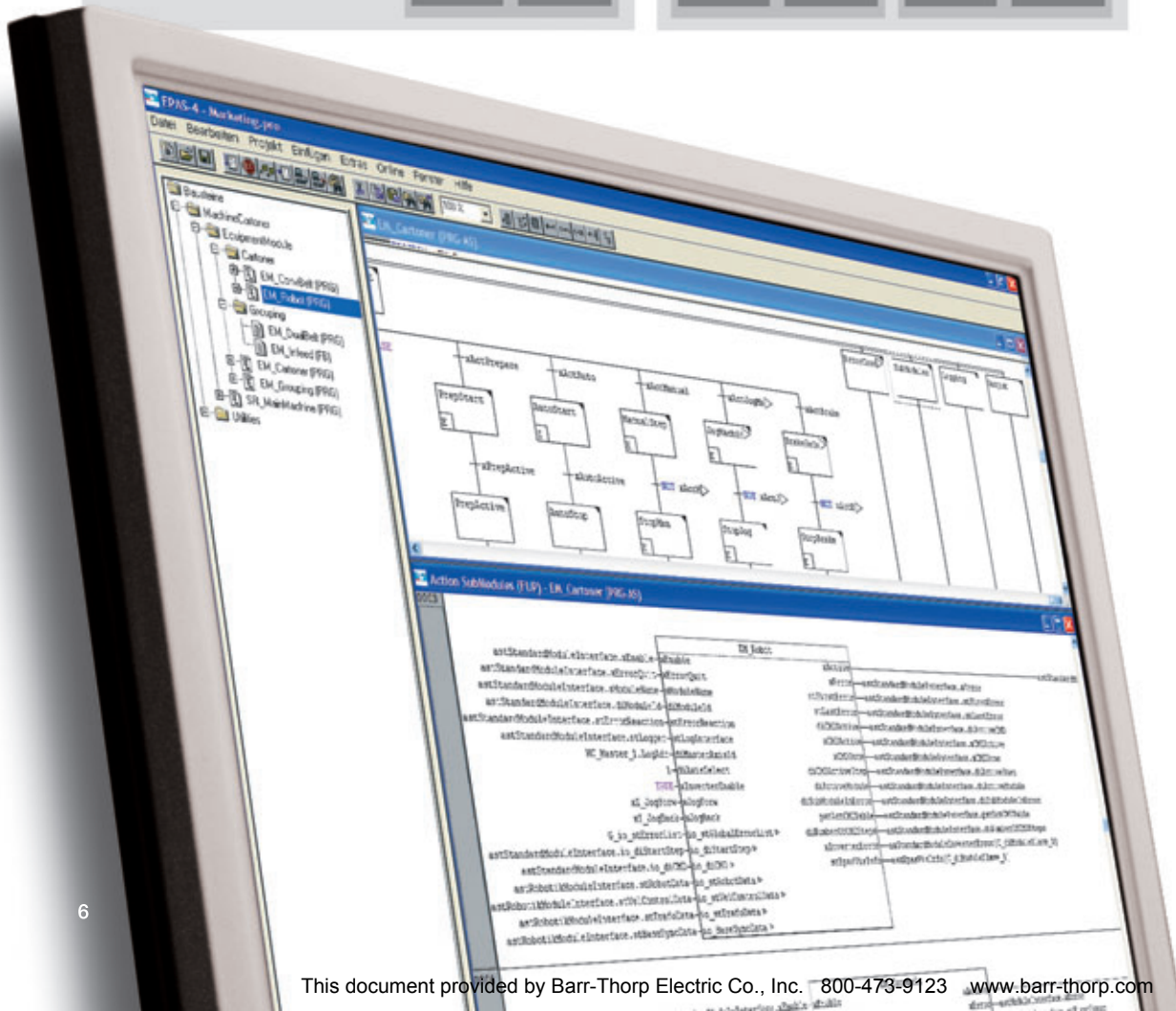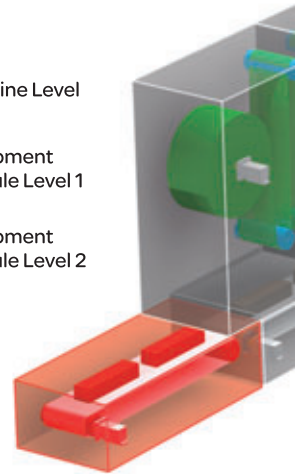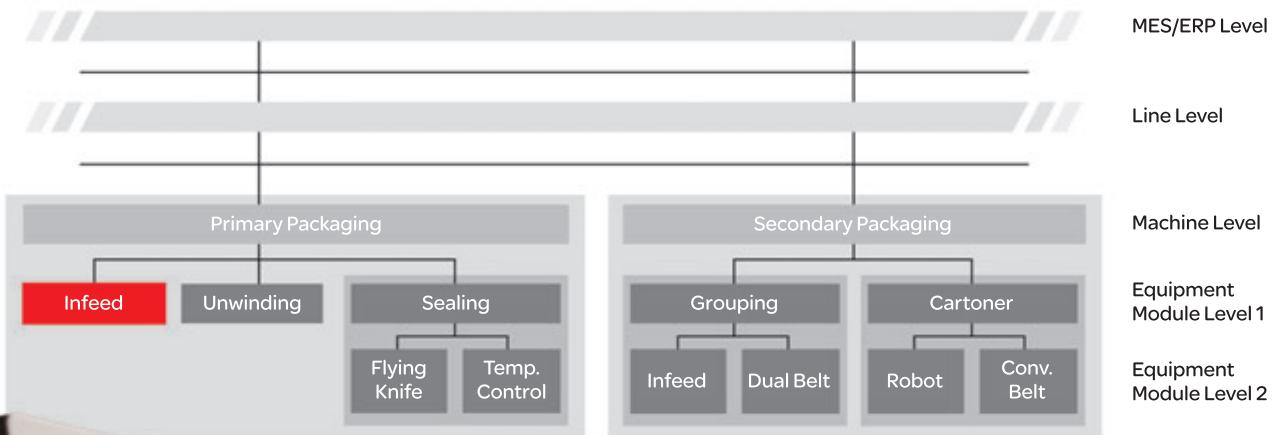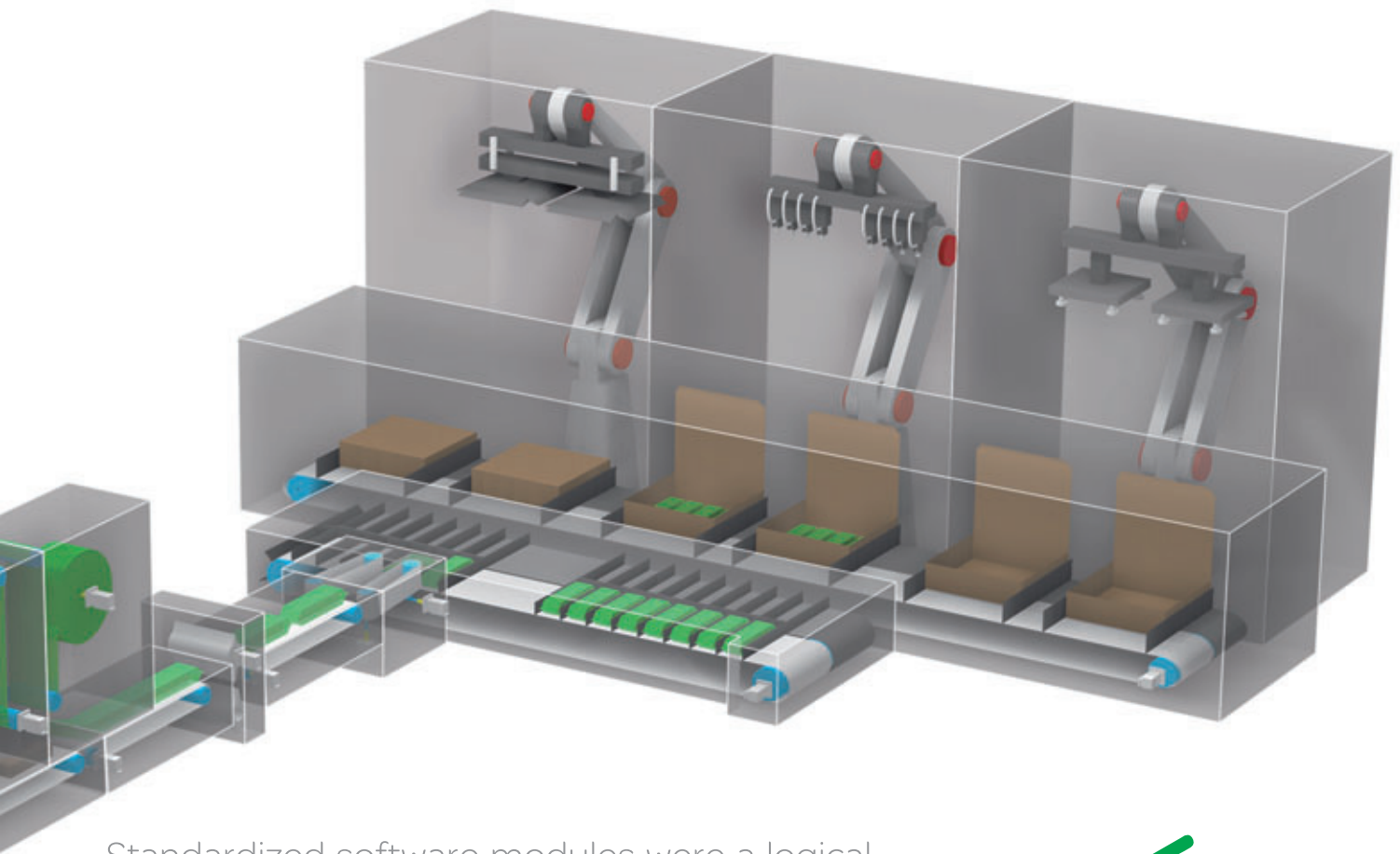
Standardized software modules were a logical progression and an alternative to programs containing hundreds of lines of custom code to write and debug. By the late 1990's, ELAU had developed a software template and a library of software objects to control the basic functions of packaging machinery.

