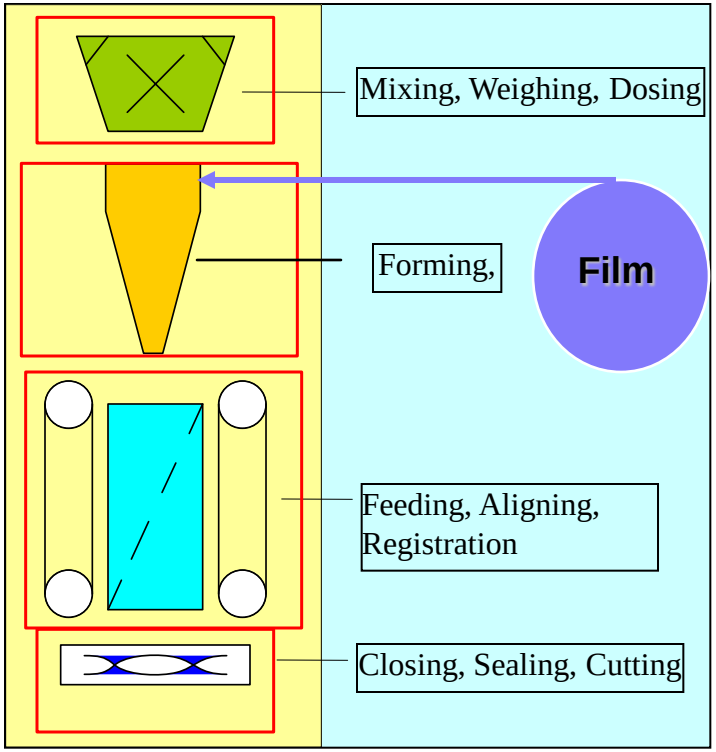
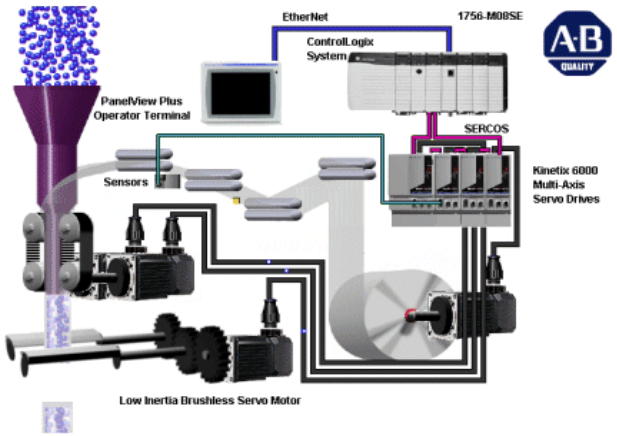
Vertical Form fill and Seal Machine立式包装机



- Mixing, Weighing, Dosing混合/称量/给料
  - Product is metered for entry into package产品在包装前的定量
  - Can be liquid or a solid可以是液体或固体
- Film Feed & Forming薄膜输送和成型
  - Film is fed and formed into package薄膜被传送和折成圆筒形
- Feeding, Aligning and Registration拉膜，纠偏和色标检测
  - Correct amount of package is fed拉送正确袋长
  - Package is aligned with product袋子与包装物同步
- Closing, Sealing, Cutting封合，裁断
  - Package with product is closed包装袋闭合
  - Package with product is sealed包装袋热封
  - Package with product is cut包装袋裁

Vertical Form fill and Seal Machine立式包装机

Vertical Form, Fill and Seal using Kinetix 6000



- Mixing, Weighing, Dosing混合/称量/给料
  - Product is metered for entry into package产品在包装前的定量
  - Can be liquid or a solid可以是液体或固体
- Film Feed & Forming薄膜输送和成型
  - Film is fed and formed into package薄膜被传送和折成圆筒形
- Feeding, Aligning and Registration拉膜，纠偏和色标检测
  - Correct amount of package is fed拉送正确袋长
  - Package is aligned with product袋子与包装物同步
- Closing, Sealing, Cutting封合，裁断
  - Package with product is closed包装袋闭合
  - Package with product is sealed包装袋热封
  - Package with product is cut包装袋裁断

