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OEM应用介绍
CPW

蒋　申

GOTC Team Lead (N/NE)
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Allen-Bradley • Rockwell Software

Rockwell Automation

Value Delivered by RA (IA+ GOTC) to OEM

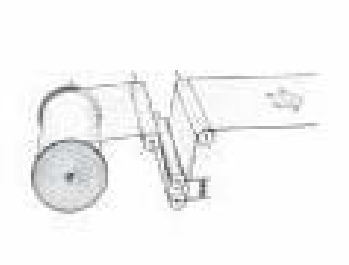
Winder/Unwinder

Flexo Printing Machine

Advanced Motion Concept

Typical Wind & UnWind Application in OEM

包装机械



卷绕

- 张力控制
- 机械惯量补偿
- 实时卷轴切换

纺织机械

绕线

- 高精度张力控制
- 同步性能高
- 可变的绕线模式
- 不同的绕线速度

塑料机械

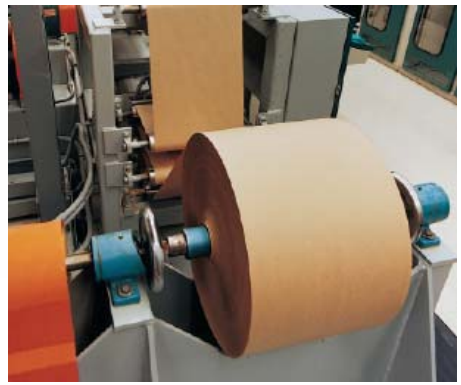
卷绕装置

- 表面收卷
- 中心收卷
- 采用扭矩电机直接收卷驱动
- 轴同步
- 摆棍控制
- 张力控制
- 全速自动筒管更换

印刷机械

卷绕

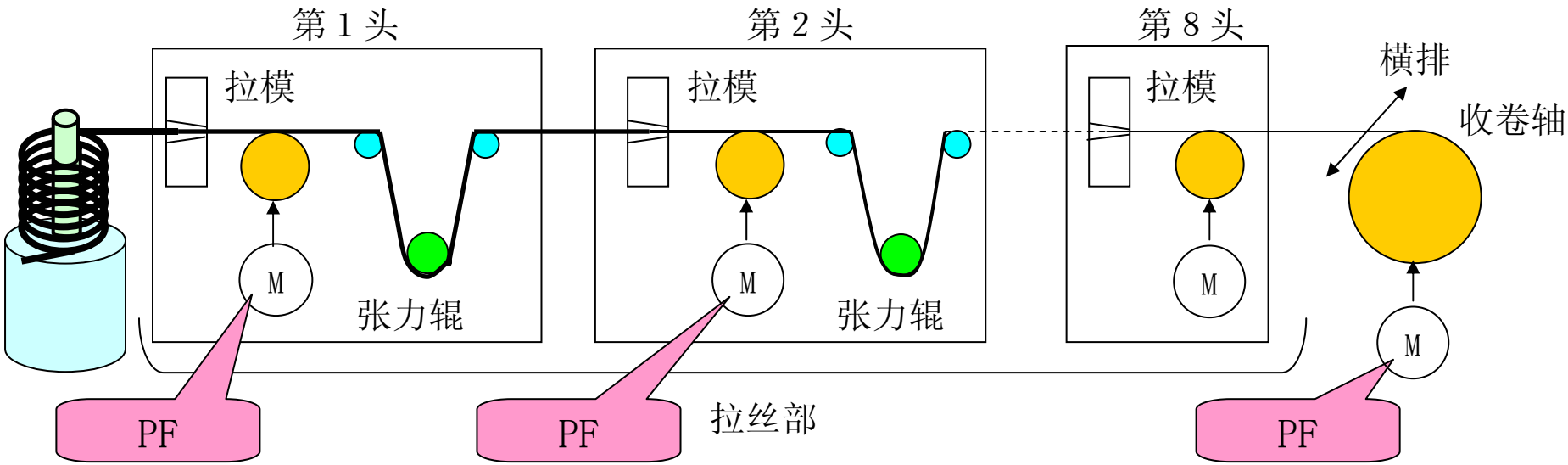
- 张力控制
- 张力定位控制
- 质量惯性补偿
- 实时卷轴切换



收/放卷机械举例

① 拉丝机

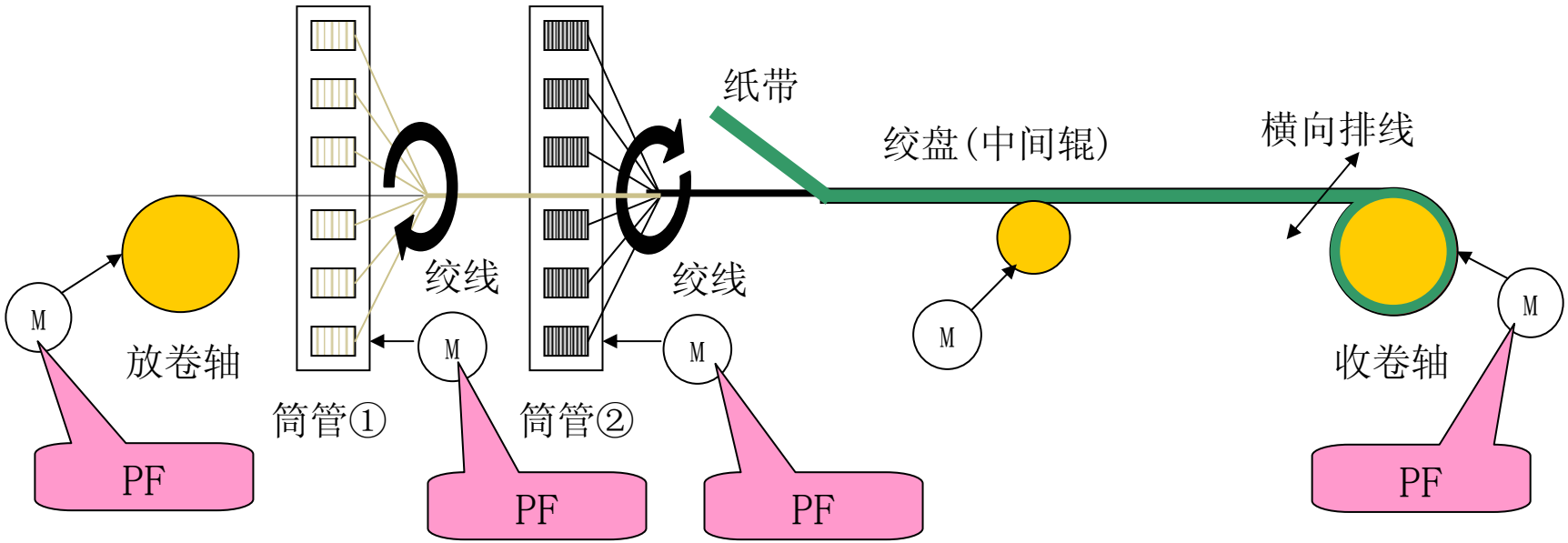
- 钢丝、电线行业的主要生产设备
- 用于把粗的钢丝按要求拉伸成细钢丝
- 也有用于棒材拉伸的拉丝机
- 开卷轴多使用自然开卷(不使用电机/磁粉离合器等)
- 中间轴（拉丝部）使用拉模伸线拉出
- 如果需要进行微弱张力控制的场合, 有时需要进行速度控制使用张力辊和变频器



收/放卷机械举例

② 绞线机

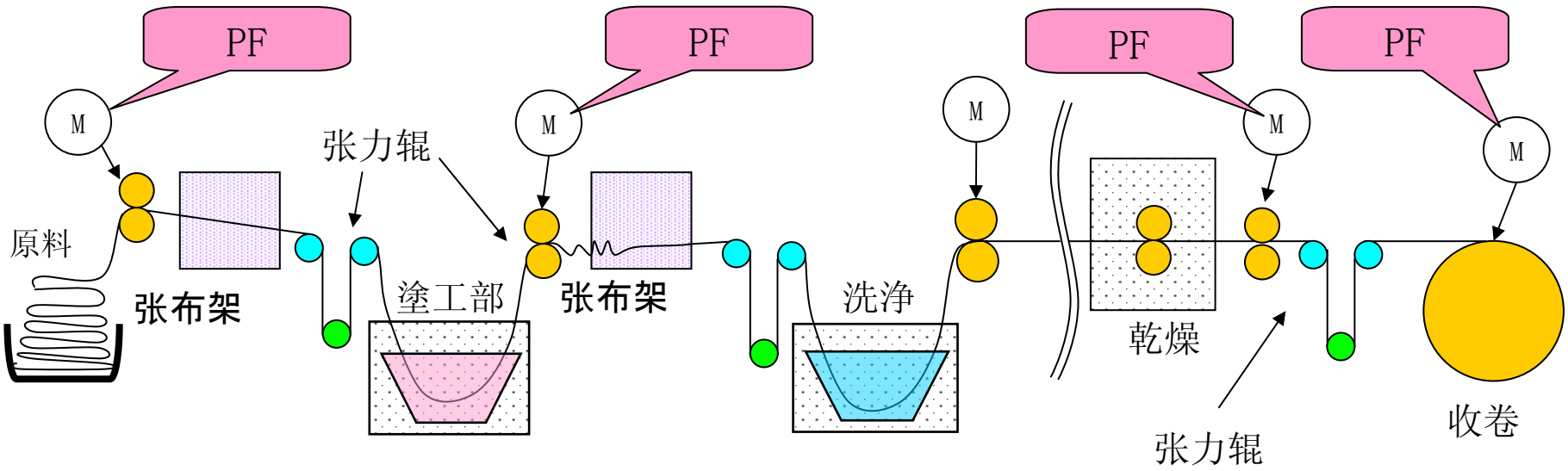
- 主要用于电线电缆机械
- 用于把多台线绞成一条线
- 纺织机械也有类似的设备
- 捻螺距根据筒管和绞盘的速度比决定
- 绞盘通常使用矢量控制（速度控制）
- 筒管通常使用矢量变频器或伺服系统



收/放卷机械举例

③ 染色机

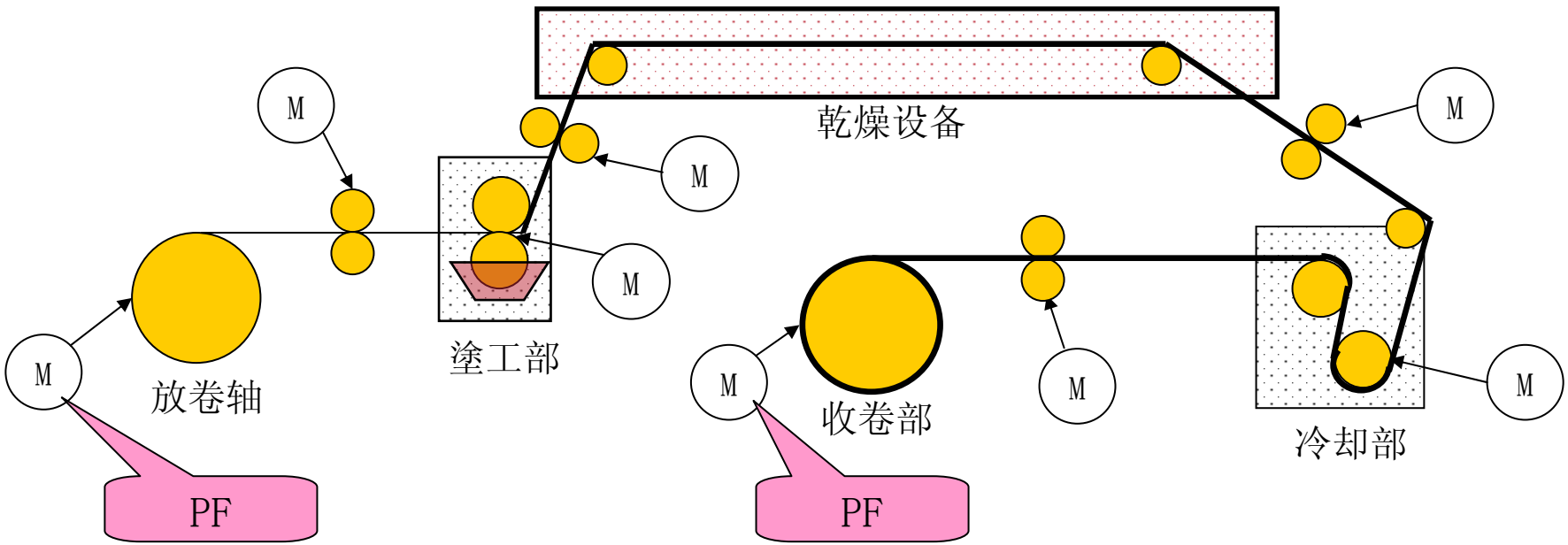
- 通过液流或气流对布及原料进行染色的装置。
- 在布料上进行印花、印字等印花机
- 某些工位需要防爆类型设备
- 收卷・放卷常用进行速度控制使用张力辊和变频器
- 乾燥工程常用使用风机变频器
- **张布架**部分需要进行张力控制，通常使用伺服/矢量变频器



收/放卷机械举例

④ 涂布机・复合机・印刷机

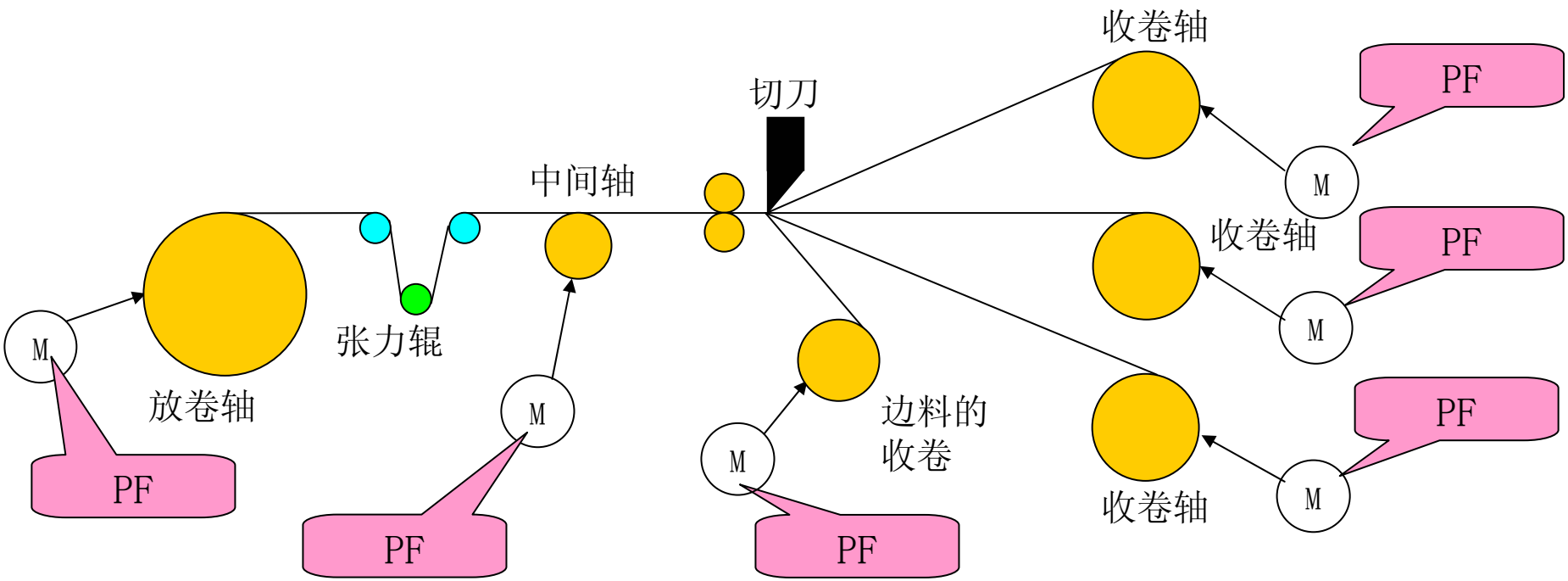
- 用于造纸、纤维等行业的设备上
- 涂布机是在原料上进行涂层的机械、复合机是将几种材料迭合到一起的机械
- 某些工位需要防爆类型设备
- 乾燥工程常用使用风机变频器
- 中间辊通常使用矢量变频器