Machine modules are mapped to the software as equipment modules

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.

7

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

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.

9

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.

Drive electronics out of the cabinet

Motor in the machine

Intelligent Servo Module: Integration of the drive electronics

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

11

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.
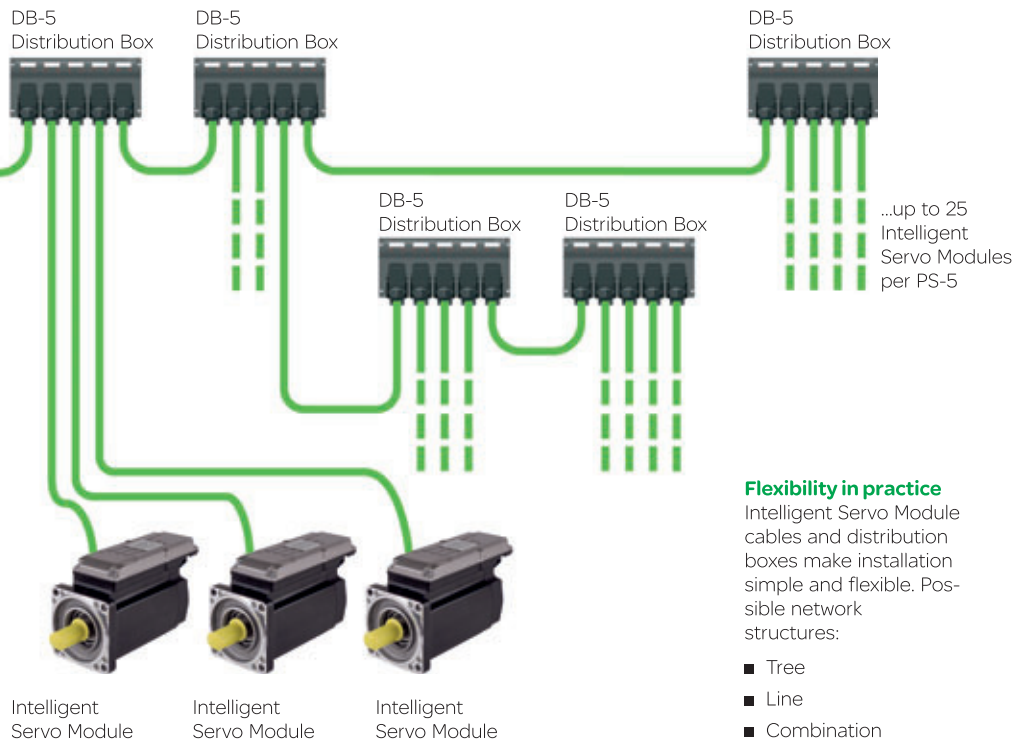
12

