Jupiter servo for Packaging Machine

General description of JMD-Servo drive in packaging industry

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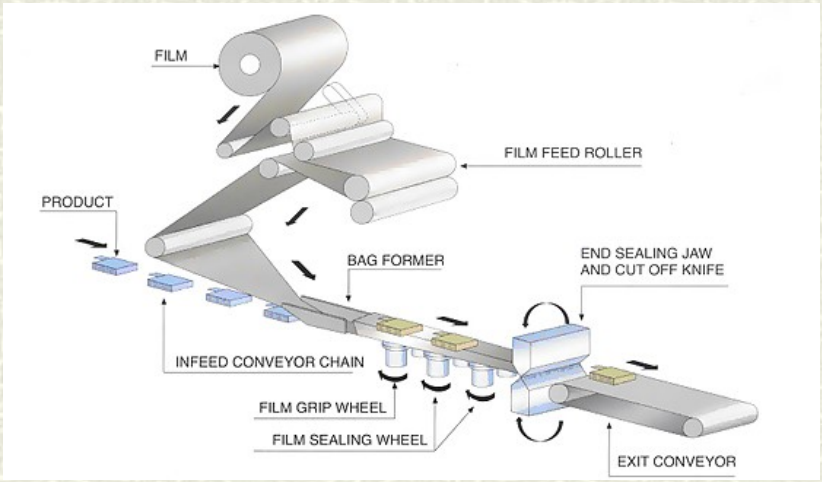
V1.1

