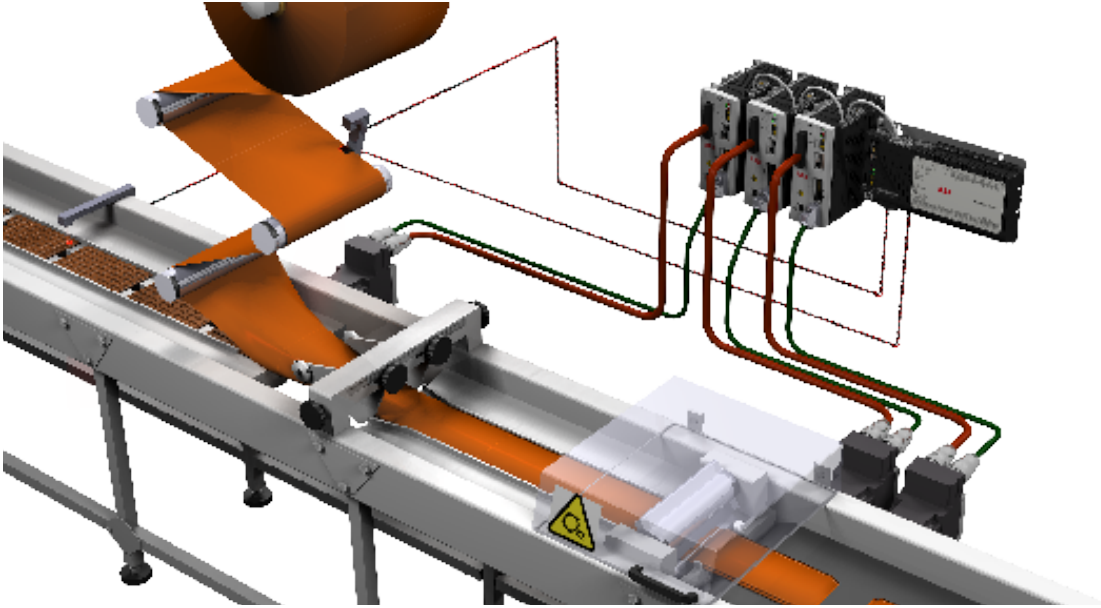


ABB motion control products

Machine profile Horizontal form fill seal

Horizontal form fill seal machine

Overview



Horizontal form-fill-seal (HFFS) or Flow wrappers

These are one of the more common types of packaging machines because of the volume and range of product that can be wrapped using this type of machine.

Many machine builders in this sector offer a range of machines from simpler lower operational speeds, to higher throughput systems with a wider range of packaging sizes and features such as print registration. In addition, there are also specialist versions tailored to a specific product or need, such as hermetic sealing. As such, control solutions vary from simple stepper based, servo based with simple PLC controllers, motion controllers, PC based or often the vendors own dedicated controller.

Principle of operation

The basic principle of these machines is to unwind the wrapping material and pull through a former to create a tube, seal it lengthways (seam), fill it with evenly spaced product and then seal, crimp and cut.

Film unwind

Unwinding of the film into the machine sometimes using an AC servo, variable frequency drive or DC motor, on lower end machines a simple tension control clutched feed is used.

Dancer arm

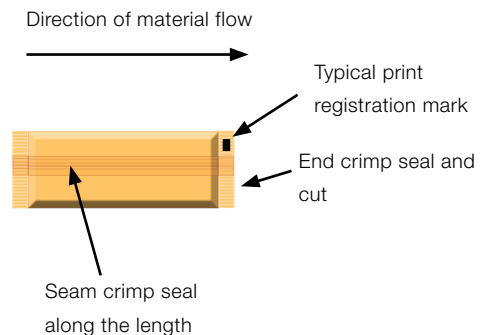
Is a free moving idling roller that changes its position according to the tension of the film. When tension is correct the roller stays in a neutral position. But if tension is too high or low the roller is moved from that position. The controller's task is to return the roller to the neutral position. This is sometimes achieved mechanically or pneumatically.