Type of VFFS machines立式包装机类型

- Intermittent & Continuous间断式&连续式
- Exposed and enclosed开放式&封闭式
- Single lane (Vertical Pouch, Sachet Form, Fill and Seal machine)单头
- Multi-lane (Vertical Strip Packing Machine)多头

Different Style Feeding Systems不同类型的给料系统

Auger Feeder

螺旋式

Multi-head Scale

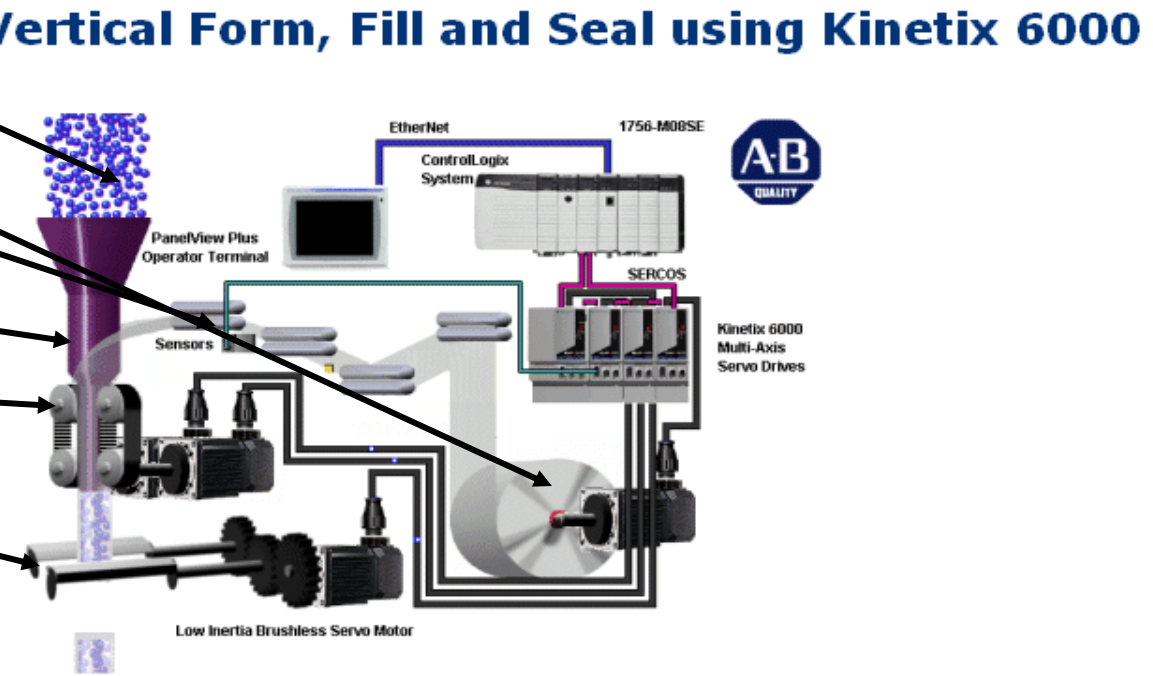
多头秤

Volumetric Feeder

定体积给料

Machine Sections机器分段

- Feeding System给料系统
- Film Unwind薄膜放卷
- Film Registration薄膜色标检测
- Forming Tube成型筒
- Film Pull Belts拉膜皮带
- Cross Jaws横封口



Machine Sections - Feeding System给料系统

- Auger Filler螺旋式给料
  - Typically servo fed – Index moves通常为伺服给定-索引运动
  - VFFS can control the auger or communicate via discrete signals

    VFFS可以直接控制螺旋式给料系统或者通过开关量信号通讯
- Weighing System称重系统
  - Mostly controlled by a specialized controller大多由专门的控制器来控制
  - VFFS communicates via discrete signals