收/放卷机械举例

⑤ 分切机

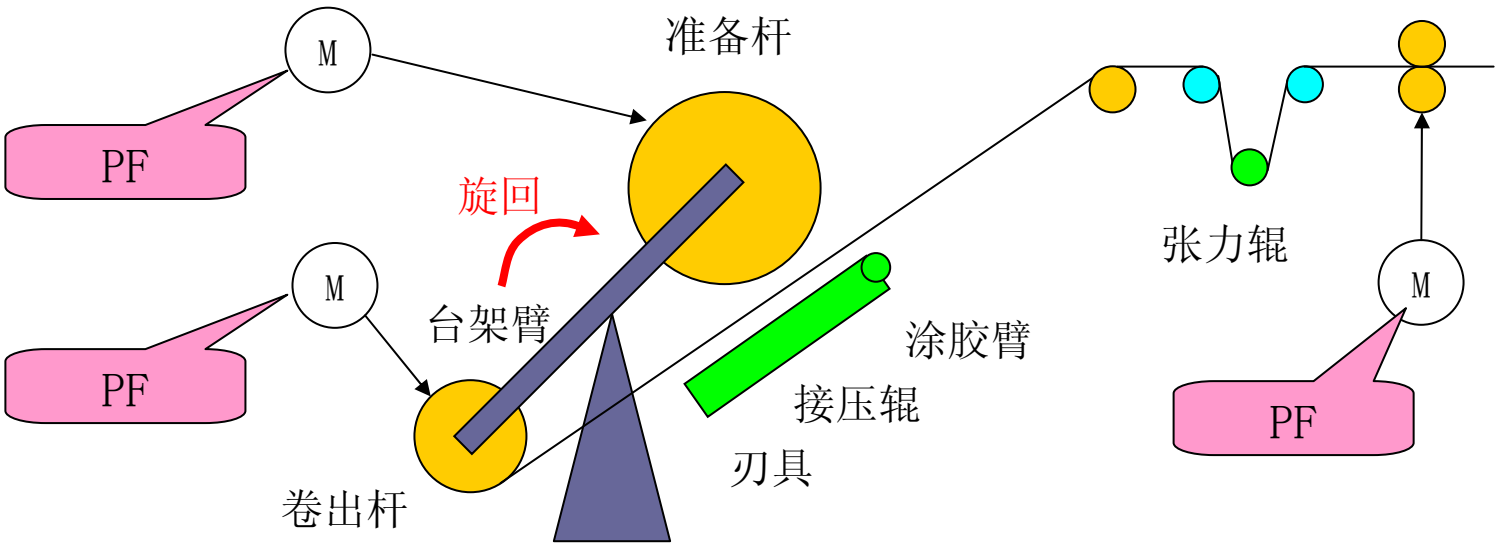
- 加工纸张、薄膜等产品所使用的分切装置
- 宽幅材料在纵切割后分成几份进行收卷
- 放卷根据材料选择、速度控制或转矩控制
- 中间轴通常使用伺服



收/放卷机械举例

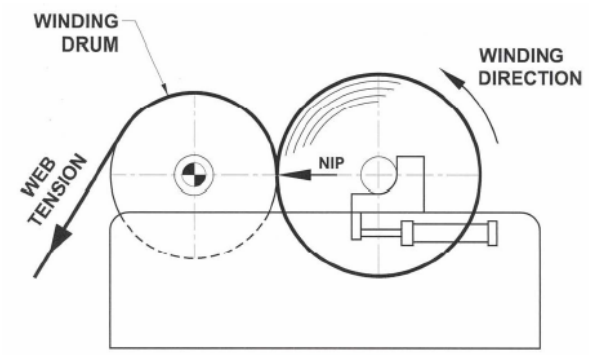
⑥ 印刷机(自动接纸结构)

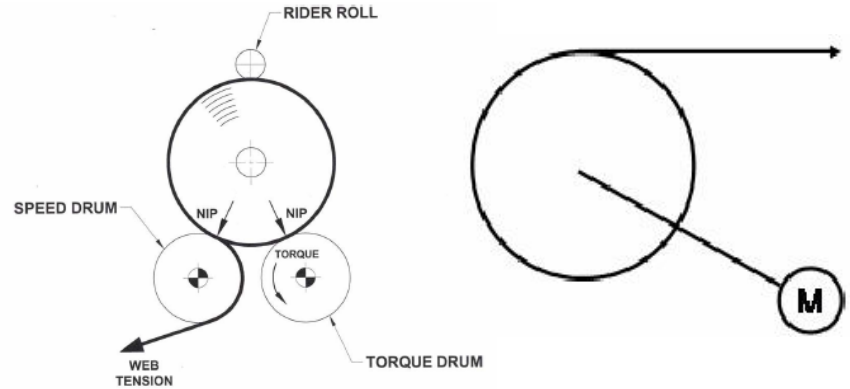
- 为不使机械停止而达到贴接材料的目的,自动接纸系统是在回旋杆上设置2-3个放卷轴。
- 使回旋杆旋转起来带动新轴向放卷材料的上方附近移动,使卷出杆的转速度与准备的转速度一致



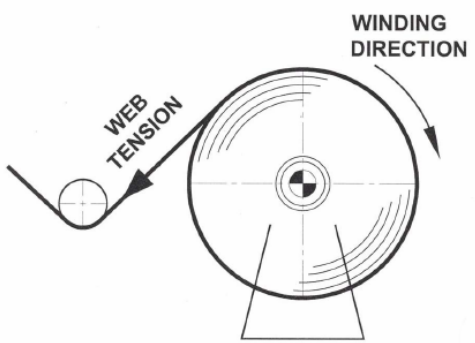
Winding Overview

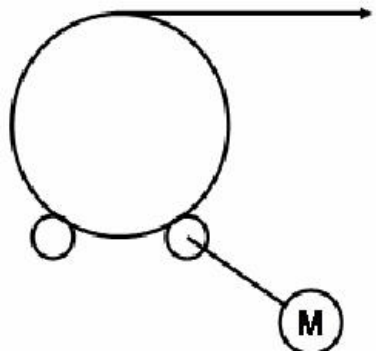
- Surface driven
  - No diameter calculation needed, simpler to control
  - May damage material surface



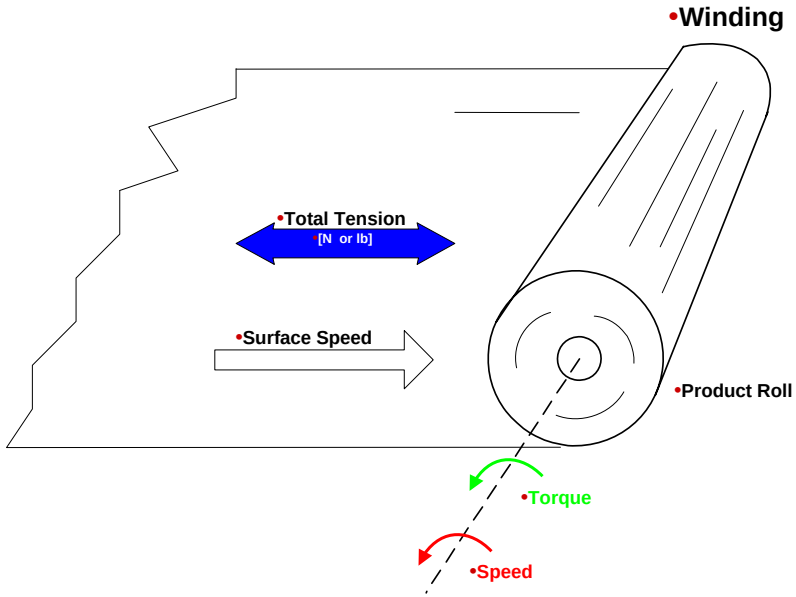


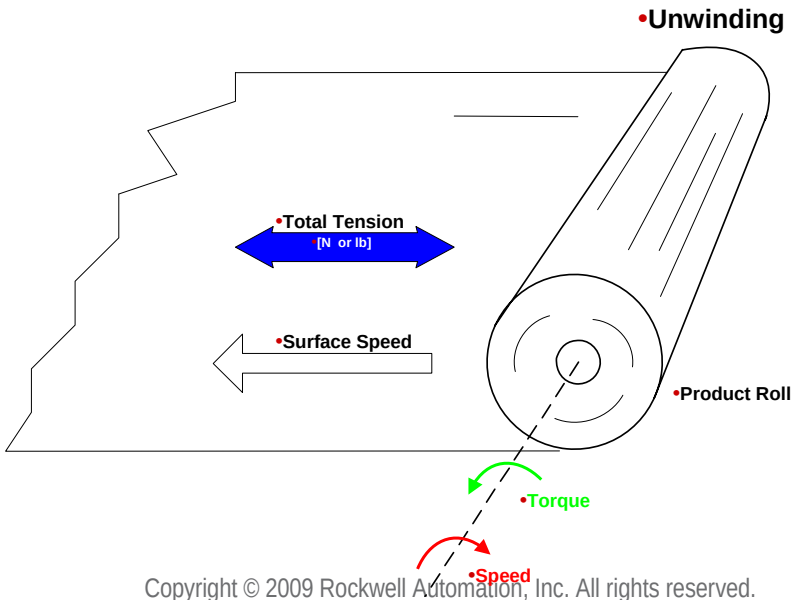
- Center driven
  - Most popular





Winding / Unwinding

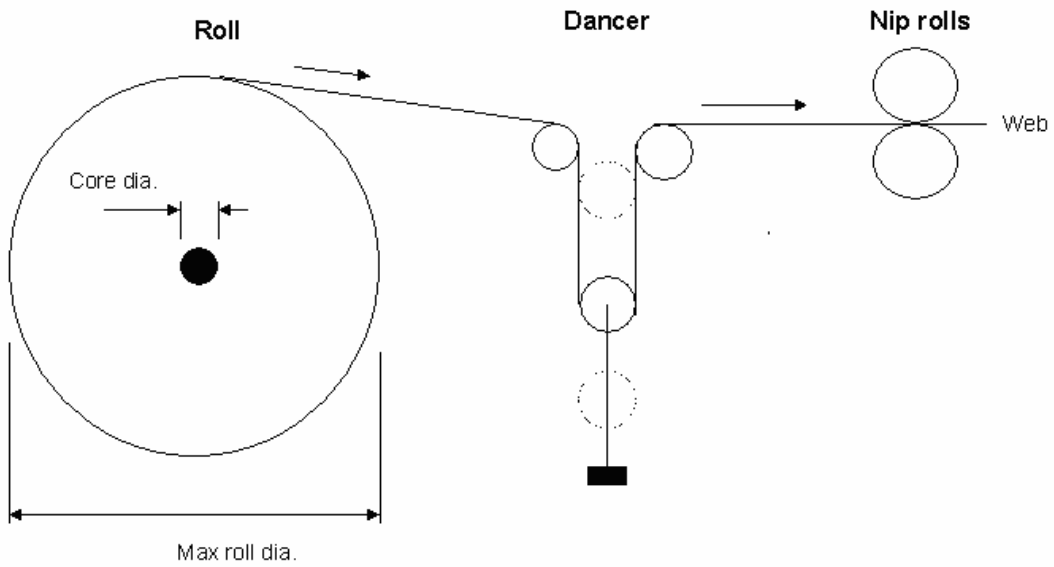




Usage of Diameter

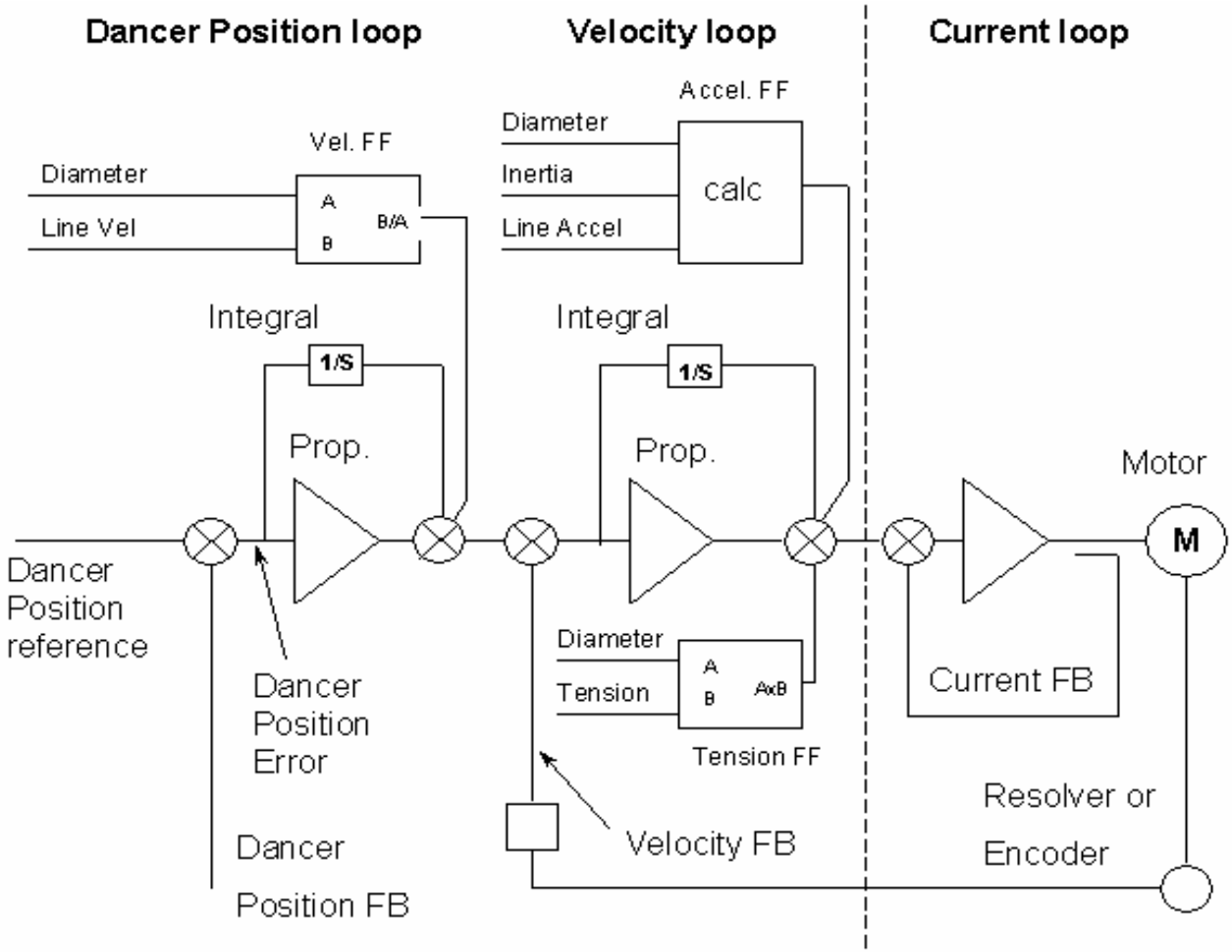
- Calculate and set motor speed to achieve given line speed
  - Motor speed = Line speed / Radius x Gear Ratio (+ correction from tension controller)

- Direct tension control
  - Web tension (x cross section) = Motor Torque x Gear Ratio x Radius
  - For low cost low specs winding tension control



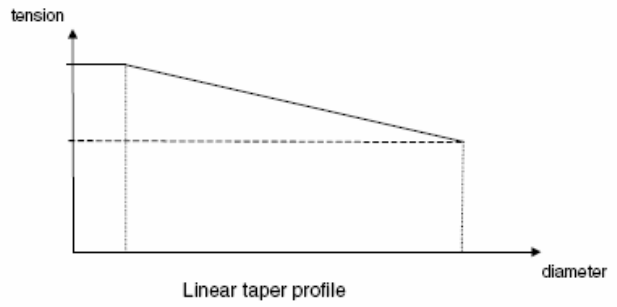
Usage of Diameter

- Adaptive control
  - Speed loop gain adaption
- Feedforward control

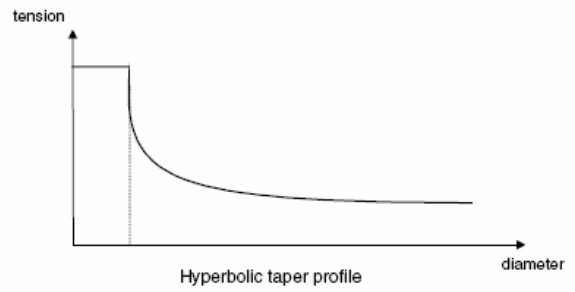


Usage of Diameter

- Taper tension
  - Requirement and parameter from process engineering
  - Linear, hyperbolic



Linear taper profile

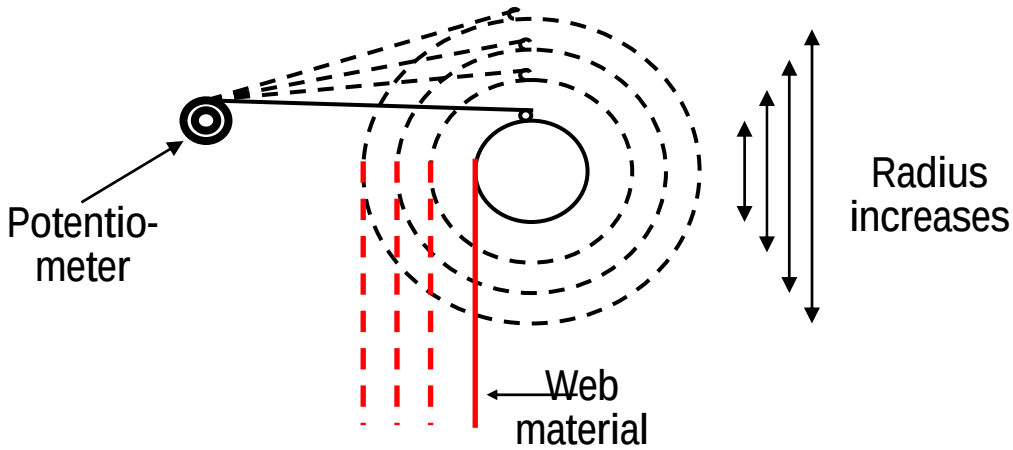


Hyperbolic taper profile

- Roll change

Methods: by Sensor

- By Sensor
  - Non-Contact
    - Ultrasonic: direct measurement, easy calculation/scaling
    - Laser: higher accuracy, more expensive
  - Contact
    - Potentiometer with mechanical arm
- Disadvantage
  - Cost
  - Signal filtering
  - Reliability