Basic machine structure

Typical machine outlook & packaging flow



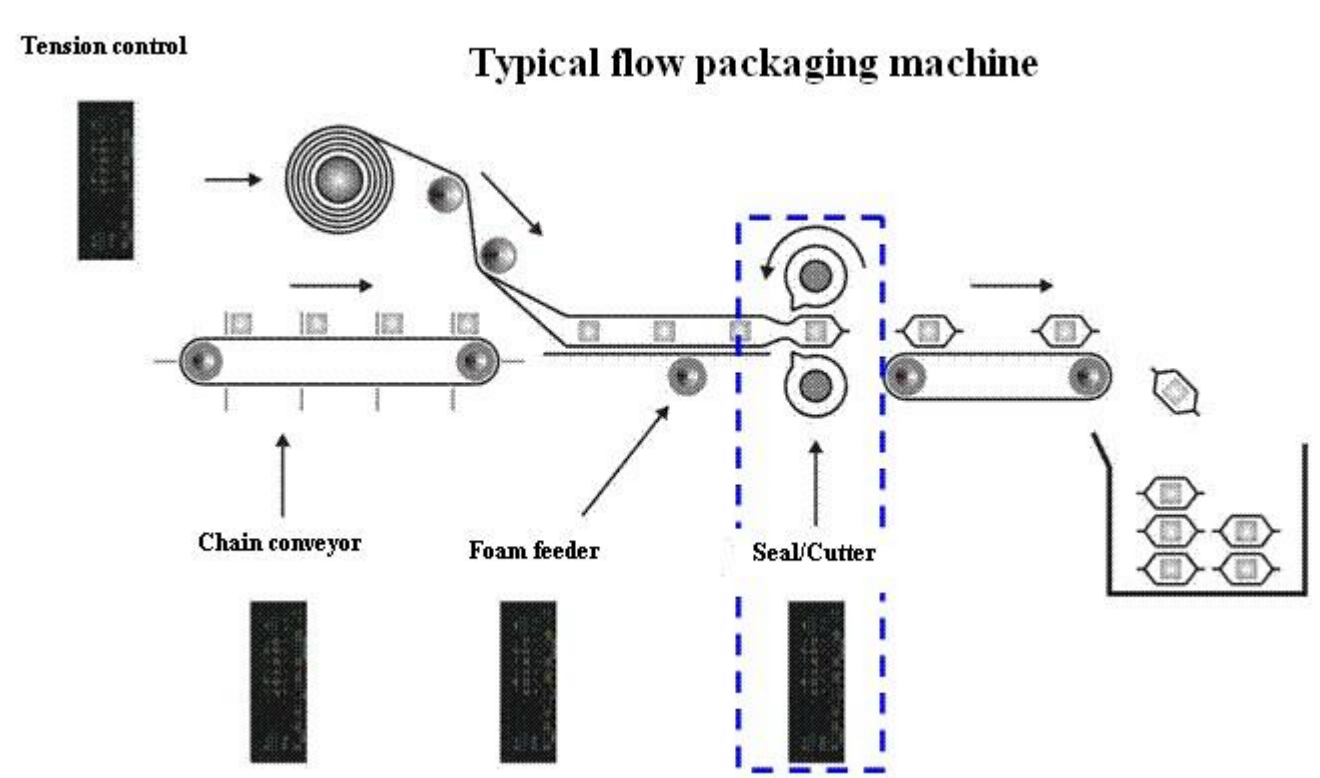
Standard rotary seal-cut type

Advantages using Jupiter servo

- Cost down by using general PLC as master controller
- Fast development time, well proven technology
  No need of experienced motion programming
- State of the art advanced functions readily available:
  a. Electronic CAM profiles embedded
  b. Cut-to-Mark tracking automatically
  c. Cut-on-Target at very first pack without waste
  d. Upright-Standby automatically
  e. No-Paper-No-Product available as standard function
  f. Hard-Cut-Skip available as standard function
  g. Long-dwell function easily achieved, …….

Axes of flow-pack machine(1)

Basic operation of flow-pack machine requires 4 axes:



Axes of flow-pack machine(2)

Jupiter servo drive embeds special functions particularly suitable for flow-packaging machine's control system.
Refer to previous figure, the machine is divided into four sections. Each section is driven by an individual servo motor:

- Axis-I (suitable model JMD-STD)
  used to drive the Chain conveyor
- Axis-II (suitable model JMD-RC)
  used to feed wrapping film to bag former
- Axis-III (suitable model JMD-RC/VRC)
  used to drive the Sealer/Cutter jaw.
- Axis-IV (suitable model JMD-STD)
  used to control the film tension(optional)