Film registration

Used primarily when the film has graphics printed on and is used to align and compensate for film slippage and stretch by the 'seam crimp servo' position based on the latched position of the film.

End crimp sealing jaws

There are numerous types of cross sealing jaw and mechanical mechanisms that machine designers use. The main task is to seal and cut the packet. The jaws will normally contain a heating element and a serration pattern. The serrations also cause a "shearing" action, where sealant layers from each side are forcibly mixed together, thus creating a stronger bond.



Horizontal form fill seal machine

Terminology

Seam crimp

To create the tube from film, it is formed and then normally six rollers (three pairs) are used to crimp the material by cold or hot method. The rollers are driven by a servo motor.

“No product - no bag”

A sensor is sometimes placed above the flighted main (infeed) conveyor to detect if there is a missing product (often called an ‘empty flight’). Some machines can deal with this by skipping a cycle to prevent making an empty packet.

Phasing belts compensate for irregular spacing

Product is often heading towards the machine at irregular spacing and needs to be presented to the wrapper at an even spacing to achieve smooth continuous operation, resulting in better control, consistent packaging and greater efficiency. To achieve this either a ‘gated buffer’ system is used to bunch up product and release it regularly, or phasing belts are used to measure the gaps and create even gaps by advancing or retarding product to fit into flights of the flighted conveyor.

Flighted conveyor

The newly, evenly spaced product enters each flight to ensure it is delivered into the package being formed. This ensures the crimp-seal jaws crimp between products avoiding jam-ups and down-time.

“Misplaced product”

At a particular point in the cycle the system checks that a product is present and that the product is back against the flight and not shifted forwards. If a product has been detected forward of where it should be, a crimp/cut/seal cycle is skipped to prevent the misplaced product being squashed.

Continuous motion rotary end crimp

As with all motion applications stationary time is lost time, and in this type of machine the most common solution is seal and crimp in a continuous cyclic motion, often achieved with CAM profiles or FLY commands if using MINT controllers.

Typical products

- Confectionary
- Cereal bars
- Food items
- Medical items

Related applications

The following application types have similar technology:

- Vertical Form Fill seal
- Over wrappers

Typical motion functions required



Electronic gearing



IncR/A
(Relative/Absolute
incremental move)