Methods: by Film Thickness

- By Film Thickness
  - Film thickness X accumulative revolutions X 2
- Advantage & Disadvantages
  - Smooth
  - Accurate only if thickness data is accurate, otherwise may cause accumulative error
    - Material inconsistence
    - Gap or air trapped in between layers

Methods: by Diameter Simulation

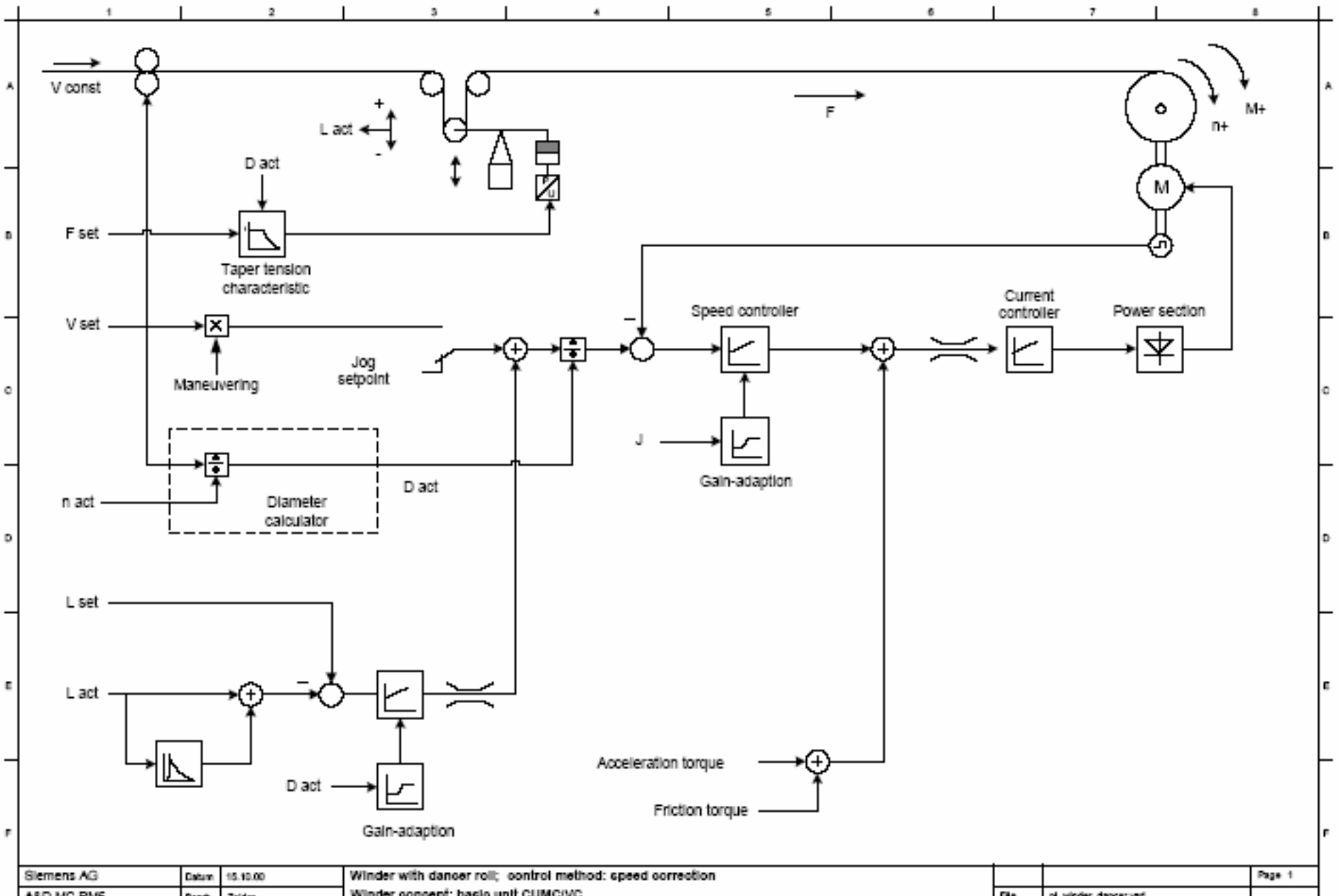
- By Diameter Simulation
  - Principle: the total mass of unwound, rewound, and in-machine material is constant
  - If we know one diameter (either unwind or rewind), we can simulate the other by some math
- Advantage & Disadvantages
  - Still need to know one diameter
  - Normally used as backup or cross-checking

Methods: by Line Speed / Roll Speed

- By Line speed / Roll speed (V/N mode)
  - Radius = Line Speed / Roll speed
  - Line speed sources:
    - Line encoder
      - Real speed, slip dependent, could cause damage
    - Draw axis actual speed
      - Real speed, however slip dependent
    - Machine line speed reference
      - Not real speed, ,highly speed stability dependent

- Advantage & Disadvantages
  - Reaction fast
  - Not accurate when line accelerating or decelerating, or at slow speed
  - Lots of noises, need good filtering

Preferred way for tension control: Speed Correction

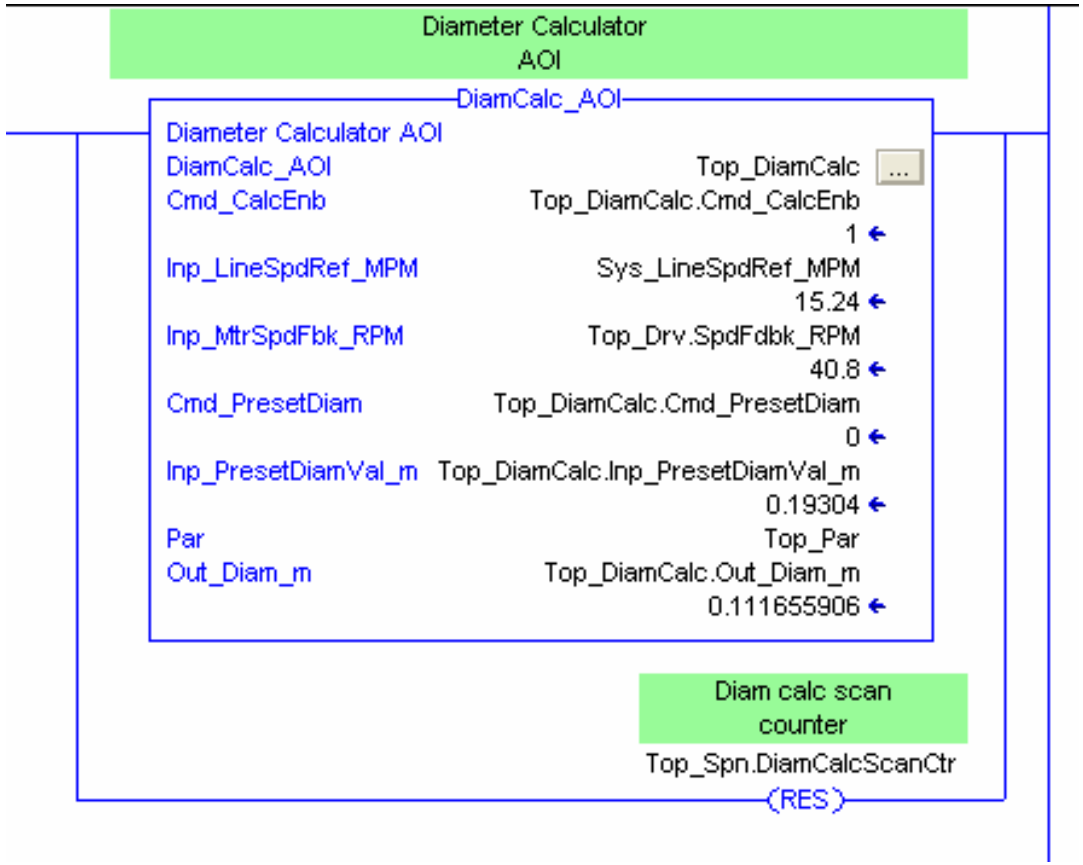


Typical Wind & UnWind

Wind & UnWind:

. Inertial compensation fixed part + variable part
. Diameter calculation
. RPM reference calculation
. Torque reference calculation
. Torque regulation
. Taper tension

Typical Wind & UnWind



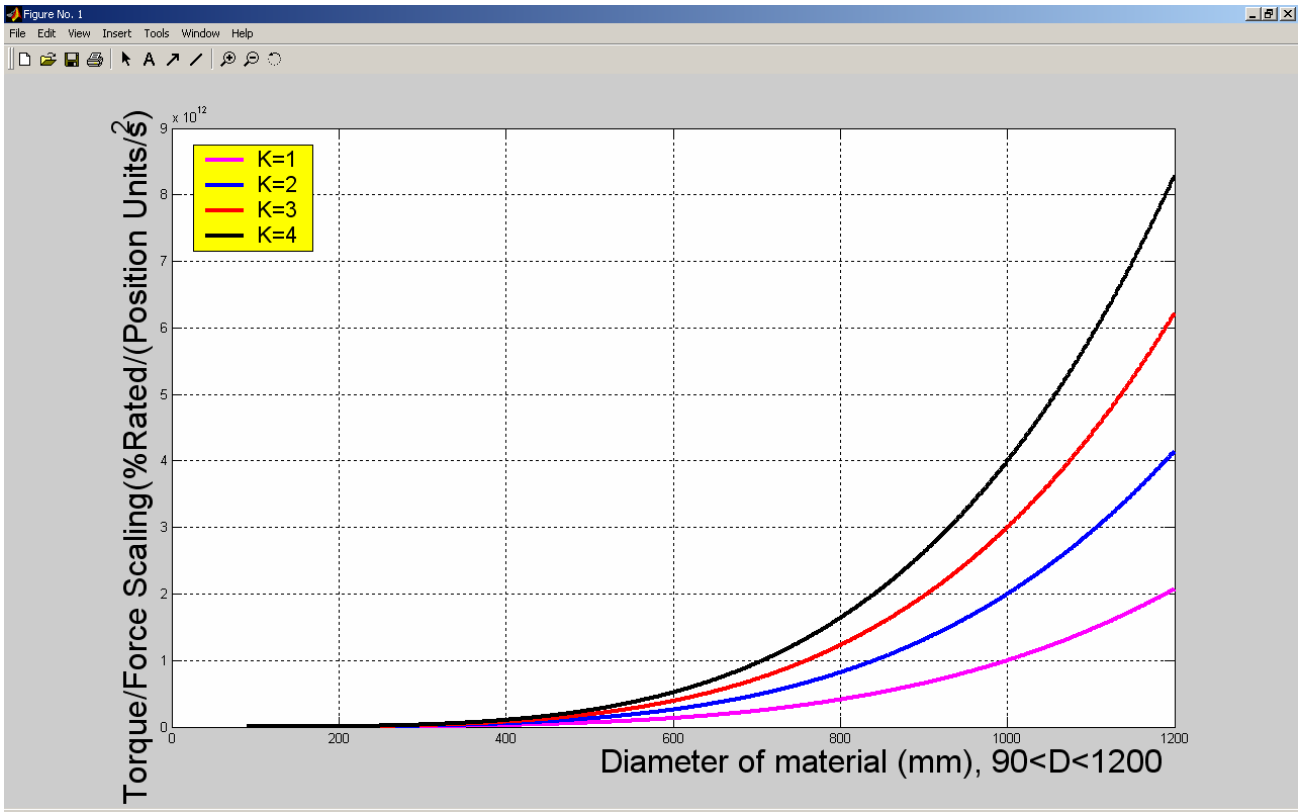
True Adaption capability for Dynamic Inertia: On-line Torque/Force Scaling adjustment via MSG

If Ratio >> 1, then the T/F is: $T/F = \frac{200\pi^2 \rho H}{32 T_R \cdot i^2} \cdot D^4 = K \cdot D^4$

$$T/F \approx K \cdot D^4$$ (Formula 1)

Where: $K = \frac{200\pi^2 \rho H}{32 T_R \cdot i^2}$

From the formula above, the T/F is in proportional to the diameter. Because the diameter is smaller and smaller , so we must decrease the value of T/F during unwind.

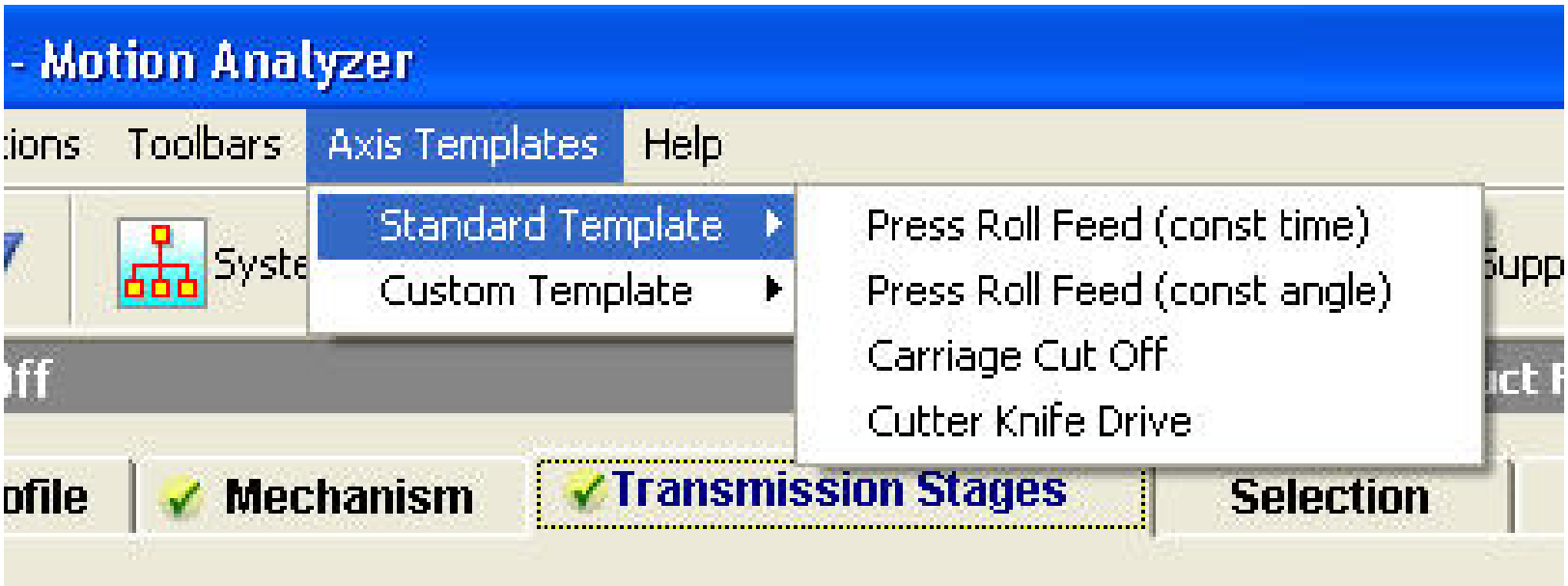


Here we assume the K is equal to different value, then we can simulate graph using MATLAB.

For different axis, the value of K is not the same, so the slope of graph is different.