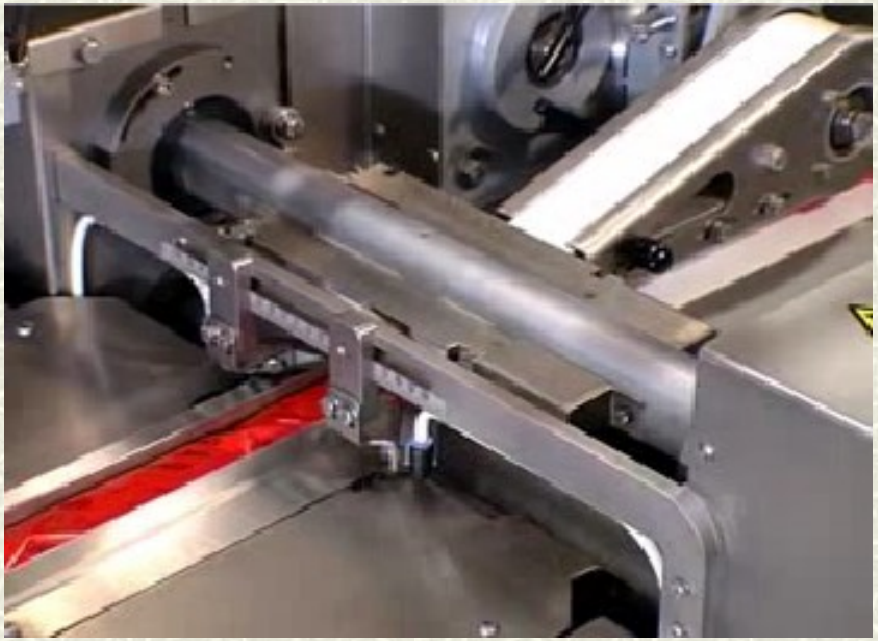
Axis-I: Chain conveyor/Push-bar

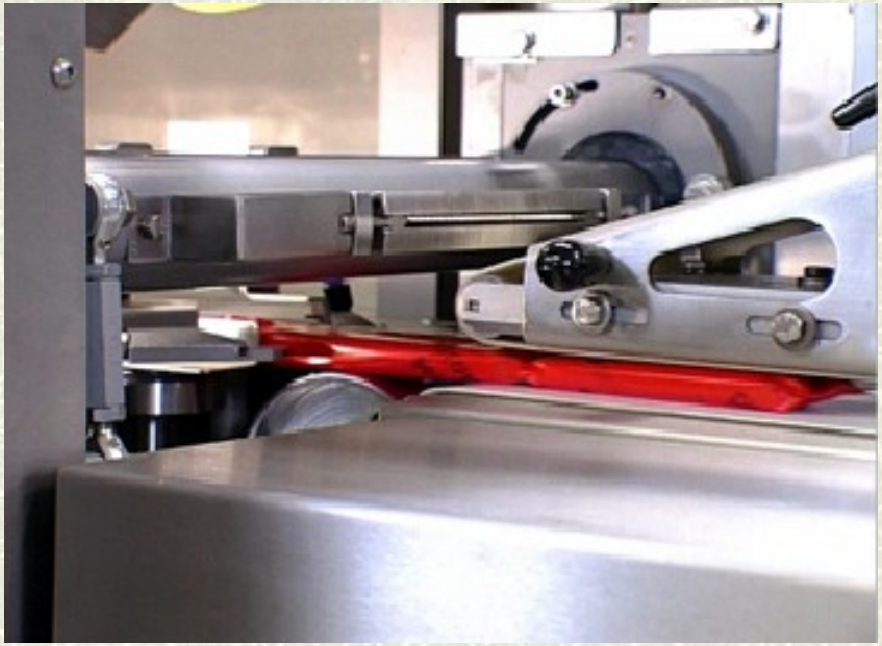
JMD-STD model has functions specially designed for film feeder axis,

- Drives the chain conveyor under speed mode, and outputs pulse train signal as master clock references for Axis-II/III.
- Prepares a special digital input function for “Push-bar index” sensor as reference point.
- Any position of the push-bar can be expressed in angle(0~360deg.) with respect to “Push-bar index”.
- Prepares four CAM switch outputs for interfacing to Axis-II/III, or other peripherals.
- Set the pitch of the Chain-conveyor equal to the film pitch
- Perihelion point or Stand-by point all expressed in angles.
- Easy control of the push-bar position

Axis-I: Standby position control

Using Jupiter, it becomes easy to move all axes to standby position for minimizing wastes





Axis-II: Film feeder

Though simple pulse-tracking method can be used to feed the wrapping film by tracking the master clocks of Axis-I, the JMD-RC model is best suit for the Film-feeder axis.

The reason is obvious when customers need to pursue/enhance the packaging speed, Mark-Registration, Empty-bag prevention, etc.

Axis-II: Mark registration control

Mark Registration method

The Jupiter RC has two special fast capture inputs reserved for push-bar and print mark sensor signals. When film tension changes, inevitable in all cases, the print mark position with respect to the product loses its phasing. By utilizing above two signals, both “Trend and Transient compensation” are executed to achieve mark registration automatically.

- **Transient compensation**

  The Jupiter-RC checks the shift between print mark and push bar signal, then adjusts the phase shift automatically

- **Trend compensation**

  The Jupiter-RC measures the distance between two adjacent print marks, analyzes the film elongation trend, then compensates the tracking rate automatically to ensure the accuracy.

Axis-II: Empty bag prevention

In order to prevent empty bags produced during the packaging process, the Jupiter-RC has special functions for achieving the "no product/no bag" requirement. They are:

- Product status observer

  By use of a sensor continuously checking "exist or non-exist" of the incoming product, the "product existence status" on the chain conveyor is recorded in a shift register queue. From the register queue, the M-value indicating how many empty push bar locations is easily verified.

- M-pitch-Packing function

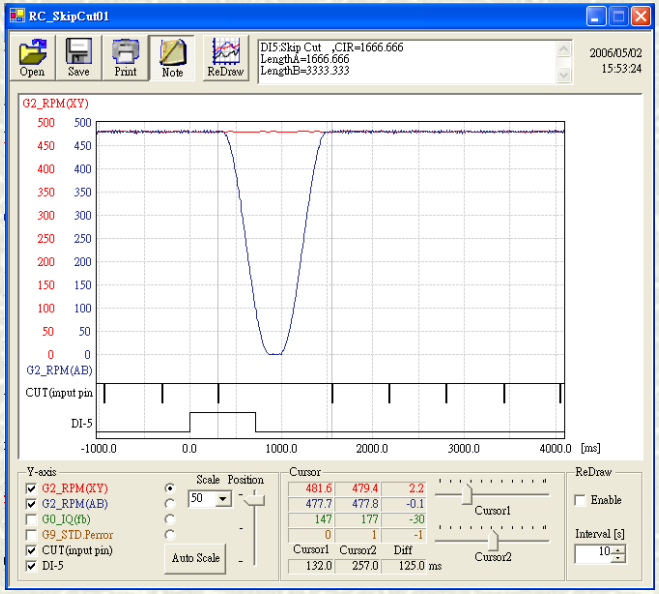
  M-pitch stands for "pack M-times of the push bar pitch as one pack". The Jupiter-RC can execute complex motion profile for immediate pitch changing process in order to prevent empty bag.