    VFFS通过开关量信号通讯
- Volumetric Feeder定体积给料
  - Can be servo actuated or pneumatic actuated可以用伺服驱动或者气缸驱动
  - VFFS can control the feeder or communicate via discrete signals

    VFFS可以直接控制或者通过开关量信号通讯

Machine Sections – Feeding System给料系统

Product Type	Example	Machine Sections	Application Needs
Liquid	Sauce	Dosing	The machine must manage the measurement and insertion of product into the pouch, which requires tight coordination with the scales, augers, and mixers. For perishable product, the machine needs to be washed down for sanitary purposes. For food products, gas flushing with inert gas or O^2 extraction is required to extend food shelf life.
Fine granules	Sugar, Salt	Dosing, Mixing	
Coarse granules	Cereals, Spices	Dosing, Mixing	
Powders	Detergent	Dosing, Mixing	
Solids	Candy, Pharmaceuticals, Hardware	Weighing	
Fresh produce	Vegetable	Dosing, Gas Flushing for product protection, Wash down	
Perishable	Meat, Fish	Dosing, Gas Flushing for product protection, Wash down	

- **Scale Interface**
- The scale interface is the most complex section of a VFFS's control. This is a result of the speeds at which a continuous motion VFFS can run. The VFFS needs to able to run in either a master mode where a scale drops product upon request from VFFS machine or in slave mode where the scale tells the VFFS when to make a new bag. Due to the high speed of the VFFS machine, multiple charges from the scale can be in flight at one time. This means that product tracking is required to know when to start and stop the VFFS at the proper times. This logic controls the virtual master that runs the position cams for the film pull belts and seal jaws, as such it is the primary module that should be developed first.

Machine Sections - Film Unwind薄膜放卷

- This section is responsible for unwinding film into the machine

  这部分负责薄膜放卷输送给机器
- Material splice, roll change out and film tension need to be considered

  接料，换卷和薄膜张力需要被考虑
- Powered or Unpowered, pneumatic brake,friction brake or a dancer control can be used to control film tension.

  主动或者被动，风闸，磁粉刹车或者摆动辊可以被用来控制薄膜张力
- Stepper, servo, DC gearmotor, or VFD are used depending on overall performance of machine

  步进，伺服，直流电机或者变频驱动都可以实现，选用哪种由整机的性能决定
- Roll change out and material splice can be manual or automatic

  换卷和接料可以是手动的也可以是自动的

Machine Sections - Film Registration薄膜色标检测

- Film registration sensor, film alignment and tracking adjustment mechanisms

  包括色标传感器，薄膜纠偏调整机构
- Registration marks on printed film to adjust for printing errors, film stretch and slippage.

  通过检测色标可以调整因印刷误差，薄膜拉伸和打滑造成的误差
- Registration control is performed differently with continuous versus intermittent machines.

  连续式机器和间断式机器的色标控制方式是不同的
- Registration adjustments are usually made on every index with an intermittent machine.

  间断式机器的色标调整通常是每一个袋长都会调整
- Continuous machines registration is usually done by averaging the distances and making minor adjustments if the averages start to drift.

  连续式机器的色标调整通常是取一段距离的平均值，如果发生偏移执行最小偏移量的调整

Machine Sections - Forming Tube成型筒

- Unique mechanical designs for different machines, films and products being sealed.
  根据不同的机器，薄膜材料以及产品要求有独特的机械设计
- General description – inverted cone with radius corners.
  通常的形式-带半角的倒锥体
- Used to convert flat film into a tubular or tunnel shape – film travels on the outside of the forming tube
  通常将薄膜转变成筒状或管状-薄膜在成型筒的外部通过
- Film is sealed (long seal) in this section of the machine via several methods – heated bars or heated metal belts are two methods.
  在这一部分薄膜通过几种方式被纵封-加热棒或者加热的金属皮带
- Bar is usually stationary
  加热棒通常是固定的
- Metal belts have heat transferred to them and move with the product
  金属皮带传导热量并且跟随产品运动
- Film is either over wrapped and sealed on one end or sealed on the edges
  薄膜被封住一边
- PID controlled heating elements via the main controller or separate stand alone PID controllers
  加热条的PID控制可以通过主控制器也可以通过单独的PID控制器控制