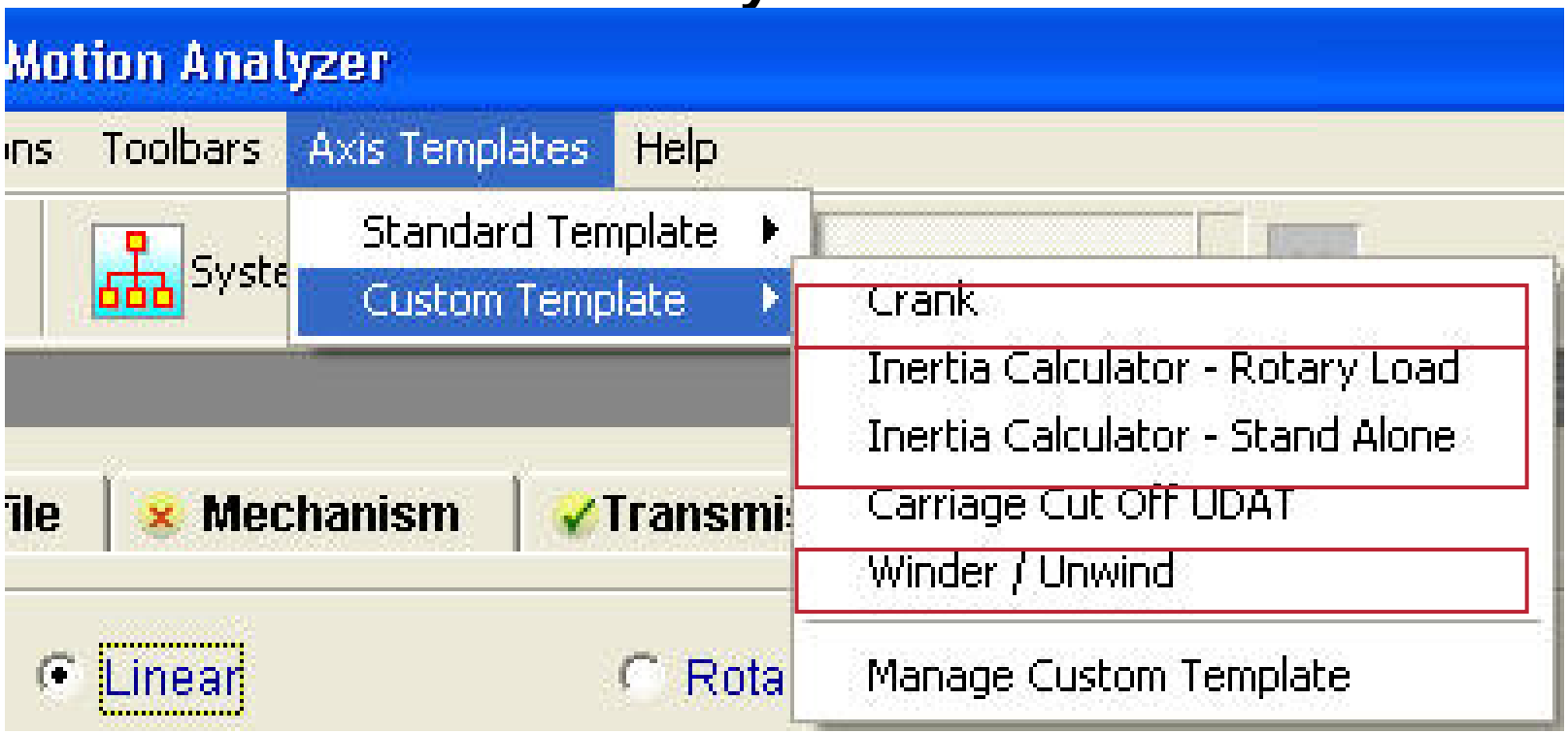
Existing Motion Analyzer Templates

Existing templates from MA v4.1:



New Motion Analyzer UDATs

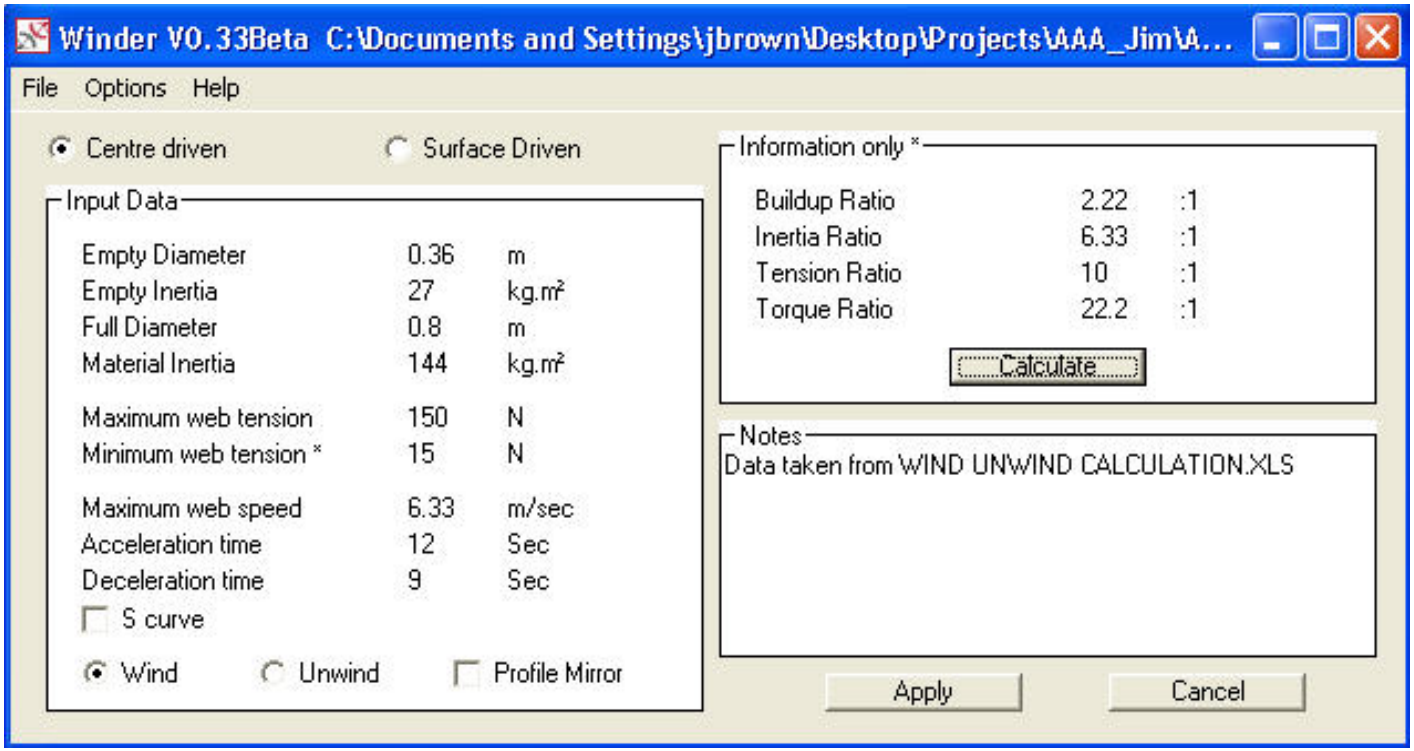
New UDATs automatically installed with MA v4.2



User Defined Application Templates

Winder/Unwinder Sizing

Fill in the blank format



Value Delivered by RA (IA+ GOTC) to OEM

Winder/Unwinder

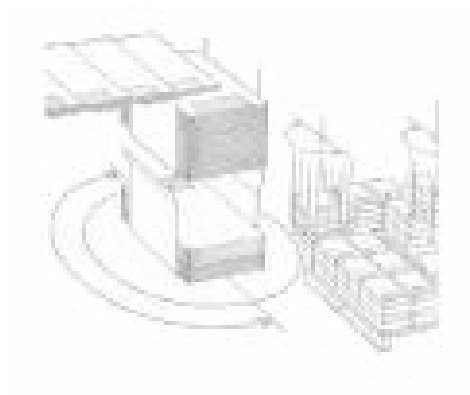
Flexo Printing Machine

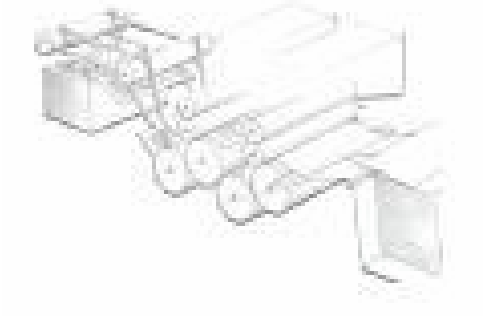
Advanced Motion Concept

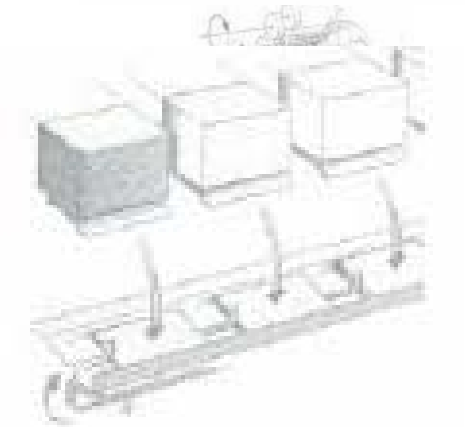
Typical Printing

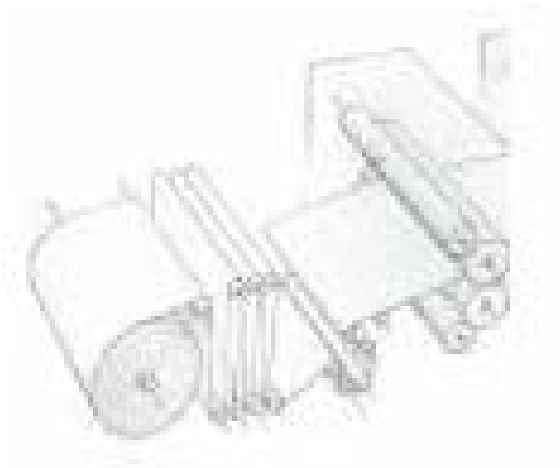
- 卷筒印刷
- 单张印刷
- 产品印刷

- 套色控制
- 卷绕,张力控制
- 印前，印后工序
- 模切，涂蜡… …
- 折叠，装订，打包… …









Flexo Printing Machine Structure
层叠式

柔版印刷机目前分层叠式、机组式、卫星式三种结构，

机组式和卫星式柔性版印刷机是最重要的机型

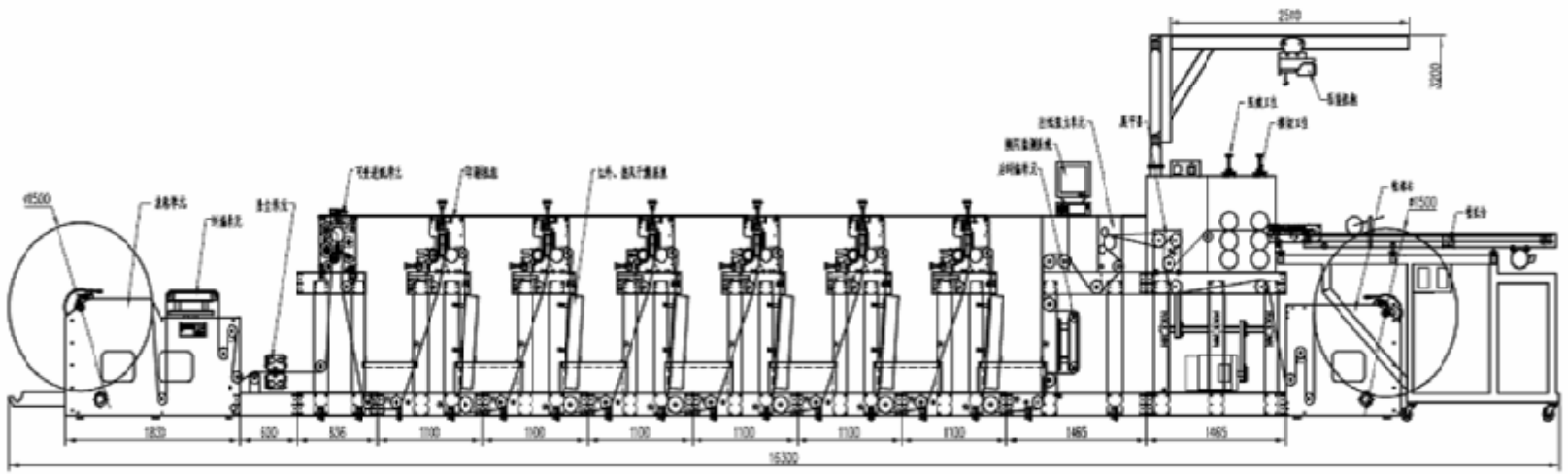
层叠式是结构最简单，价格最便宜的柔印方式。

层叠式柔版印刷机具有占地面积小、操作简单、价格便宜等优点。
但是其缺点也比较突出，主要是套印精度低，只有±0.5mm，不能用于印刷高精度的包装产品。
速度慢，受结构以及干燥原因，最快70m/min，部分机器单色印刷也能达到100m/min。

Flexo Printing Machine Structure
机组式

机组式柔版印刷机同目前国内流行的凹版印刷机一样，采用机组排列组合方式。

机组式柔版印刷机的印刷基材范围广泛，操作方便，套印精度在±0.2mm之内，印刷速度属于中速范围，基本在220m/min以内。但是机组式柔版印刷机宽幅集中在600mm以下，业内也常称之为窄幅柔版印刷机。
机组式柔版印刷机主要用于烟包、不干胶标签等附加值较高之产品，



Flexo Printing Machine Structure
卫星式

卫星式柔版印刷机是柔版印刷方式在中国地区应用较少而发展也较慢。

卫星式柔版印刷优点其实非常多，除开套印精度高、速度快等优点外。在印刷大面积色块（实地）时其实是有非常大的优势。

卫星式柔版印刷机的主要技术参数

- 最大印刷色数
- 适应的印刷材料
- 印刷宽度
- 印刷图文重复长度范围
- 干燥方式
- 印刷速度
- 油墨类型
- 控制方式

Machine Structure

卫星式柔版印刷机的主要技术参数：

- 最大印刷色数
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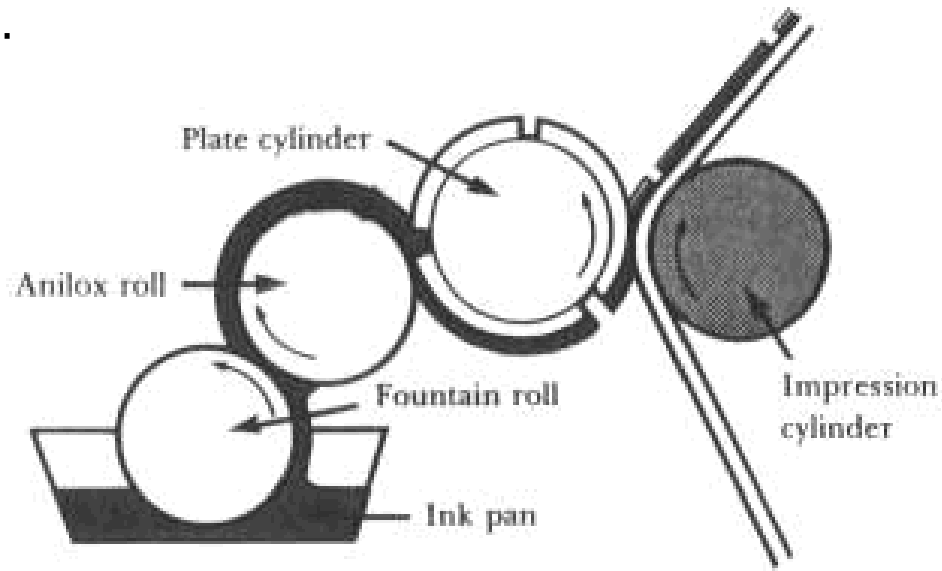
- 印刷图文重复长度范围
- 干燥方式
- 印刷速度
- 油墨类型
- 控制方式

最大印刷色数表示印刷颜色数量，一般最少四色，最多十色；适应的印刷材料，对卫星式柔版印刷机来说，非常广泛，这个是其最大优点。几乎市面上所有可以印刷的卷材，基本上都可以在卫星式柔版印刷机上印刷；印刷宽度指的是该台设备最大可以印刷的宽幅范围；印刷图文重复长度范围，指的是该台设备在长度方向最小和最大值。通常标准的卫星式柔版印刷机范围在300mm~1000mm之间；干燥方式，根据客户的实际需求，可以选用：热风干燥还是UV干燥；印刷速度，就是该台设备的最大印刷速度数；油墨类型，该台设备使用何种油墨：水溶性油墨、溶剂型油墨、UV油墨等；控制方式，该台设备采用手动快速调整还是自动调整控制。

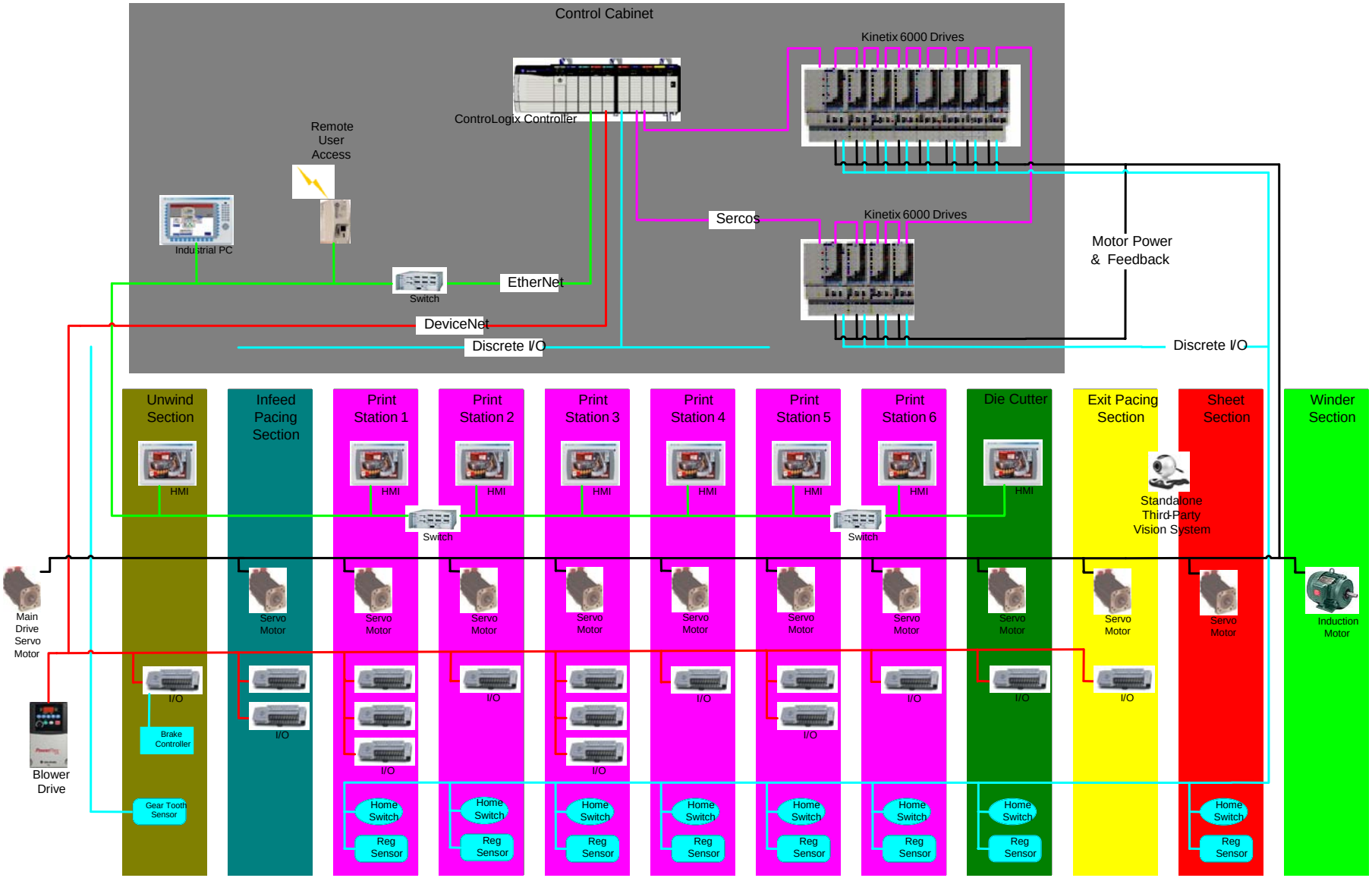
Typical Machine Specifications

- Max Speed: 100 ~ 250m/s
- Registration accuracy: ± 0.1mm
- Tension Control: ~100kg, ± 1kg
- Max web width: narrow, wide
- Plate roller diameter: 120mm ~ 260mm
- Printing material: paper, BOPP, …