Axis-II: Product-Observer

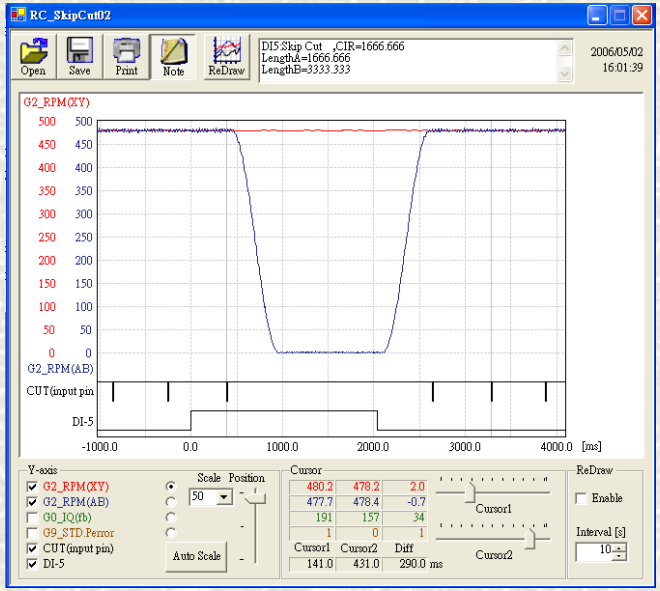
- By adopting a product sensor to a special digital input of Jupiter, combined with an internal 16bit shifter, “product status” on the conveyor line is recorded any analyzed.
- The sensor location is freely selectable(up to 15pitches away) by parameter.
- Analyzed M-value stands for empty push bar locations to be avoided.

Axis-II: M-Pack function

- When the internal “Product observer” issues a M-pack command, the motion profiles changes automatically.
- This function is used to smoothly stop the wrapping film temporary and also restart next feeding smoothly.