Machine Sections - Film Pull Belts拉膜皮带

- Typically two belts right and left side
  通常有左右两根皮带
- Typically vacuum which allows for better gripping
  通常用真空可以获得更好的吸力
- Belts are controlled by either servo, induction motors or steppers.
  皮带由伺服，感应马达或者步进控制
- Two motors for both belts or one motor mechanically linked to both belts
  两个马达驱动两根皮带或者一个马达驱动通过机械连接两根皮带
- Belts provide the force to pull the film through the machine
  皮带提供摩擦力拉动薄膜穿过机器
- Controller code either uses electronic CAM control or incremental moves dependant on type of machine.
  根据机器类型不同，控制代码可以用电子凸轮或者增量运动
- Controller code used to monitor the velocity and/or position between the belts so one belt doesn't pull more than the other.
  程序监控两根皮带的速度和/或位置以保证一根皮带没有拉更多薄膜
- Registration correction code is applied to this section
  色标纠正代码作用在这段

Machine Sections - Cross Jaw横封口

- Three major functions:
  三个主要功能：
  - Seal the top of the previous bag
    封住前一袋的顶部
  - Create the bottom for next bag
    生成下一袋的底部
  - Cut or separate the bags
    剪切或者分隔袋子
- Front and back jaws oppose each other – sometimes one moves and sometimes they both move
  前后相对的一对横封条-有时只有一条运动，有时两条都动
- One jaw usually contains a knife and other an anvil. Knife is sometimes actuated pneumatically
  通常一个横封条上带了一把刀而另一个横封条做砧。刀有时由气缸推动。
- Intermittent machine – cross jaw section is stationary (doesn't follow film). Film starts and stops
  间断式机器-横封口是固定的（不跟随薄膜上下运动），薄膜有启停
- Continuous machine – cross jaw section follows the film
  连续式机器-横封口跟随薄膜运动
  - Rotary Jaw ("D" Jaw) – special mechanism to cause "D" motion
    旋转式（"D"型）-特殊的机械设计实现"D"形运动
  - Vertical Jaw – two separate moving mechanisms – seal and follow
    垂直型-两个独立的运动机构-横封和上下跟随
- Servos, Induction, Stepper motors or Pneumatics, sometimes with springs used for actuation of Jaws.
  伺服，感应电机，步进或者气缸，有时甚至弹簧都可驱动横封口
- PID control of heating elements
  加热条的PID控制
- Controller code using electronic CAM used for continuous machine
  连续式机器要应用电子凸轮编程

Machine Section Controls机器分段的控制方式

- Feeding System给料系统
  - Discrete control, servo control离散控制，伺服驱动
- Film Unwind薄膜放卷
  - Discrete control, servo, VFD, analog dancer离散控制，伺服，变频，模拟量
- Film Registration色标检测
  - Registration sensor色标传感器
- Forming Tube成型筒
  - PID control PID控制
- Film Pull Belts拉膜皮带
  - Discrete control, servo, VFD离散控制，伺服，变频
- Cross Jaws横封口
  - Discrete control, servo, VFD, PID离散控制，伺服，变频，PID控制

VFFS machines

VFFS machines controls can vary from all servo control to use of VFD's, steppers, mechanical or pneumatic driven actuators.