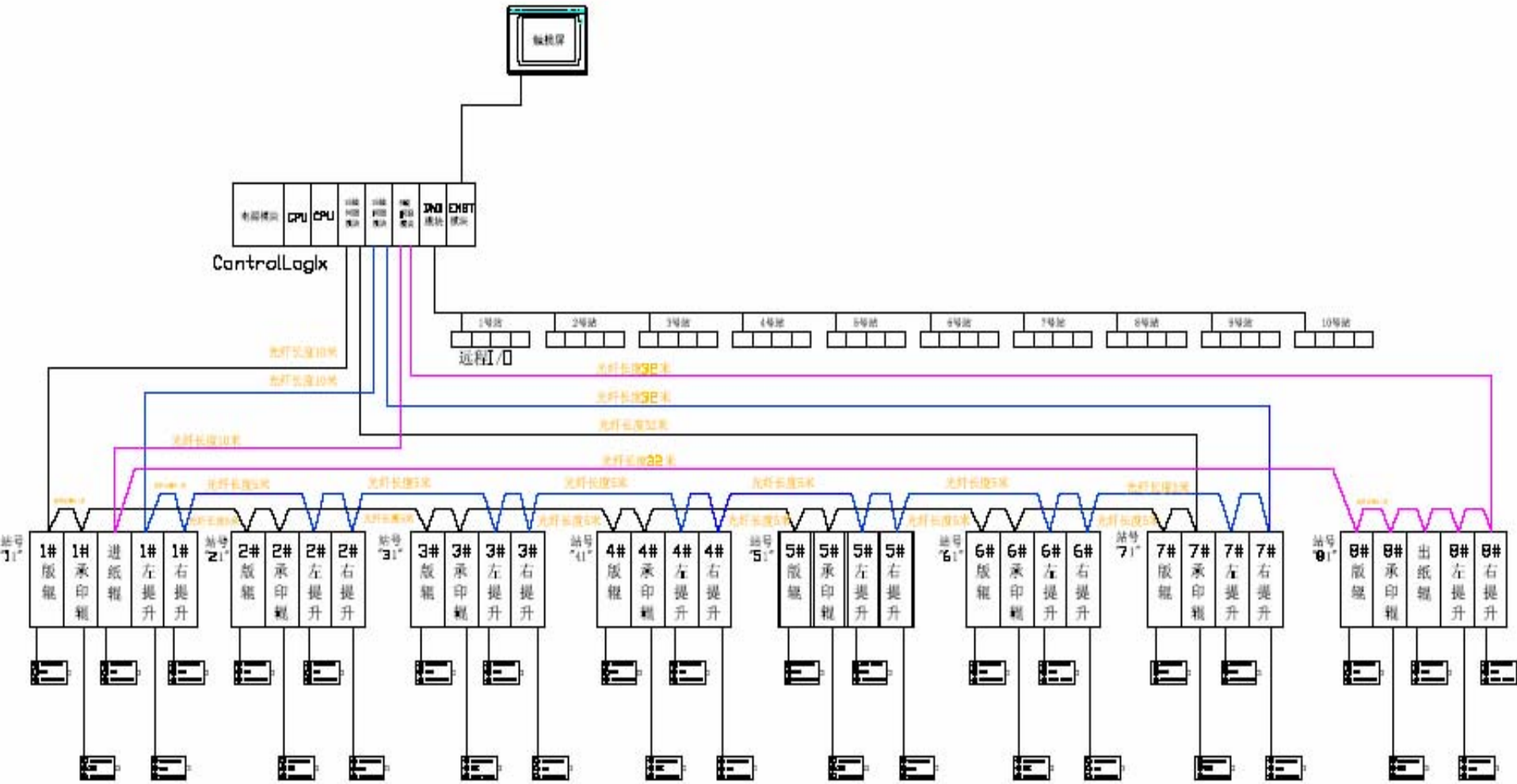


麦安迪(Mark-Andy)柔印机

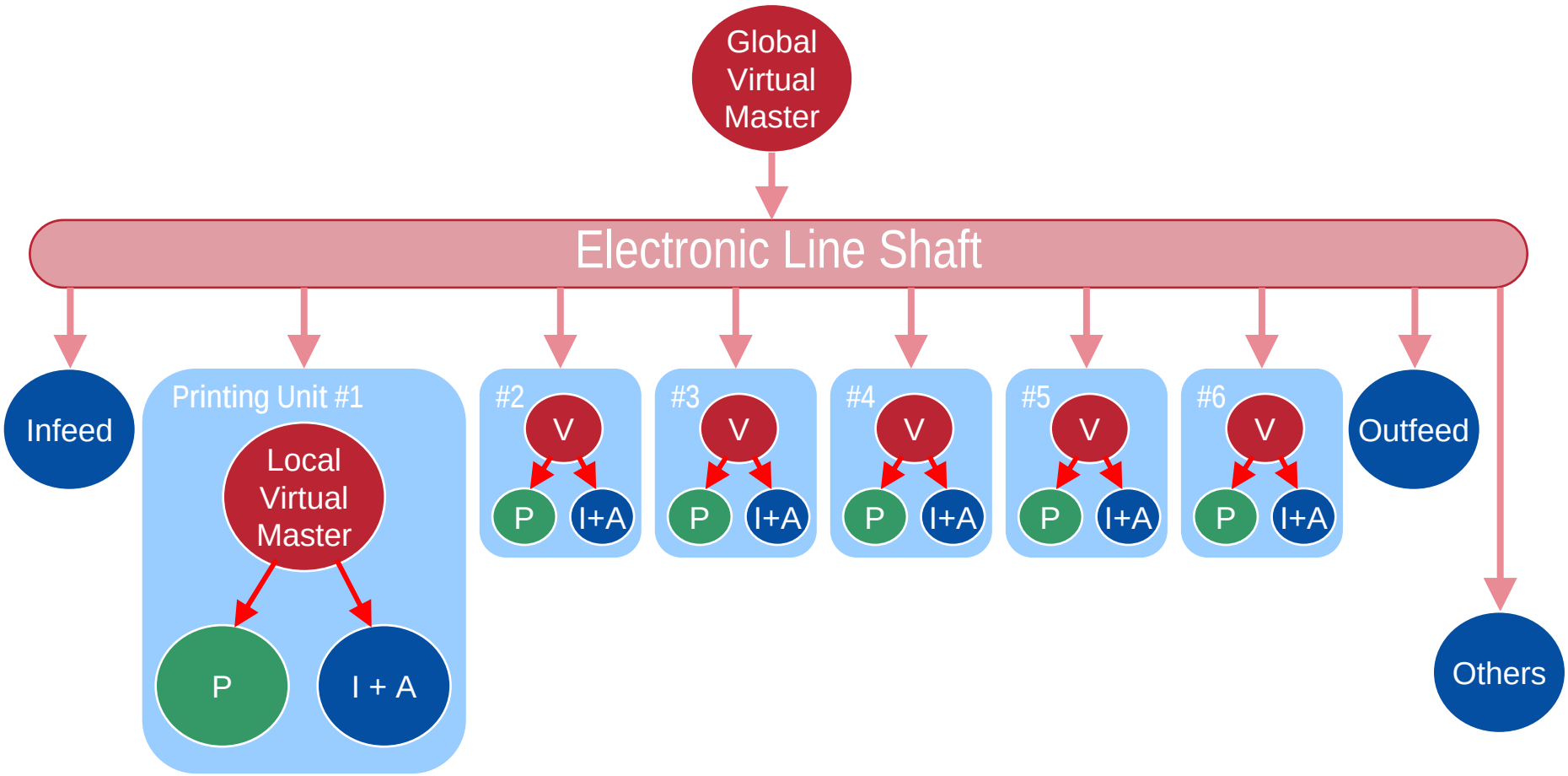
Integrated Architecture



8 Color System Drawing

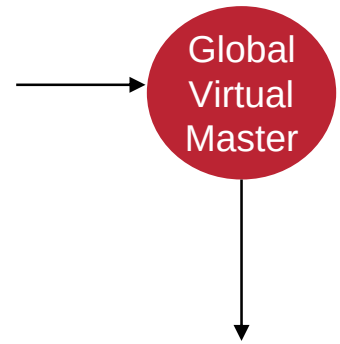


Non-Shaft Inline Flexo Printing



Virtual Master

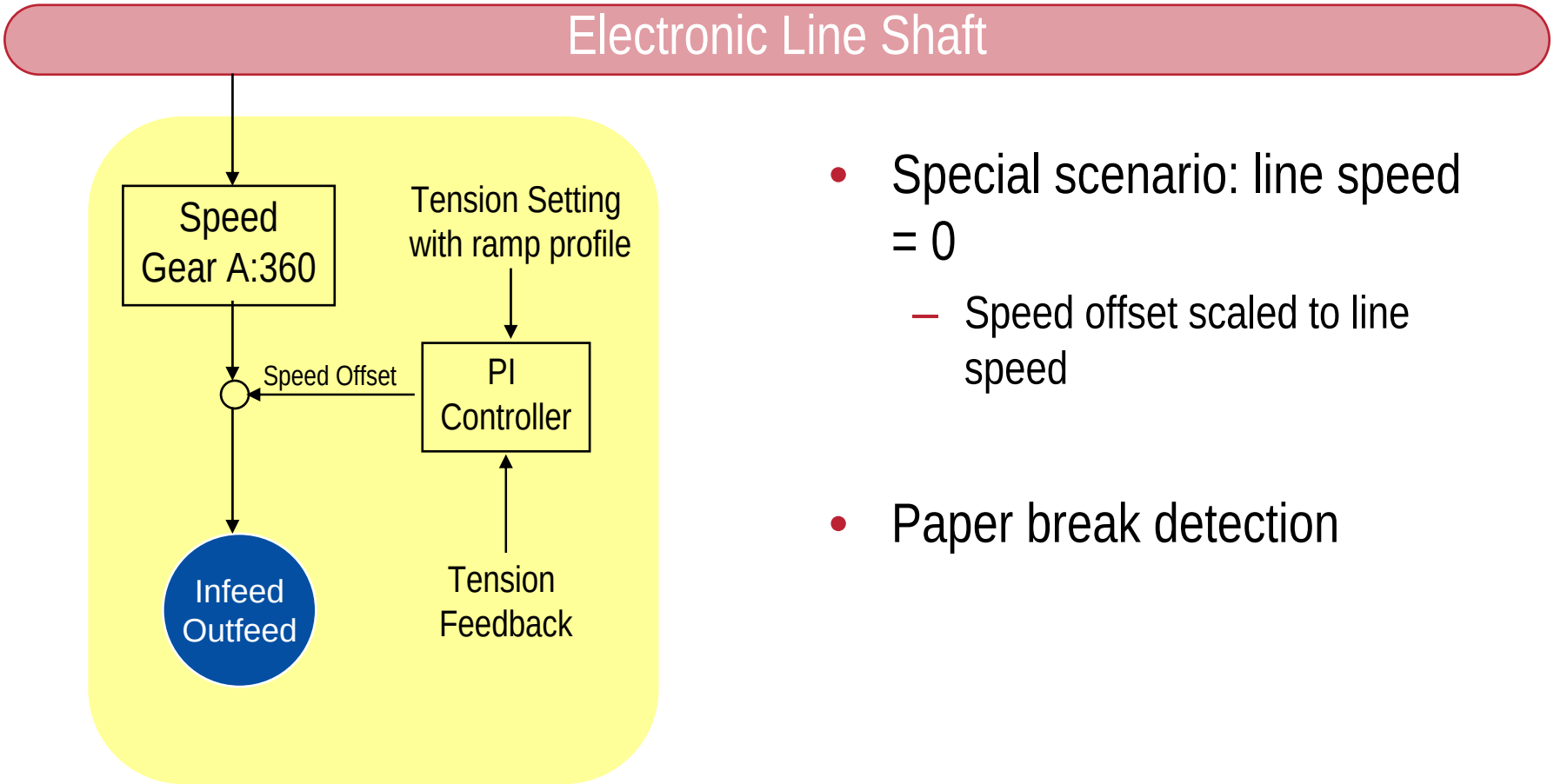
- Auto Stat/Stop: S-curve ramp
- Manual: Jog



- Normalization: 360 degree per revolution
  - One product per revolution

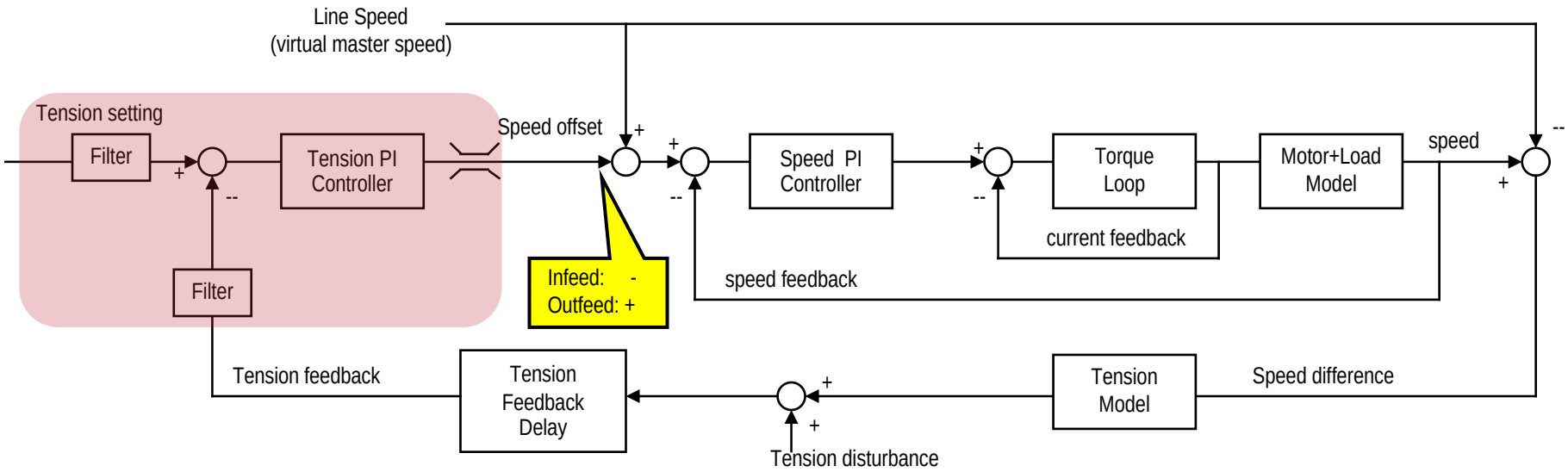
Electronic Line Shaft

Infeed / Outfeed Tension Control



- Special scenario: line speed = 0
  - Speed offset scaled to line speed
- Paper break detection