M=2



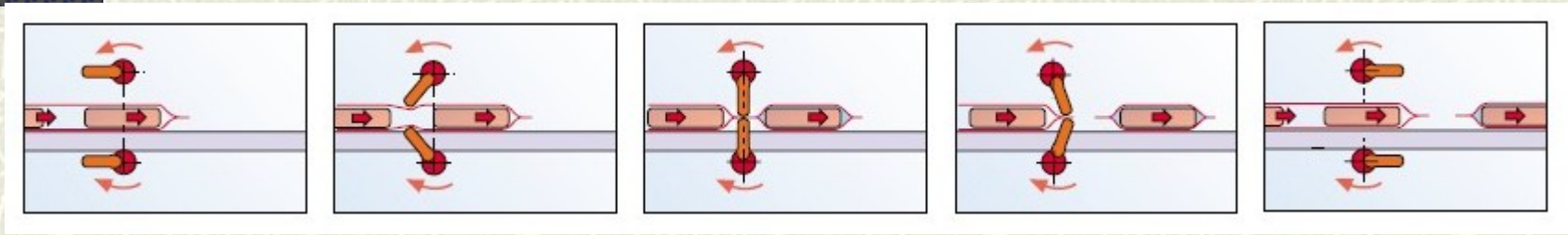
M=3

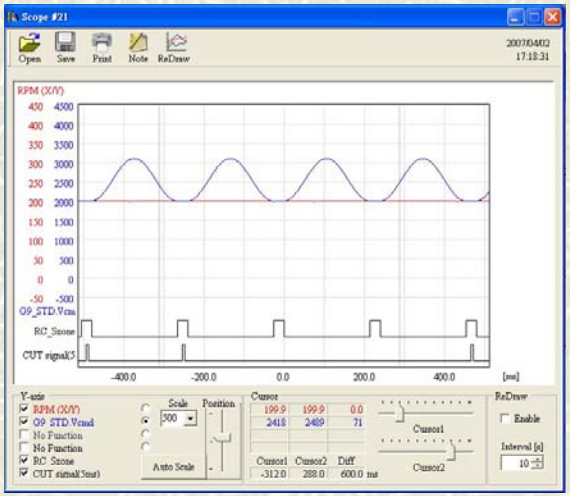
Axis-III: Rotary Sealer/Cutter

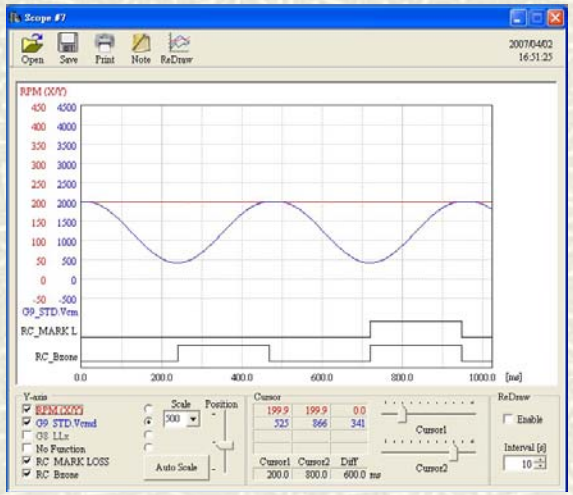
JMD-RC & JMD-VRC, are best models chosen for the Rotary End-Sealer/Cutter. The packing machines are categorized by Standard rotary type and Long-dwell/Cradle type.(distinguished by the mechanical design)

- JMD-RC is designed for Standard rotary type
- JMD-VRC is designed for Long-dwell or Cradle type
  VRC: **Volcanic shaped RC** motion profile for Cosine-Compensation
- Both RC & VRC have ability for Mark-Cutting & Skip-Cutting

Standard Rotary-Seal/Cut motion



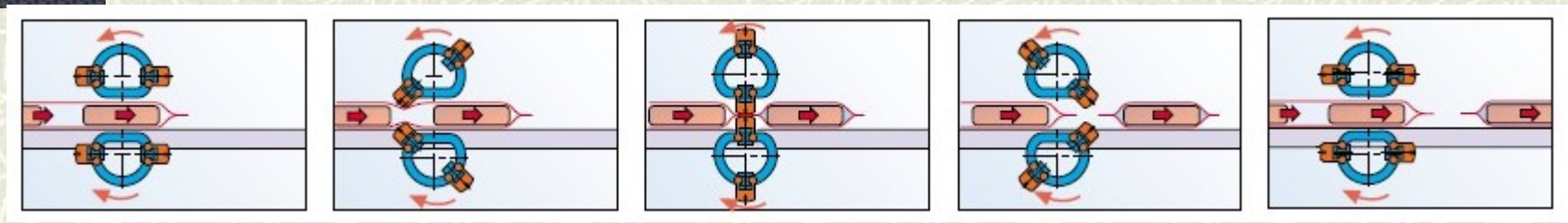


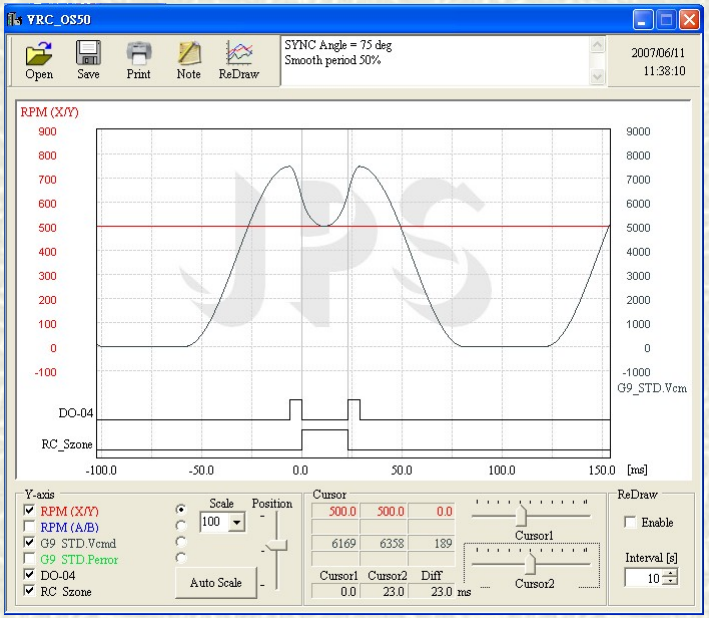


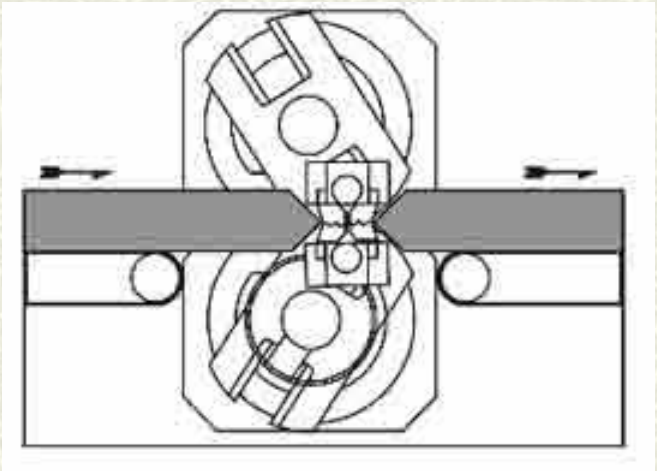
Standard rotary seal/cut type, requires less sync. Angle(<30deg)

Jupiter RC generates optimum profile curves automatically.