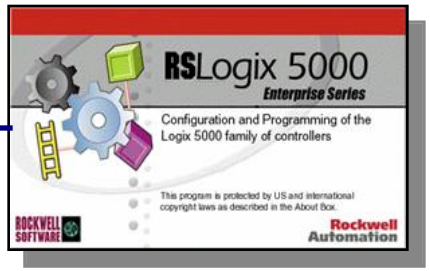
VFFS机器的控制可以从全伺服控制到用变频驱动，步进，机械方式或者气缸驱动都可行

VFFS machine – RA Solution – All Servo全伺服

PanelView Plus

Ethernet I/P

CompactlLogix L4 or Control Logix



Sercos

Kinetix 6000 or Ultra 3000

24 VDC Inputs

24 VDC Outputs

Thermocouple Inputs

Isolated DC Outputs

Registration Sensor

Product Feed (Auger)

Film Unwind

Film Pull Belt 1

Film Pull Belt 2

Cross Jaw 1 (Washdown)

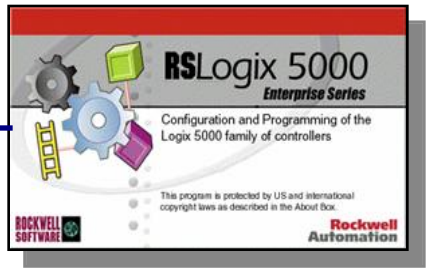
Cross Jaw 2 (Washdown)