Infeed / Outfeed Tension Control



- More compensation algorithm can be added

Printing Unit

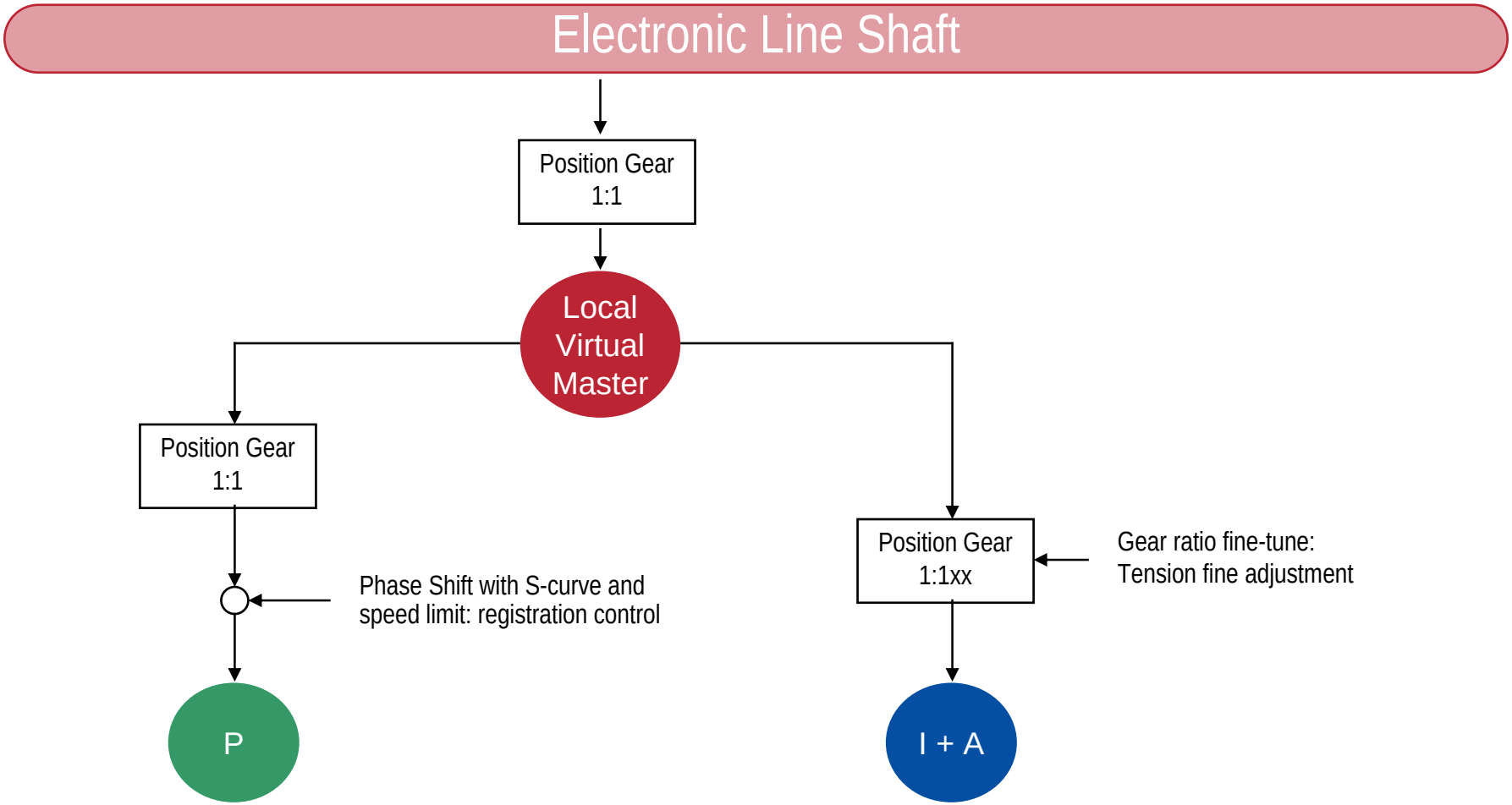
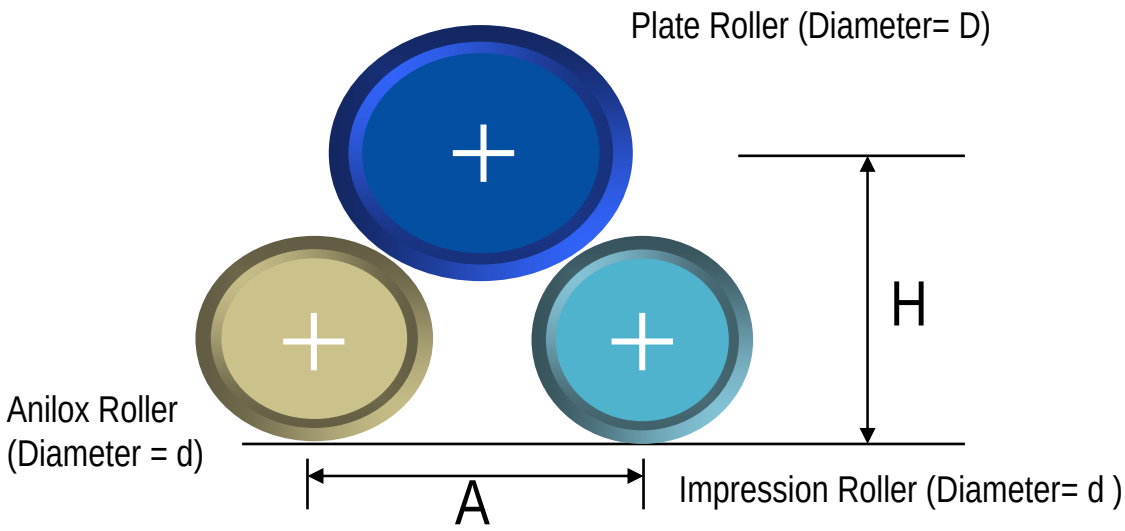


Plate Roller Pre-Press Position

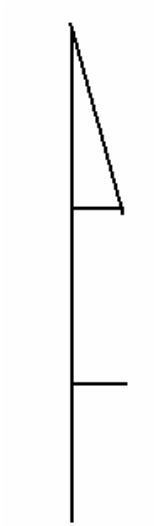


$$H = d/2 + SQRT(((D+d)/2)^2 – (A/2)^2)$$

- Impression Roller diameter is almost equal to Anilox Roller diameter

套色控制 （纸向及轴向）

- 手动套印
  印刷时人工操作按钮实现，套准线速度 0.3mm/s

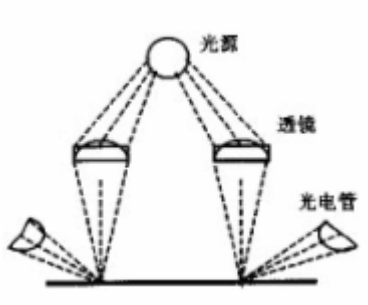


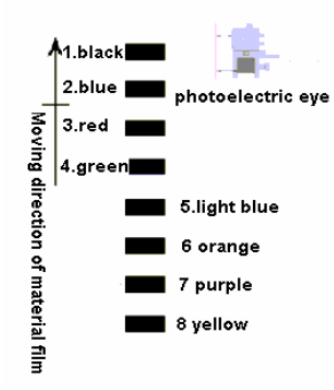
- 自动套印
  套准控制器通过安装在印刷单元上的双光眼检测开关，（除第一色外）计算套准距离，以脉冲信号形式发送到伺服控制器，高电平为启动伺服调整，低电平为停止调整，调整线速度速度为 1mm/s

- 预套准
  更换新版时，根据版辊直径，及色组间纸路长度，计算色组间版辊相位差。启动时，伺服运行到预套位置，之后进行手动或自动精确套印

Auto Registration Control

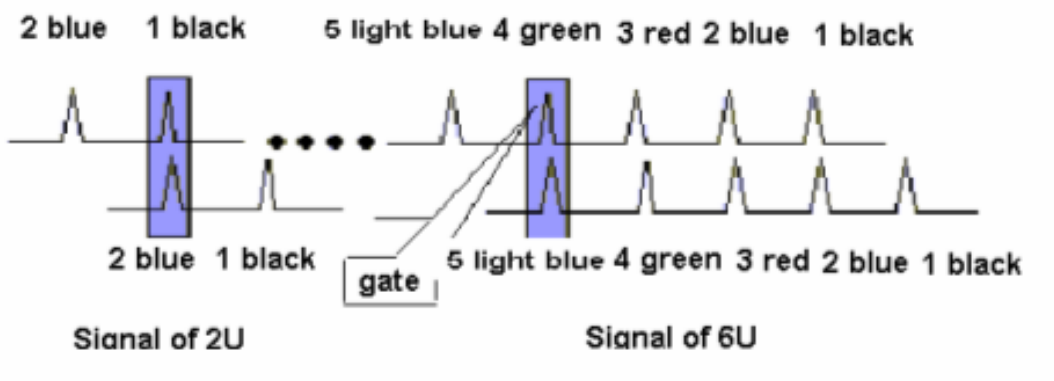
- Registration Mark and Sensor – Photo Sensor
  - Very popular in flexo and rotogravure (AP)
  - Dual photo mark sensor
    - Single photo mark sensor: lower accuracy
  - One sensor for each press, except first color



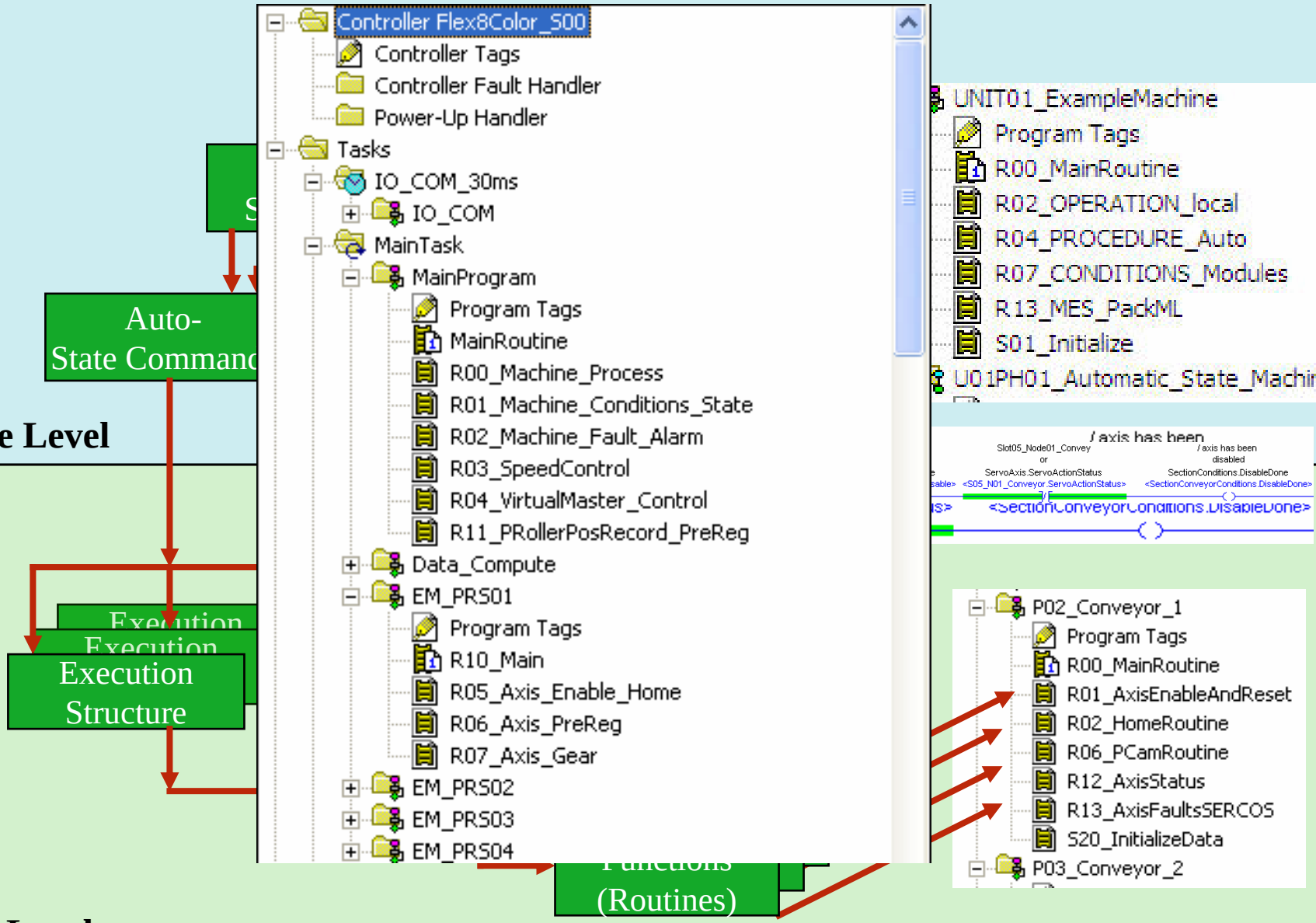


- Specifications
  - Measurement/correction resolution: 0.005mm (industry: 0.01mm)
  - Max speed: 500m/min

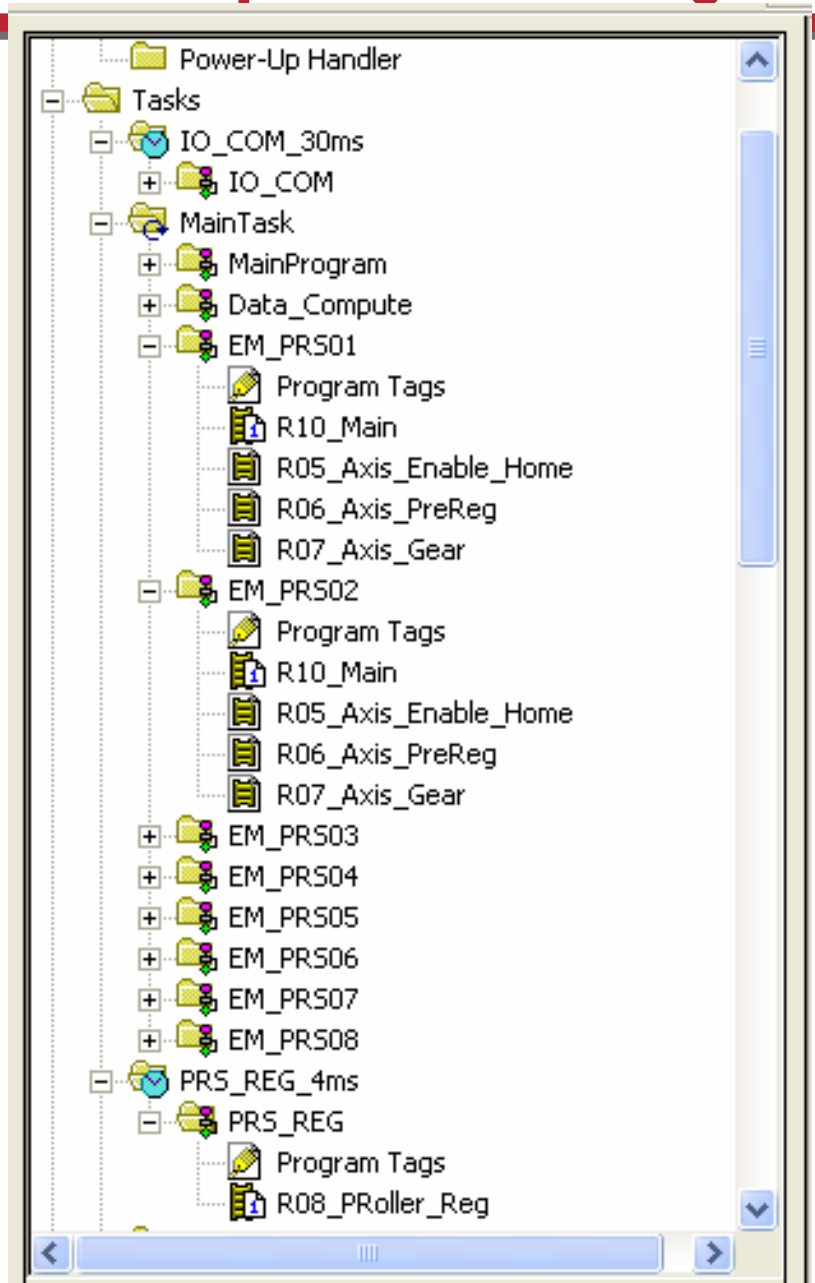
由一个光源、两个透镜、两个光电二极管所组成。因此，在反射面上聚集有两个焦点，两个焦点中心距正好为20mm(色标间距）。在这两个焦点面上各套色标志通过时，两个光电二极管分别接收两个焦点的反射光，反射光的变化由双电眼记录下来，并转换成相应的电流。随后这种电流的变化被送入到中央控制器，并称为脉冲。如果，两个脉冲在双电眼中的两个光电二极管同时发生时套色偏差为零。在时间上不管哪一方先发生均作为套色偏差而存在。这个时间愈短，套色偏差量就越小。