Multi-axis
interpolation



Homing



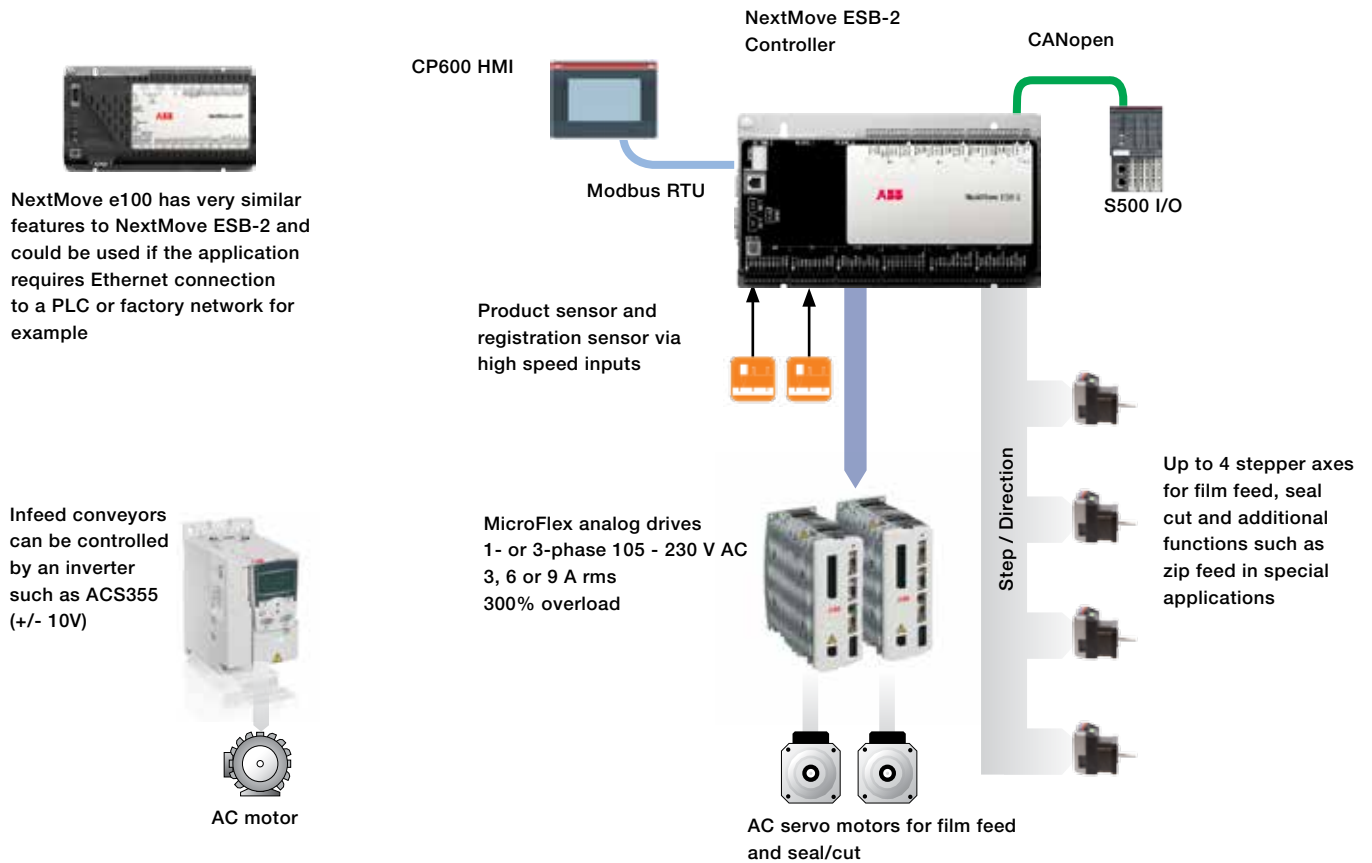
Fly - Flying shear
segments



Registration control

Horizontal form fill seal

ABB Solution 1- stepper and/or analog solutions



In principle, solutions could be based on either stepper, analog demand drives or a mix of the two. In both cases, NextMove ESB-2 can be used. Alternatively, NextMove e100 can be considered if an upstream Ethernet connection is required.

Stepper solution, features and benefits

- Stepper solutions are usually the lowest cost and therefore entry level control solutions for intermittent machine types.
- Usually aimed at basic filling machines, often non-printed film with low throughput rates.