Example of a VFFS using VFD含变频驱动的例子

PanelView Plus

Ethernet I/P

Control Logix



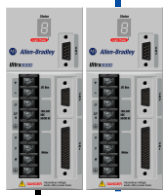
Product Feed

Film Unwind

MO2E A

Sercos

Ultra 3000

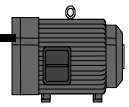


24 VDC Inputs

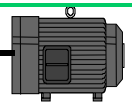
24 VDC Outputs

Thermocouple Inputs

Isolated DC Outputs



Film Pull Belt 1



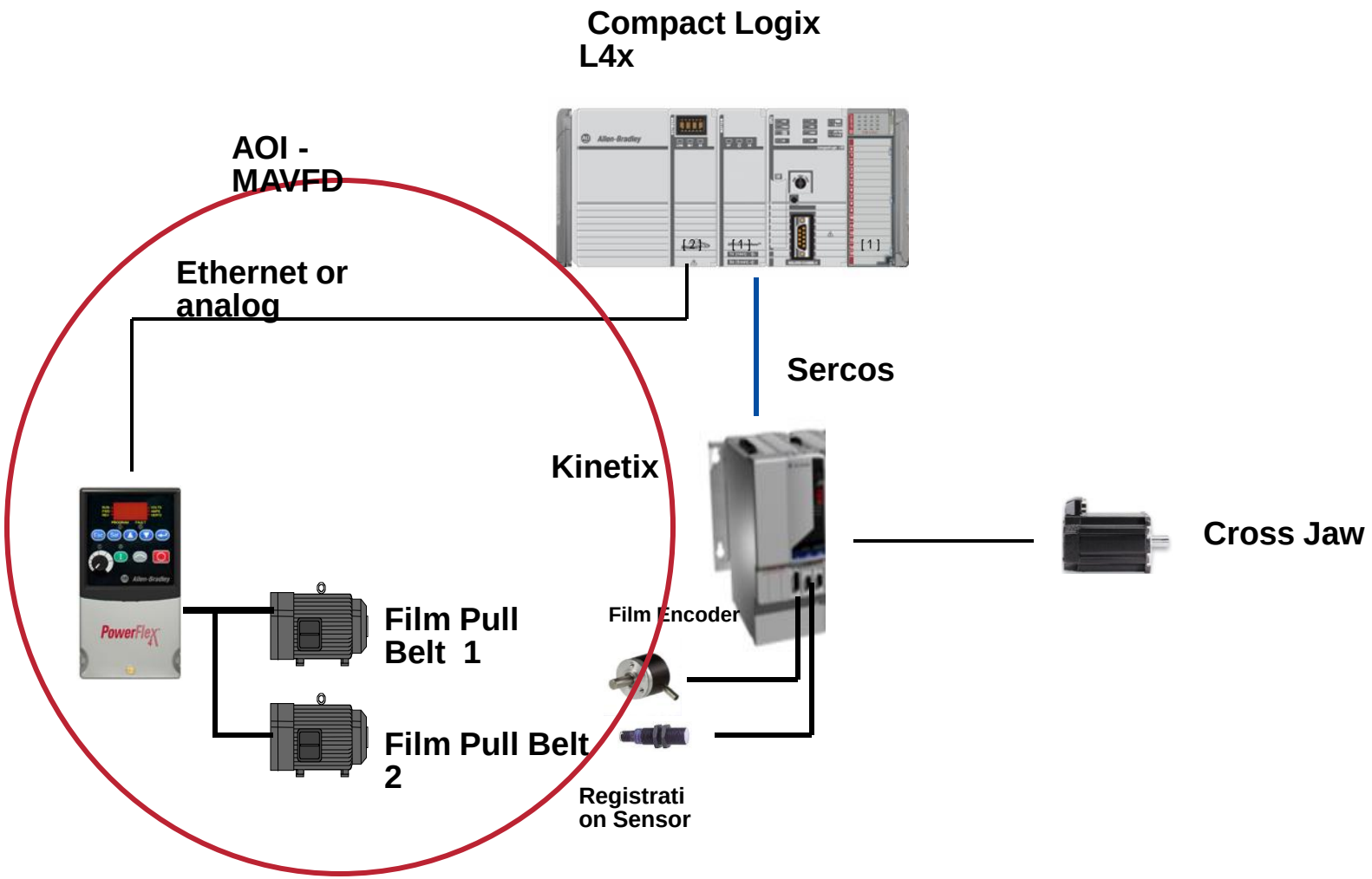
Film Pull Belt 2

Registration Sensor

Cross Jaw 1 (Washdown)