Faster Time to Market, Lower Cost to Design& Develop: Power Programming



Faster Time to Market, Lower Cost to Design& Develop: Power Programming



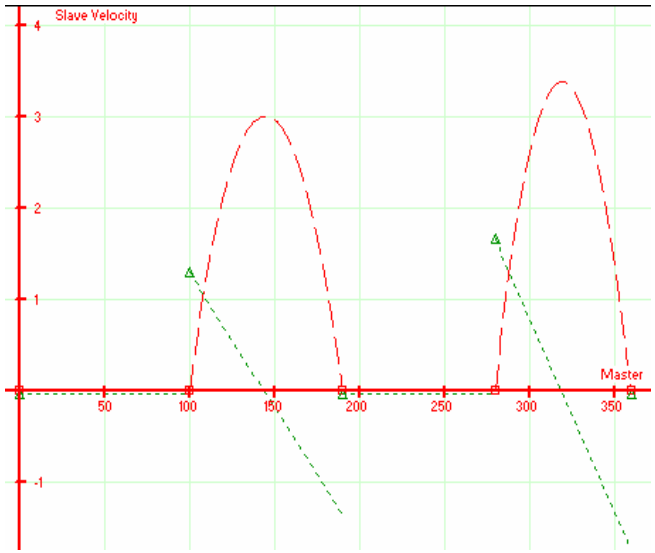
Value Delivered by RA (IA+ GOTC) to OEM

Winder/Unwinder

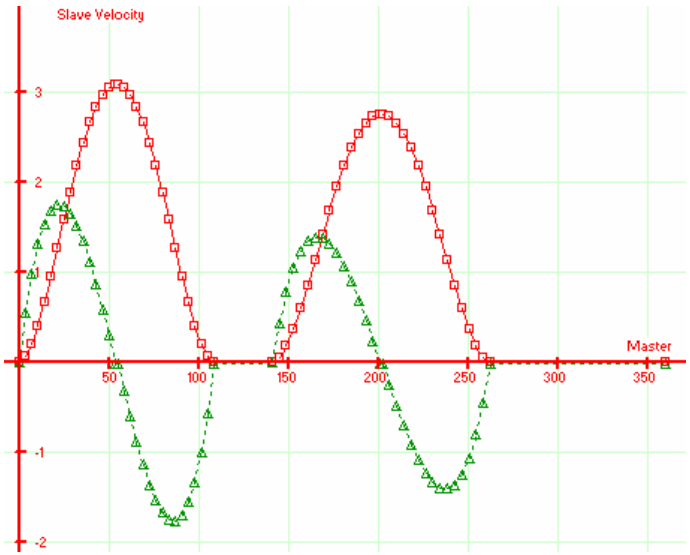
Flexo Printing Machine

Advanced Motion Concept

Impact of Good Application Code



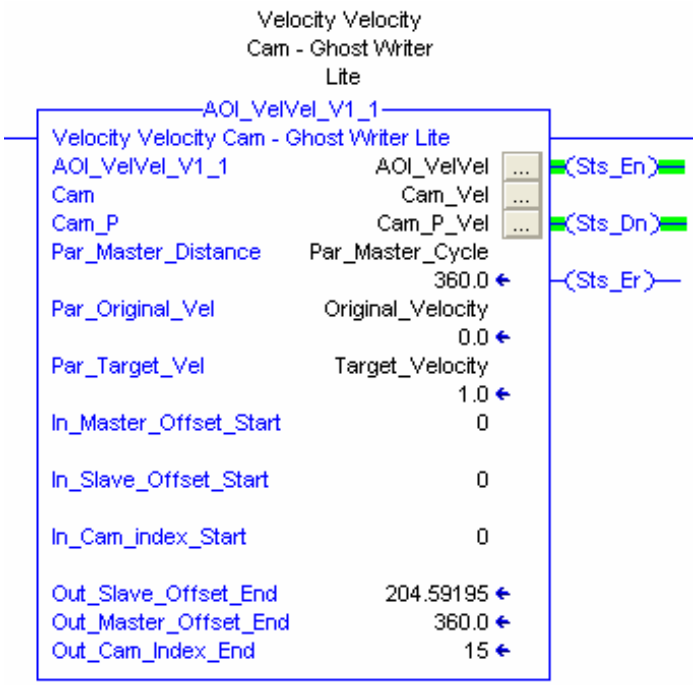
- Original Profile
  - Large inertia for load
  - Infinite jerk at corners
  - Machine “jumped” off the floor at high speed

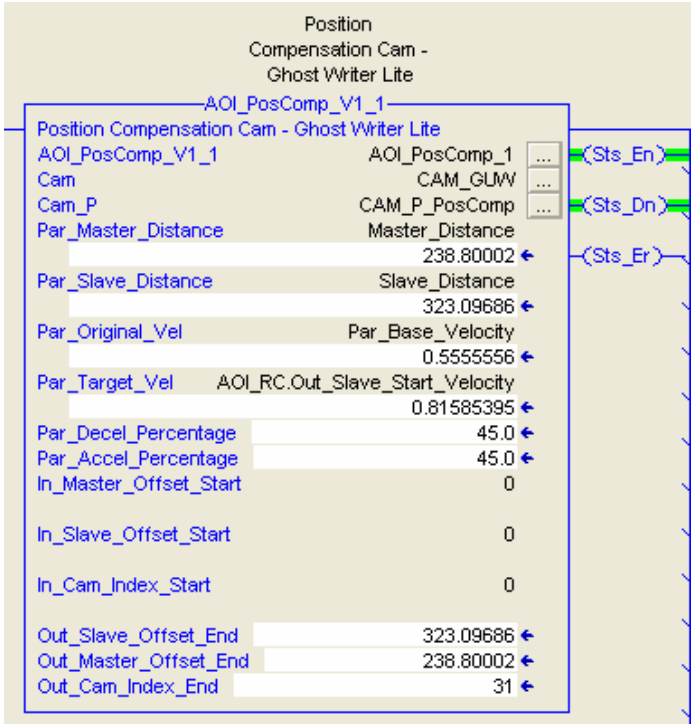


- Optimized Profile
  - Same inertia
  - Limited jerk through entire profile
  - This axis was no longer a limiting factor for machine speed

Ghost Writer Lite ☺

- Open to use for everyone
- Simple interface of cam sections
- Basic two aois (Velvel, Poscomp)





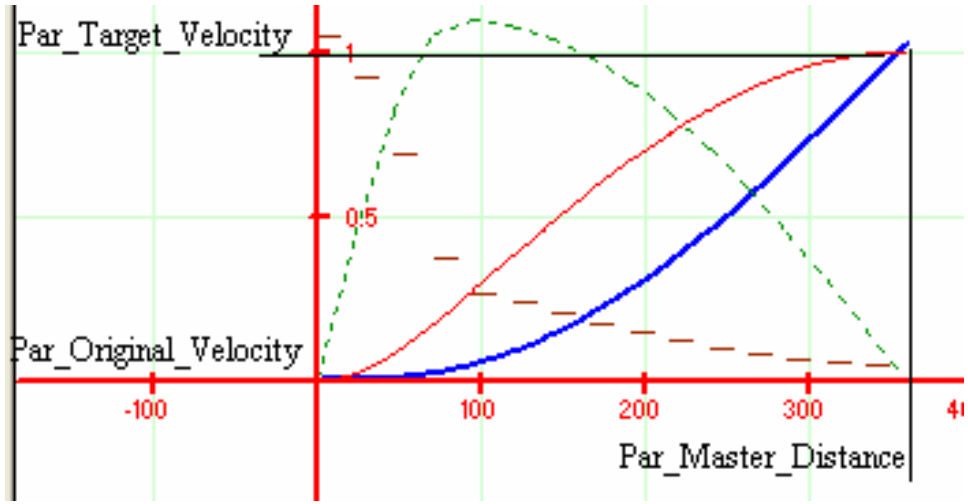
VelVel Cam

Velocity Velocity
Cam - Ghost Writer
Lite

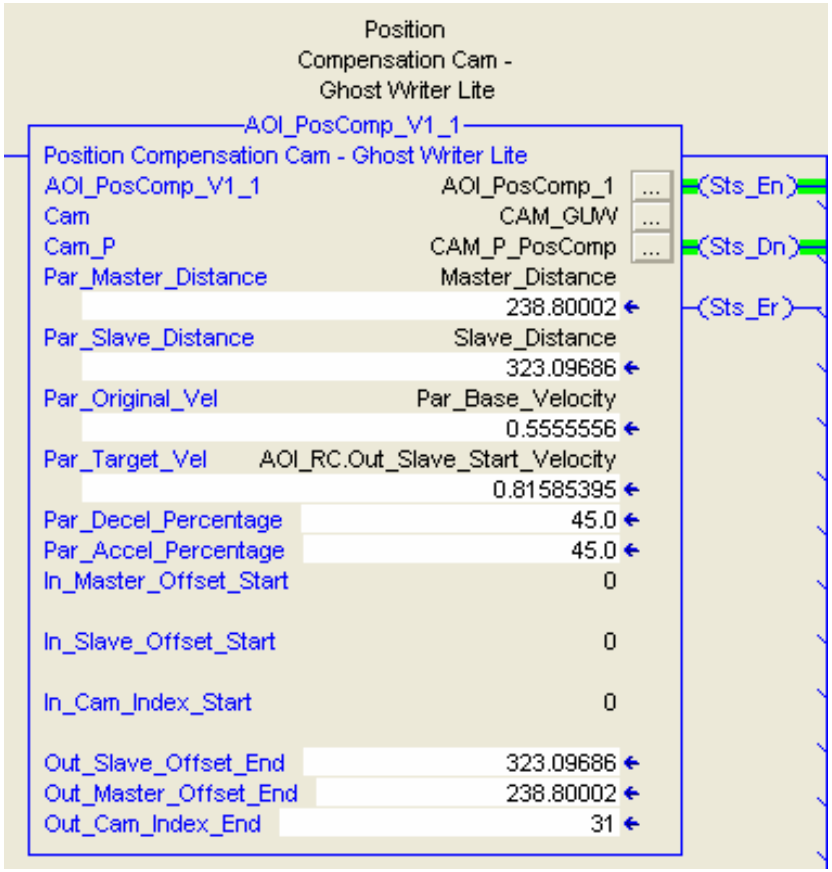
AOI_VelVel_V1_1

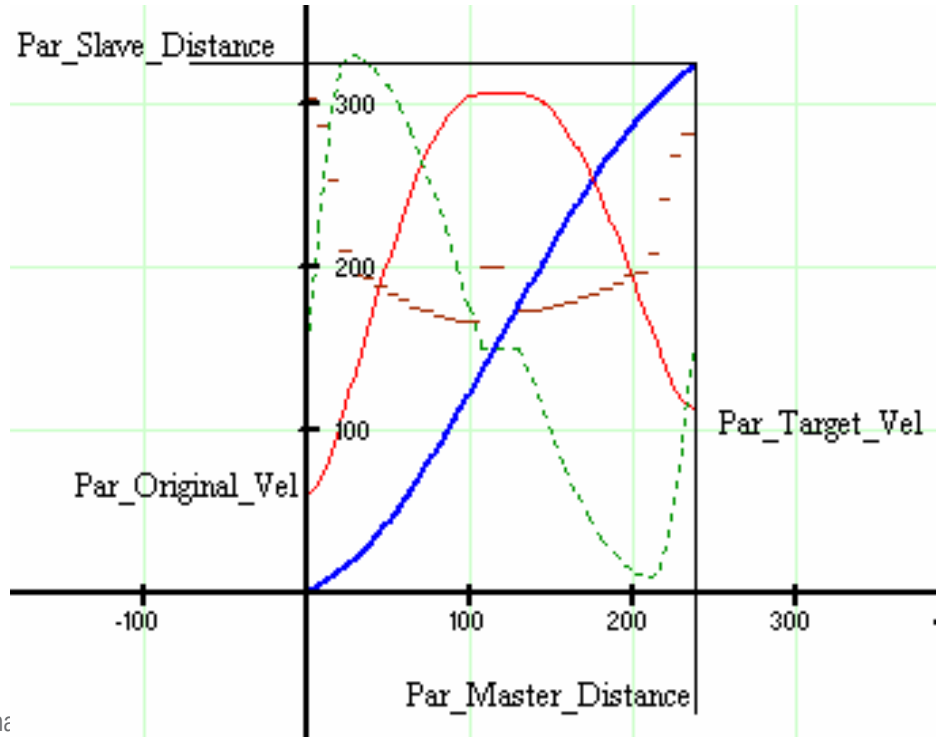
Velocity Velocity Cam - Ghost Writer Lite

AOI_VelVel_V1_1	AOI_VelVel ...	(Sts_En)
Cam	Cam_Vel ...	
Cam_P	Cam_P_Vel ...	(Sts_Dn)
Par_Master_Distance	Par_Master_Cycle 360.0 ←	(Sts_Er)
Par_Original_Vel	Original_Velocity 0.0 ←	
Par_Target_Vel	Target_Velocity 1.0 ←	
In_Master_Offset_Start	0	
In_Slave_Offset_Start	0	
In_Cam_index_Start	0	
Out_Slave_Offset_End	204.59195 ←	
Out_Master_Offset_End	360.0 ←	
Out_Cam_Index_End	15 ←	