Analog servo solutions

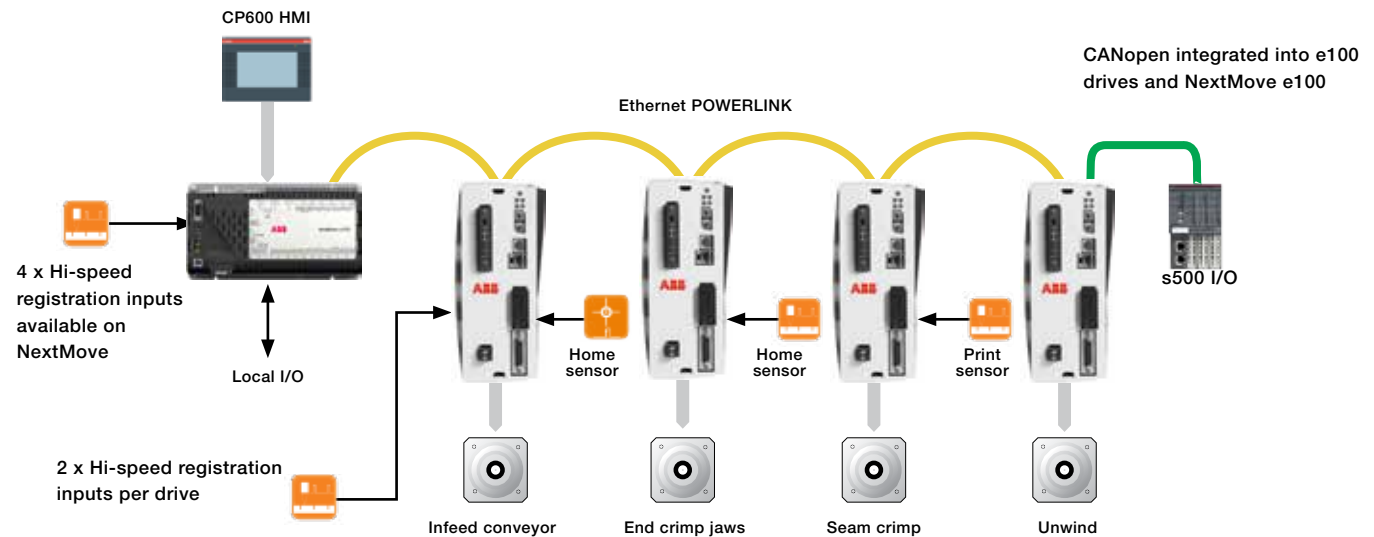
- Device costs are generally lower than Ethernet technology, but higher than stepper systems
- Used for mid-range throughput in the intermittent machines category
- Remember that you can use our Ethernet product lines for higher performance with the same software tools
- MicroFlex analog drive supports resolver or encoder types such as incremental ABZ with Halls and Baumer SSI.
- MicroFlex or ACS355 drives could be used for film unwind.

NextMove ESB-2 features and benefits

- NextMove ESB-2 features advanced stepper control which provides smooth velocity control over a wide frequency range with micro-stepper drives/motors.
- In addition, s-ramping control of stepper axes is supported to reduce jerk and hence film slip.
- Digital and analog IO built in for machine logic
- IO easily expanded by the CANopen interface
- 4 x stepper axes for additional auxiliary axes
- 4 x analog axes of control with +/-10 V demand and incremental ABZ encoder feedback (10 MHz quadrature)
- 5th encoder input for line shaft following
- 4 x fast inputs (1µs) for position latch functions such as registration of film
- Recipe data can be stored on board the controller or CP600 HMI panel.
- A single, easy to use software tool, MINT Workbench for configuration and programming of NextMove and MicroFlex products.
- MINT is easy to program, and provides multi-tasking for performance and Events for critical tasks.
- No software licenses. MINT is no charge.