Long-dwell Sealing motion



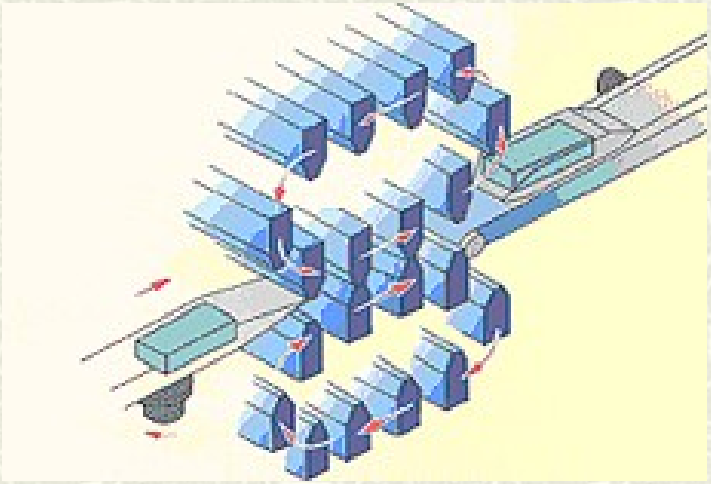




Large Sync angle with Cosine compensation

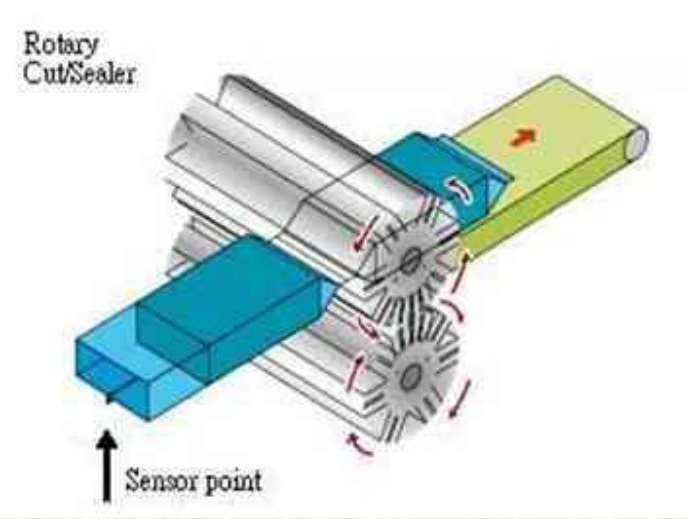
Cradle type and Long-swell

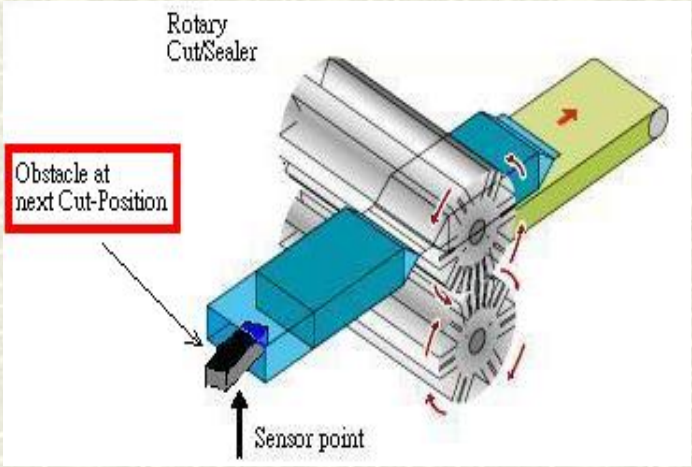
- The Long Dwell cutting is designed for producing packages with various sizes/shapes; or, which is hard to seal film and where airtight package is required.
- It allows the sealing bars a longer sealing time compared to the standard rotary sealing/cutting heads.
- The "D" type cams allow the sealing bars a linear translation movement.
- The flat part of the "D" type cams corresponds to the sealing length.
- In the Sync-region(as high as 120deg), the motor’s angular speed requires an extra cosine compensation to match the film’s linear speed.
- Cradle type has different mechanism, Same control method can be applied.