Cabling

Network concept: versatile and simple

PacDrive
Automation
Controller

PS-5
Power Supply

Small cabinet,
flexible arrangement

DB-5
Distribution Box

DB-5
Distribution Box

DB-5
Distribution Box

DB-5
Distribution Box

DB-5
Distribution Box

...up to 25
Intelligent
Servo Modules
per PS-5

Intelligent
Servo Module

Intelligent
Servo Module

Intelligent
Servo Module

Flexibility in practice
Intelligent Servo Module
cables and distribution
boxes make installation
simple and flexible. Pos-
sible 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 inter-changeable 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 Intel-ligent 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 com-bination of the two – and **70% less cable** than conventional servosystems.

13

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.
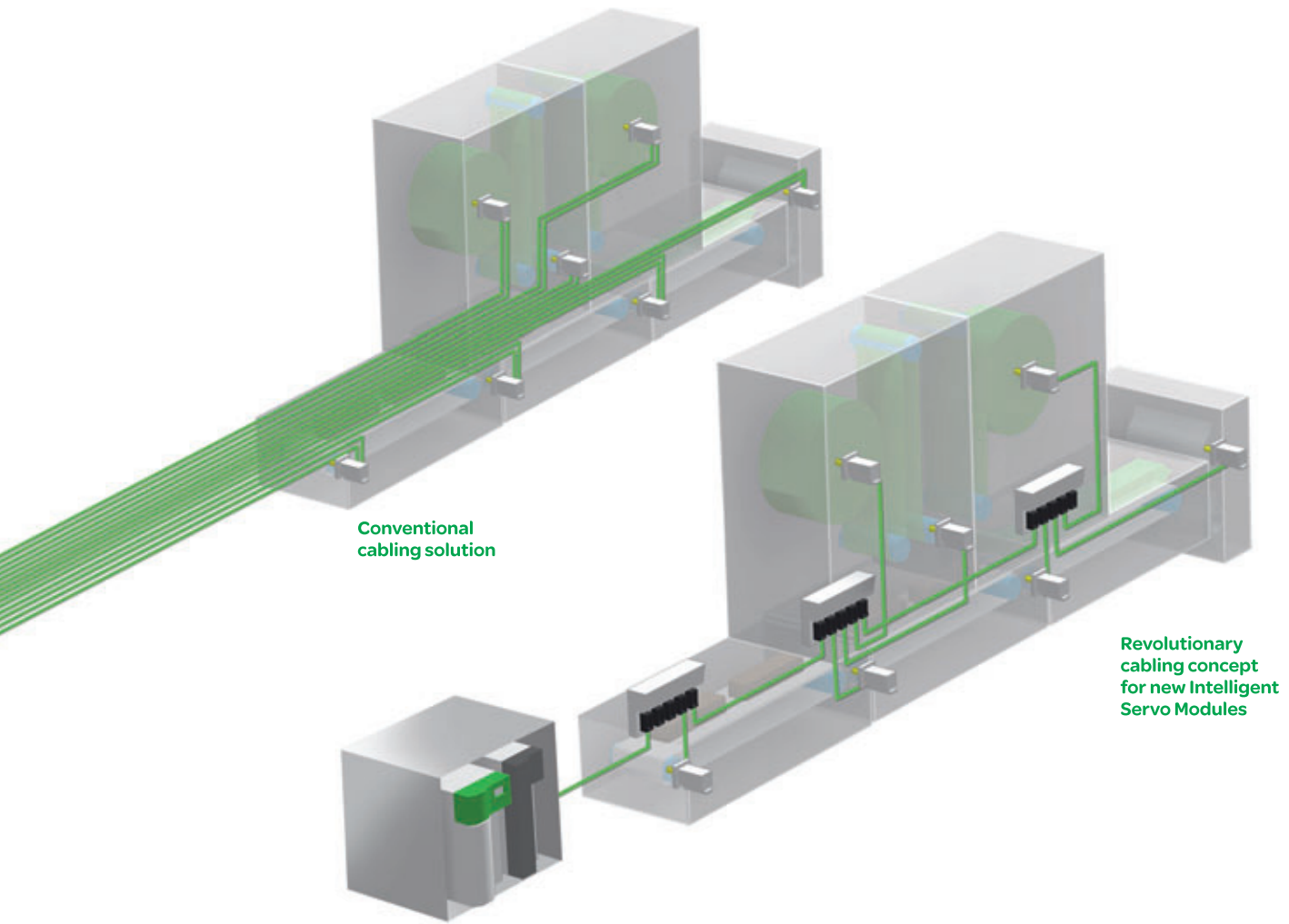
Conventional cabling solution