Horizontal form fill seal machine

ABB Solution 2 - Ethernet POWERLINK motion control



Infeed conveyor can be controlled by an inverter such as ACS355



Summary of features and benefits

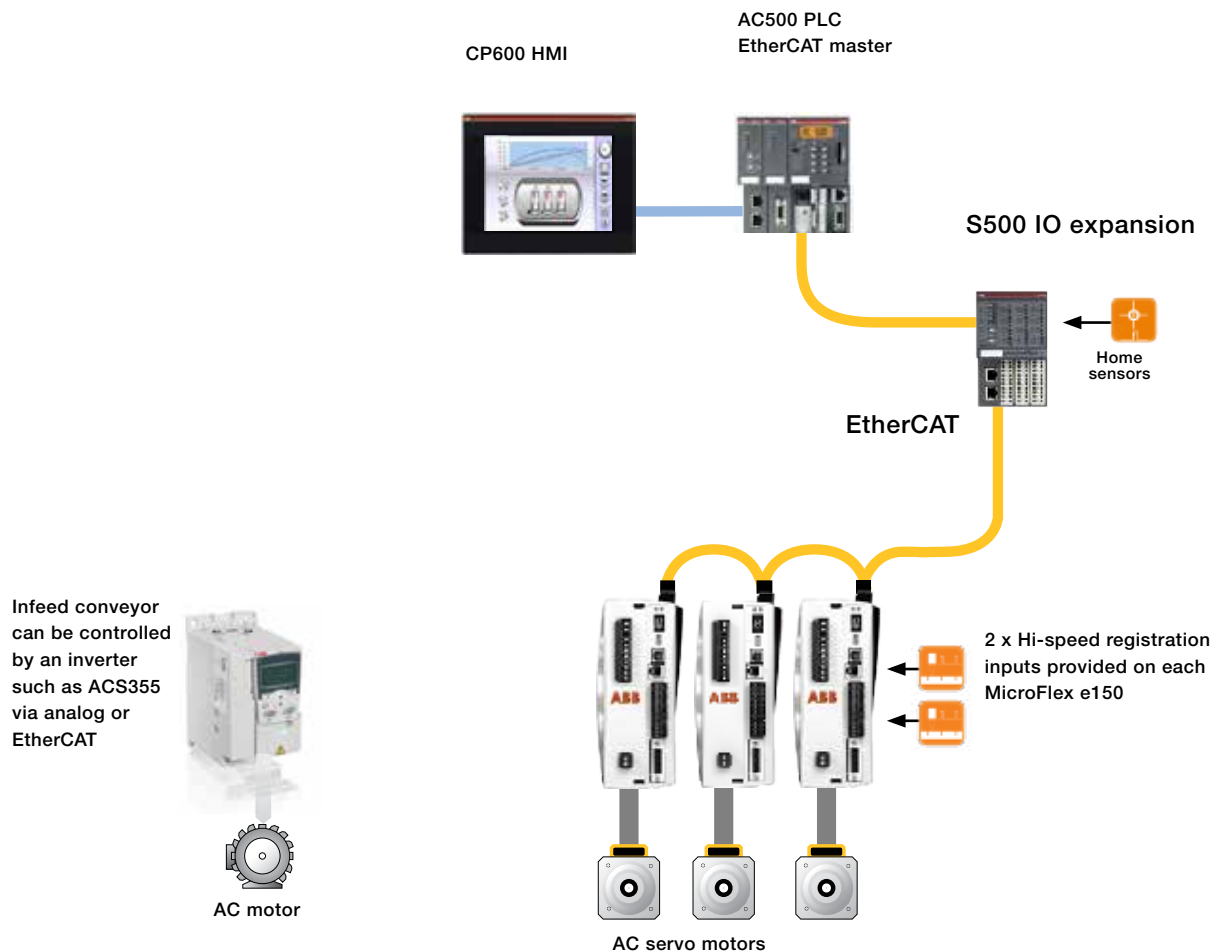
- 1µs fast Inputs used for film registration
- Fast processing time of a dedicated motion controller.
- Recipe data can be stored in on-board NV-ram or in a CP600 HMI if used.
- MINT code can be written in a modular format, if an option of a ZIP applicator were added this can be easily handled.
- Easy to program multitasking software
- Flying shear and cam software commands for synchronisation in continuous mode.
- No software licenses. MINT is no charge.
- One control system for all your Horizontal form fill seal requirements - control analog, stepper or Ethernet POWERLINK based drives for simple to high performance machines.
- Drives feature a wide input voltage range – no transformer required for different continents
- Use BSM servomotors with absolute feedback, no homing required – reduced downtime after product jam, power off

POWERLINK solutions

- Significantly reduced wiring costs – One Ethernet cable replaces the analog demand (2 core + shield), the simulated encoder (minimum 7 wires + shield) and the error reset signal.
- Pure digital demand – No ADC/DAC dependency, no drift, noise or offsets
- A single point of connection for commissioning all devices via the NextMove e100 and MINT Workbench
- ‘Total network visibility’ - remote connection possible via POWERLINK router device, for service and Factory networking.