Misposition-Observer

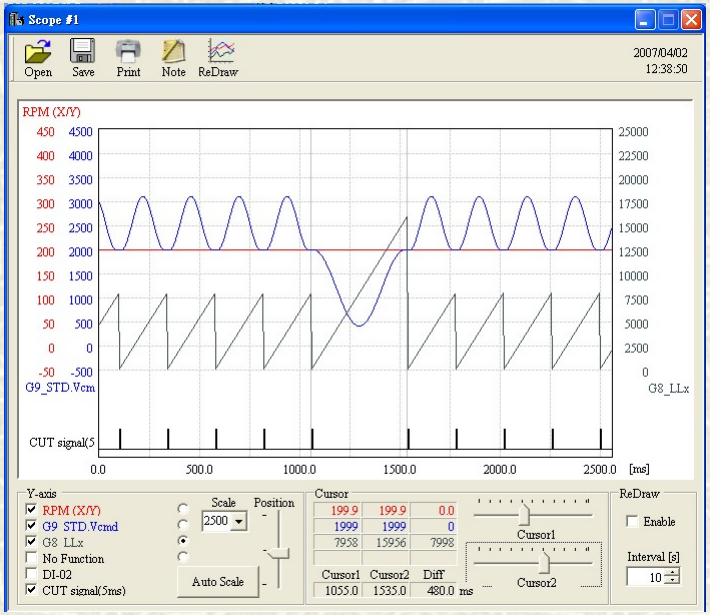
When an obstacle exists at the seal/cut position, it could damage the mechanical parts. In order to avoid this, with a obstacle sensor, the Jupiter can create the misposition-observor internally.
Unlike the product-observor detects “product non-exist”;
The misposition-observor is used to detect “obstacle exist” at the cut-point.



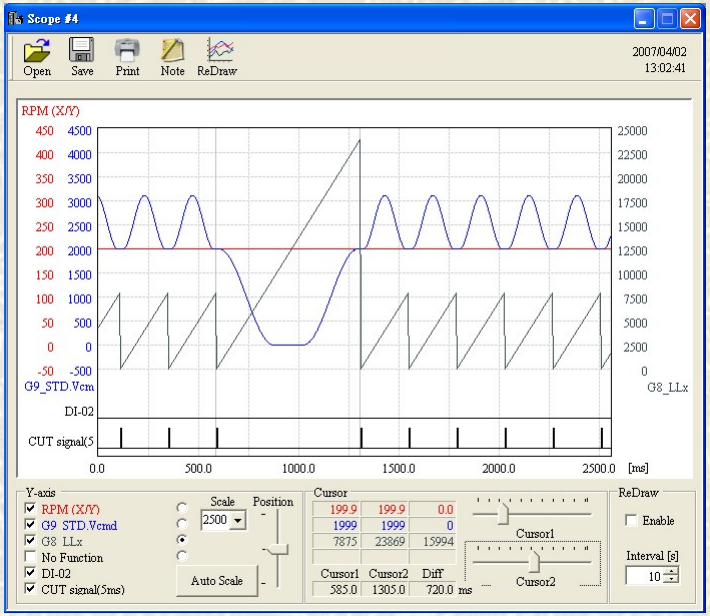


Skip-Cut & misposition observer

When the observer detects obstacle/obstacles that should appear at next cutting position/positions, the “Skip-value” indicating the required skip pitch, will be generated for the sealer/cutter to skip automatically.