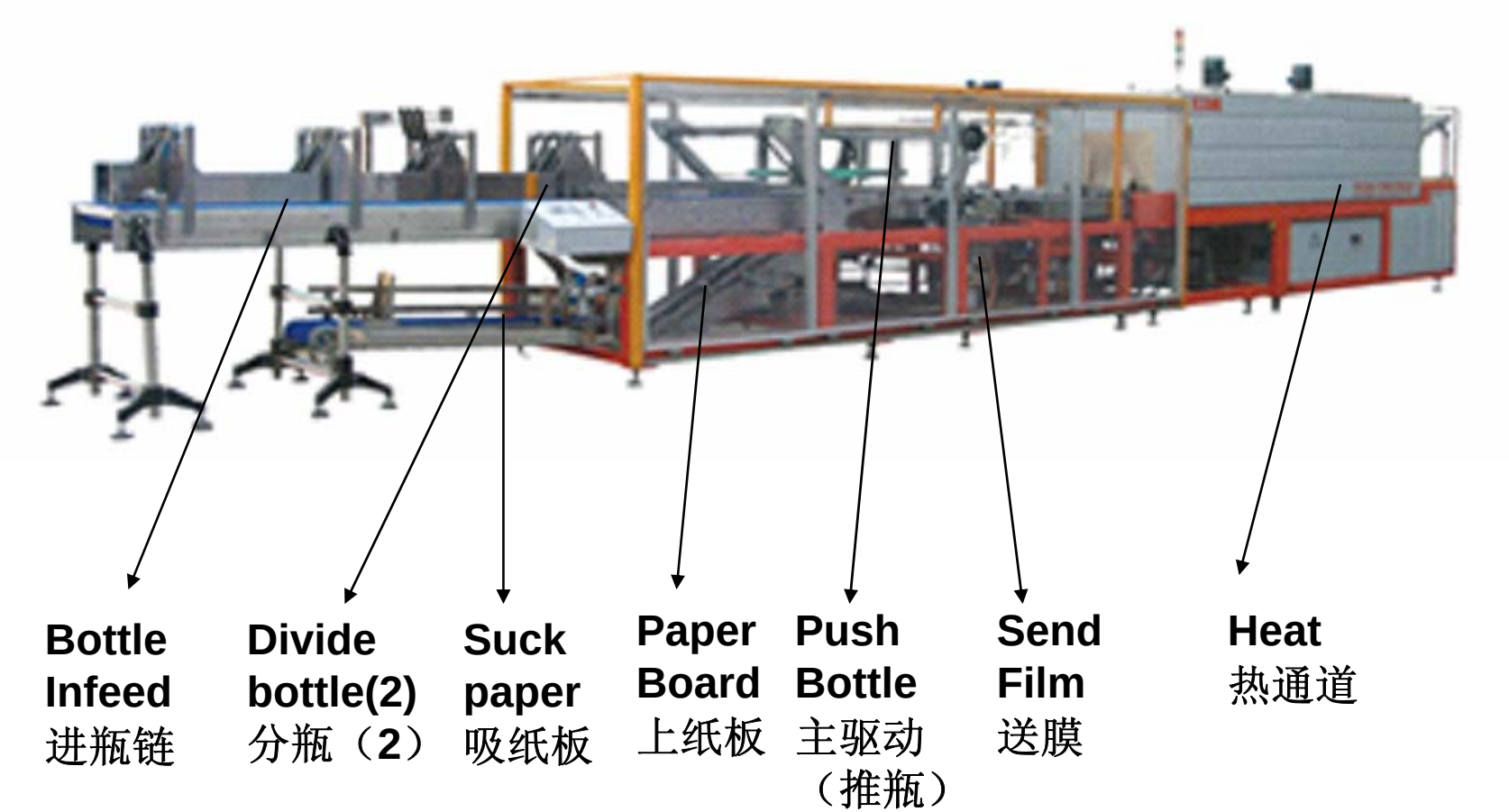


PosComp Cam

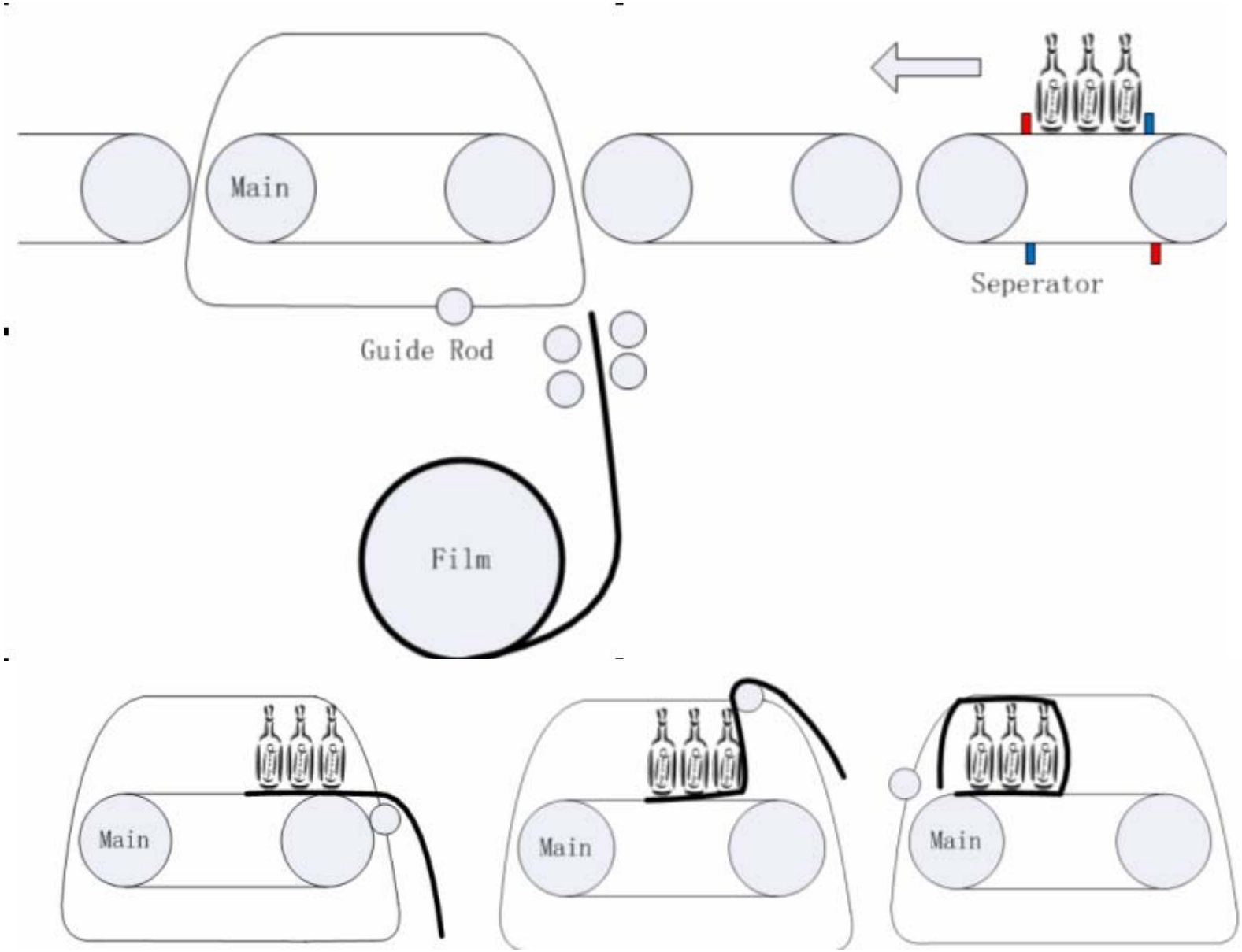




热缩膜包装机



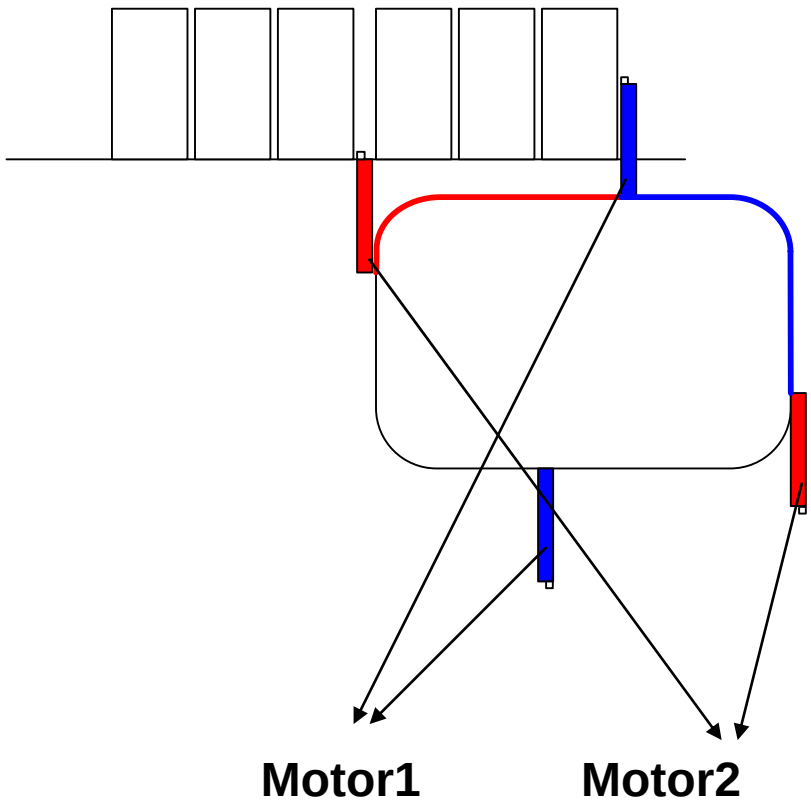
热缩膜包装机



Divide Bottle:

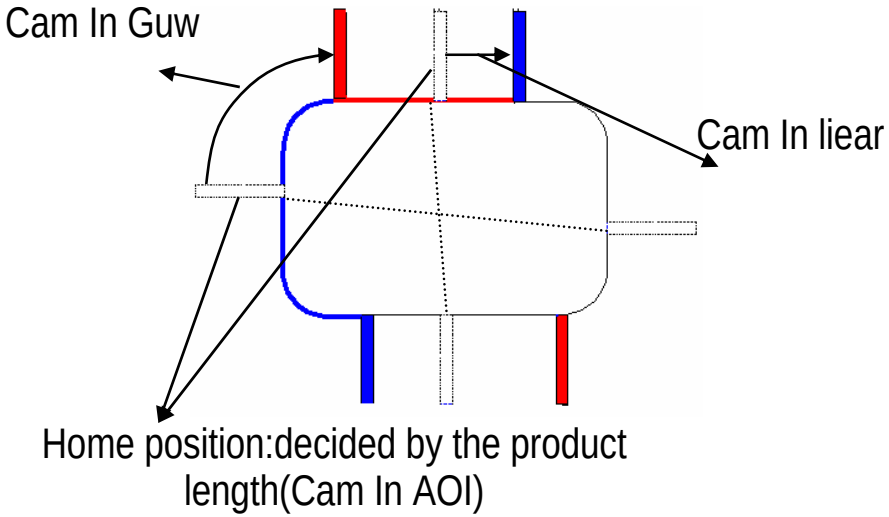
- 2 servo motor
- 2 package per rotation
- 7200unit per rotation for 2 package
- Per package,divide servo motor 1 + motor 2 = 1 package = 3600 unit

  red + blue = 3600uni
- Start angle for synch with push bottle axis
- Divide bottle basis(original to red position)
- Divide bottle distance(red to blue position)

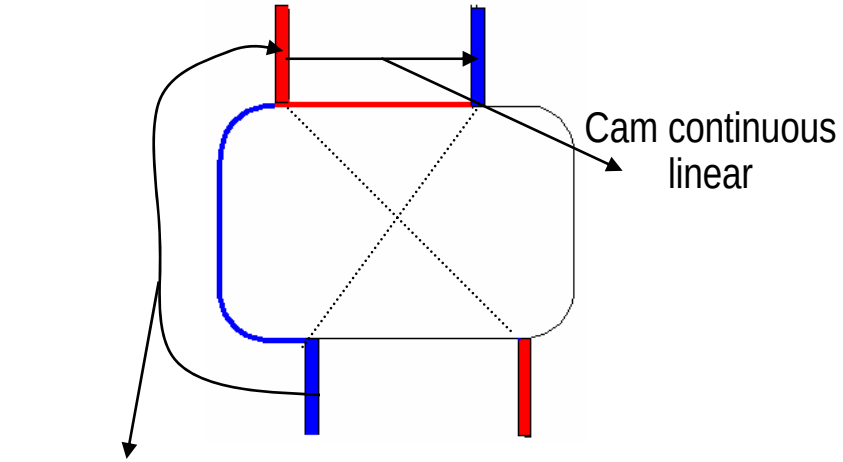


Divide bottle cam process

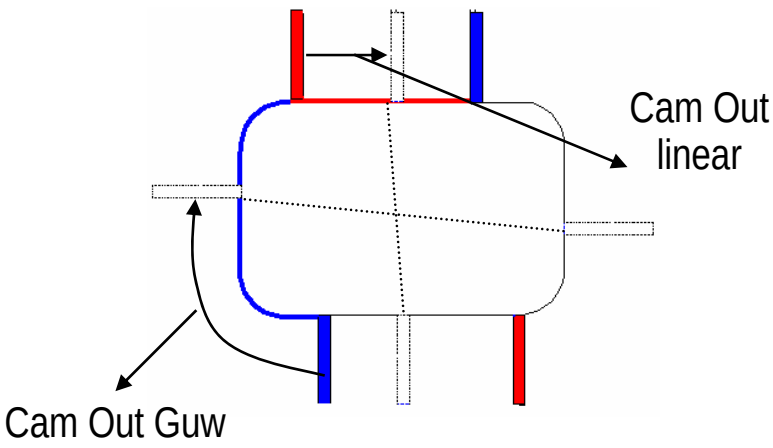
1、Cam In linear and guw

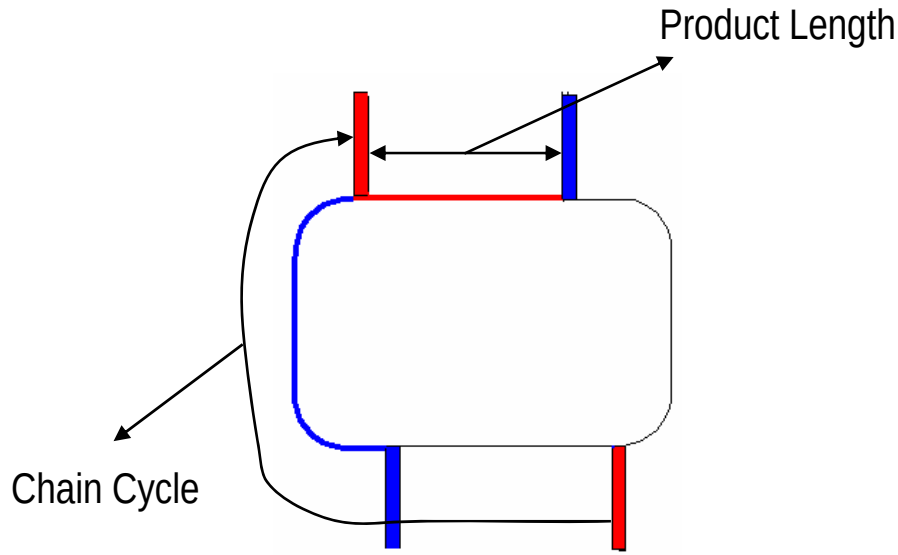


2、Cam Continuous linear and guw



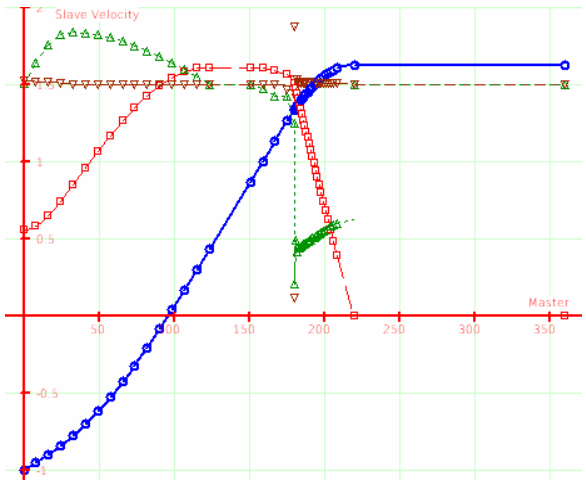
3、Cam Out linear and guw



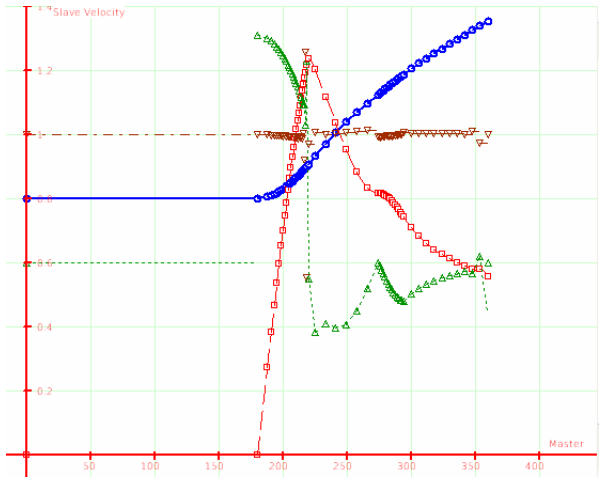


6 Cams

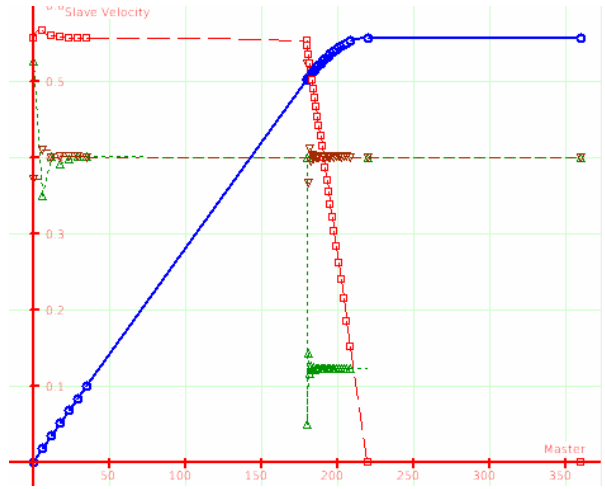
1、Cam Out Guw



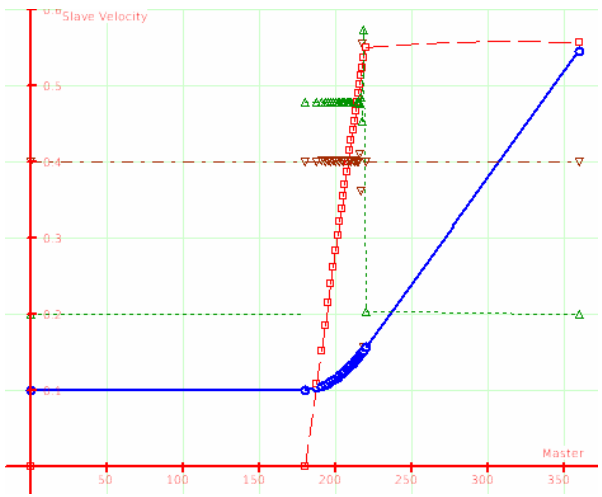
2、Cam In Guw



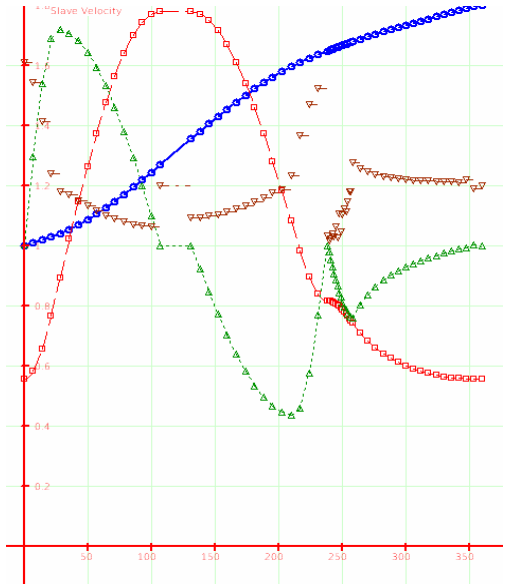
3、Cam Out linear



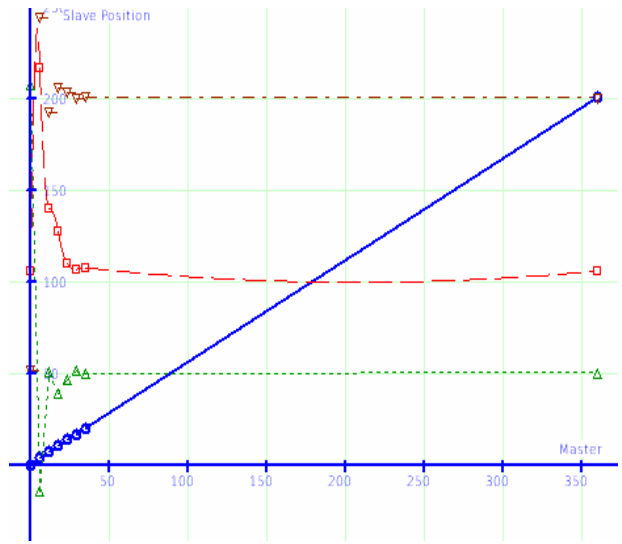
4、Cam In linear



5、Cam Continous Guw



6、Cam Continous Linear



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THINK.
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问题？

LISTEN.
THINK.
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Insert Photo Here

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