Revolutionary cabling concept for new Intelligent Servo Modules

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 in-serter 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 require-ments 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.
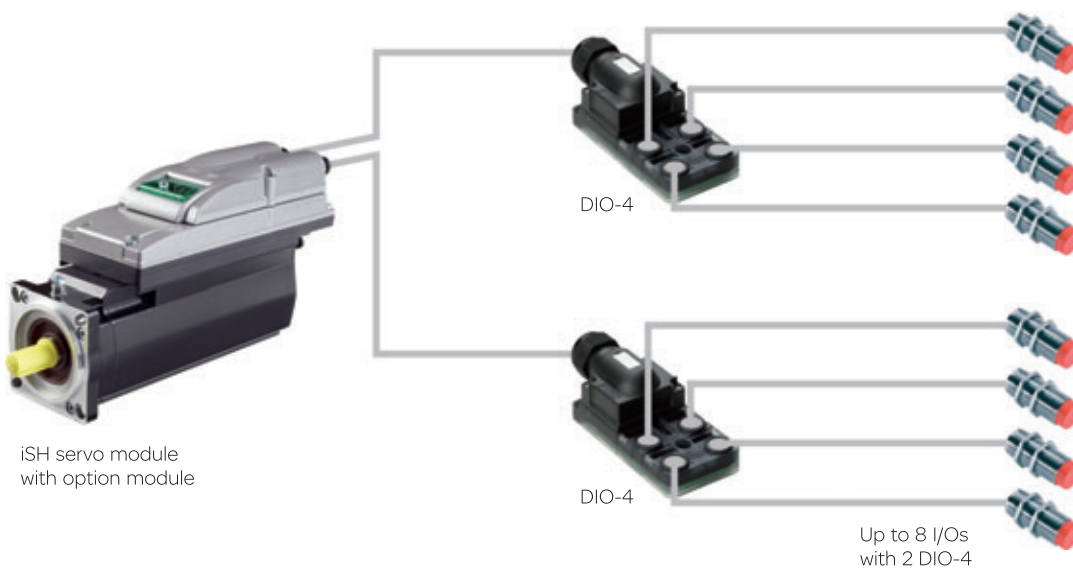
> I/O communication
via motion bus

I/O Option Modules

Simplified cabling for sensors and actuators

iSH servo module
with option module

DIO-4

DIO-4

Up to 8 I/Os
with 2 DIO-4

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.

18

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 [kgcm^2]	Rated Speed n_N [min^{-1}]	Dynamics [Nm/kgcm^2]	Power density [Nm/dm^3]	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

VM08132-001 I 1009-EN

ELAU PACKAGING SOLUTIONS

Schneider Electric