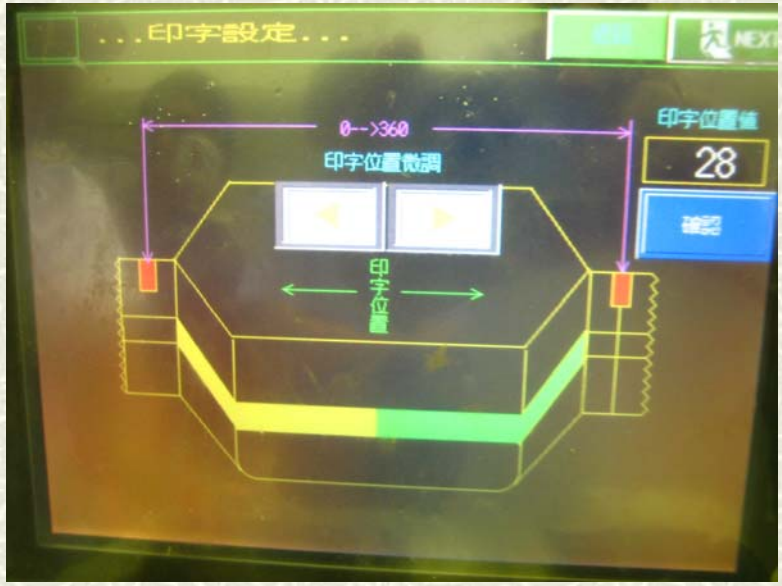


Skip=2



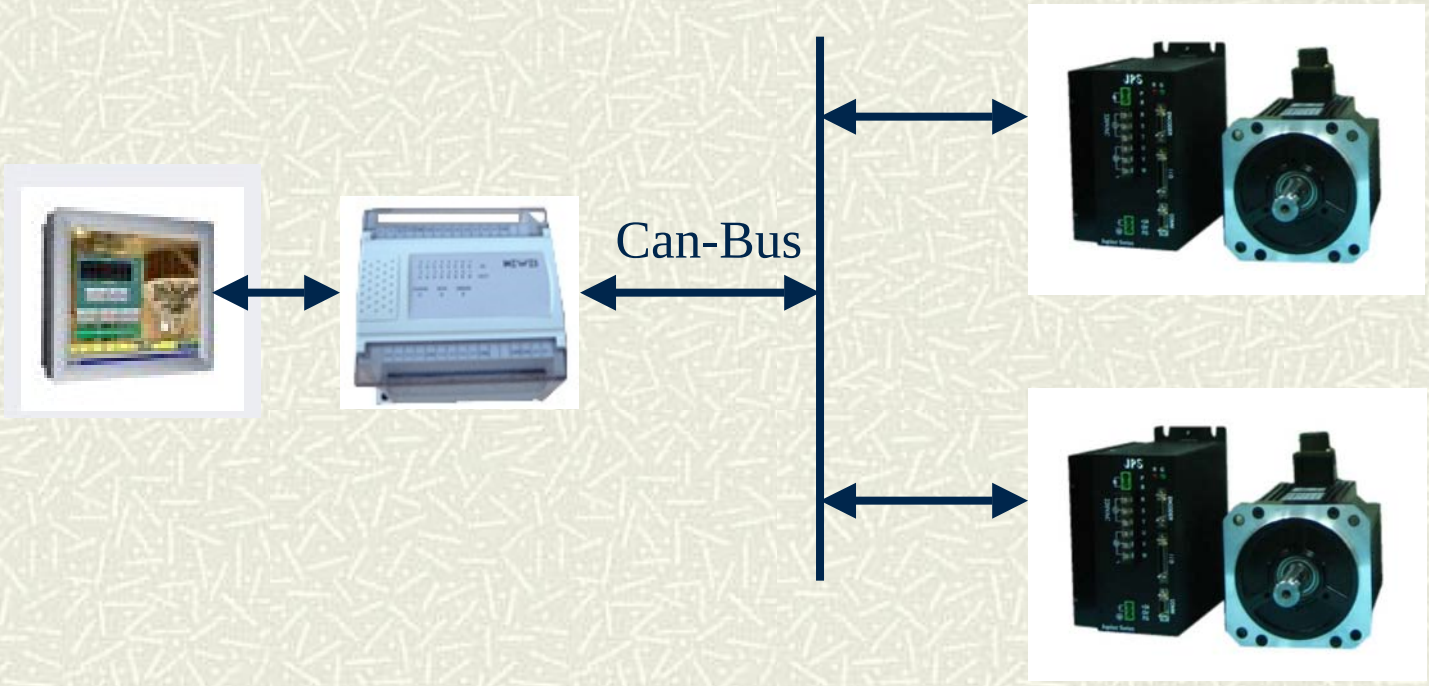
Skip=3

Easy setting through Modbus



System integration by CAN PLC

If necessary, by cooperating with third parties companies, we can also supply “Fully integrated system” to meet specific customer’s request.



* Perihelion point of the chain-conveyor & push bar

- Perihelion point of chain-conveyor is a particular push-bar position where the products change from “conveyor speed to film speed”.
- Before reaching the Perihelion point, product speed equals to the conveyor speed because it is pushed to move by the conveyor push-bar.
- After passing through the Perihelion point, the push bar can no longer exert any force to push the product any further; product is now carrying away by the film(formed bag).
  Therefore the product speed should equal to the film speed.
- Note: “push bar pitch must always larger than bag-pitch”. In other words, “Chain conveyor speed always faster than Film speed”