Horizontal form fill seal

ABB Solution 3 - AC500 PLCopen + EtherCAT solution



AC500 PLC solutions, features and benefits

- PLC based solutions are increasingly popular in the packaging industry, our AC500 PLCopen motion functionality is one of the most capable of all PLC vendors.
- Scalable and modular architecture allows the solution to be tailored to the application
- Industry standard IEC61131-3 programming and PLCopen motion function blocks are very popular in the packaging industry
- IO expansion by fieldbus or local expansion bus
- Many types of fieldbus and Ethernet technologies are supported
- Factory networking can be realized to provide machine metrics and maintenance information.

MicroFlex e150 features and benefits

- 1 or 3 phase operation, 105 - 250 V AC
- 3, 6 and 9 A ratings
- Real-time EtherCAT control interface
- Universal encoder feedback supports many feedback types
- Servo performance with 200% overloads for dynamics
- e150 drives feature 2 x high-speed (1µs) latch inputs useful for registration
- Safe Torque Off (STO) SIL3 PL e
- ACS355 can be added for a lower cost infeed conveyor control, via analog demand or EtherCAT if preferred

Horizontal form fill seal machine

ABB Solutions

Horizontal Form Fill Seal - Possible solutions

		Entry level machines	Mid range	High performance
Component	Controller	NextMove ESB-2	NextMove e100	NextMove e100 AC500 PLC ^[2] with PLCopen Motion
	Drives	DMS Steppers motors with integrated drive	MicroFlex e100	MicroFlex e100 MicroFlex e150
	Motors	MicroFlex BSM Servo Motors	BSM Servo Motors	BSM Servo Motors
	HMI	KPD202-501 CP600	KPD202-501 CP600	CP600
	IO	CAN IO + Drive IO + Controller IO	CAN IO + Drive IO + Controller IO	CAN IO + Drive IO + Controller IO Various IO options
	Other / optional	ACS355 for auxiliary axes, unwind, Infeed conveyor etc	ACS355 for auxiliary axes, film unwind, infeed conveyor etc	ACS355 for auxiliary axes, film unwind, conveyor etc
	Safety	Jokab safety	Jokab safety	Jokab safety / AC500S

[1] As per ESB-2 but adds Ethernet support for machine networking.
 [2] PLCopen motion is increasingly popular as a standards based motion technology.

Solutions

The table above shows possible solutions or component configurations that could be used to solve horizontal form fill seal machines (and similar). In addition, our solution capabilities are developing all the time and alternatives may exist.

ABB benefits as a supplier

- World's leading drives manufactured by volume
- Global presence with support and service infrastructure
- A broad product offering including motion, servo drives and motors, industrial drives, PLC systems, safety products, robots and much more

Frequently asked questions

Can we use an ABB PLC?

You have the choice to use our PLC or the specified PLC for logic. With a MINT motion controller, there is the added advantage that the core motion program on the MINT controller will stay the same making your job easier. The MINT code can be written generically, giving the flexibility to adapt to PLC requirements. **Process data can be sent to the MINT program via communication such as Modbus RTU, Modbus TCP, Ethernet/IP, etc, such as length of bag, number of bags in the production cycle and reading data back such as the number of bags produced.**

Can I protect the machine program using my current solution?

No problem. In a MINT controller, you can do exactly the same by downloading just the executable file from within Workbench and not including the source file. The program can even be tied to the serial number of the unit for unauthorized cloning of the application.

What experiences does ABB have in this application?

We have motion control, drives and PLC experts who have worked and served this industry for many years, specifically developing product features to address this type of application.

Do we need to learn a new programming system?

MINT is a very simple intuitive language in 'real English' terminology. Our customers often praise the ease of use and rapid development after a very short learning curve. We offer demonstrations, training classes, and many MINT application notes relevant for examples. Alternatively, ABB also offers IEC61131 and PLCopen motion functions with the ABB AC500 PLC range and solution based on this platform with the advantages of an industry standard based programming method and class leading motion functions.

Available promotional literature

The ABB motion product family is fully supported with literature - data sheets, Q & A, pricing, and catalogs. Commercial collateral is available at www.abb.com/motion, www.abb.com/plc.

Visit www.abb.com/motion/solutions for examples and application animations including Horizontal form fill machines.

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