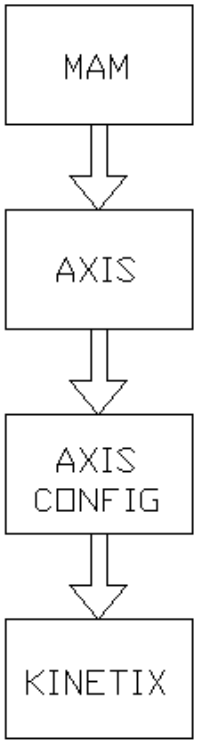
Cross Jaw 2 (Washdown

RA Solution - Lower End VFFS 最低端方案

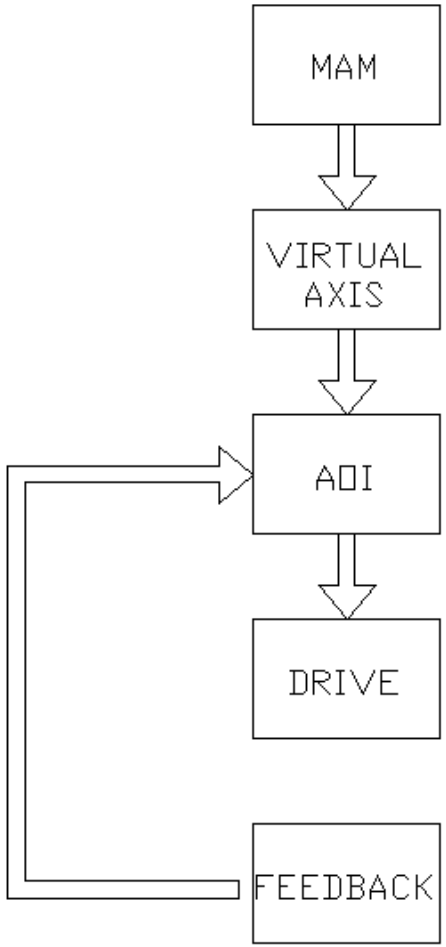


MAVFD AOI: Concept概念

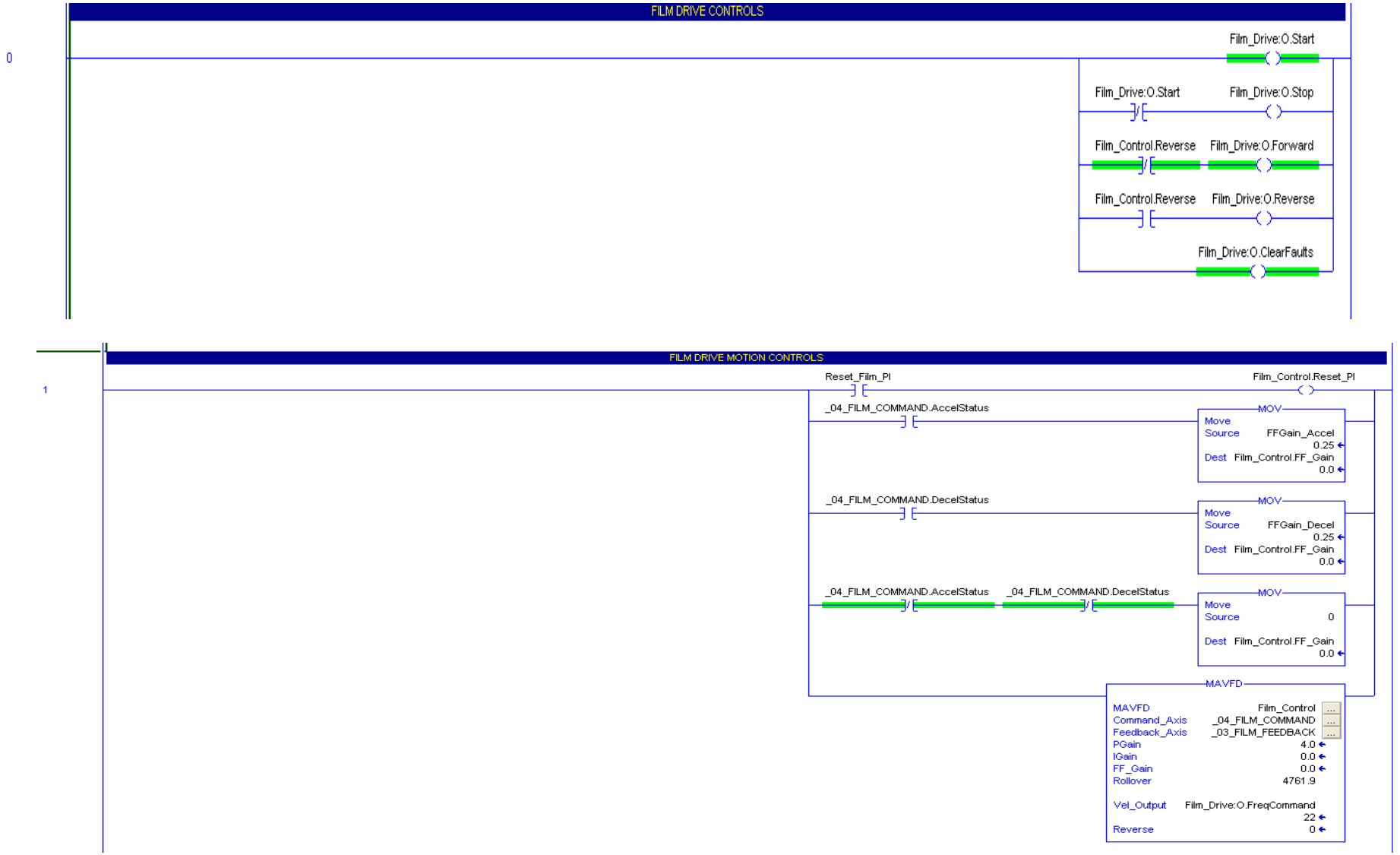
STANDARD Motion



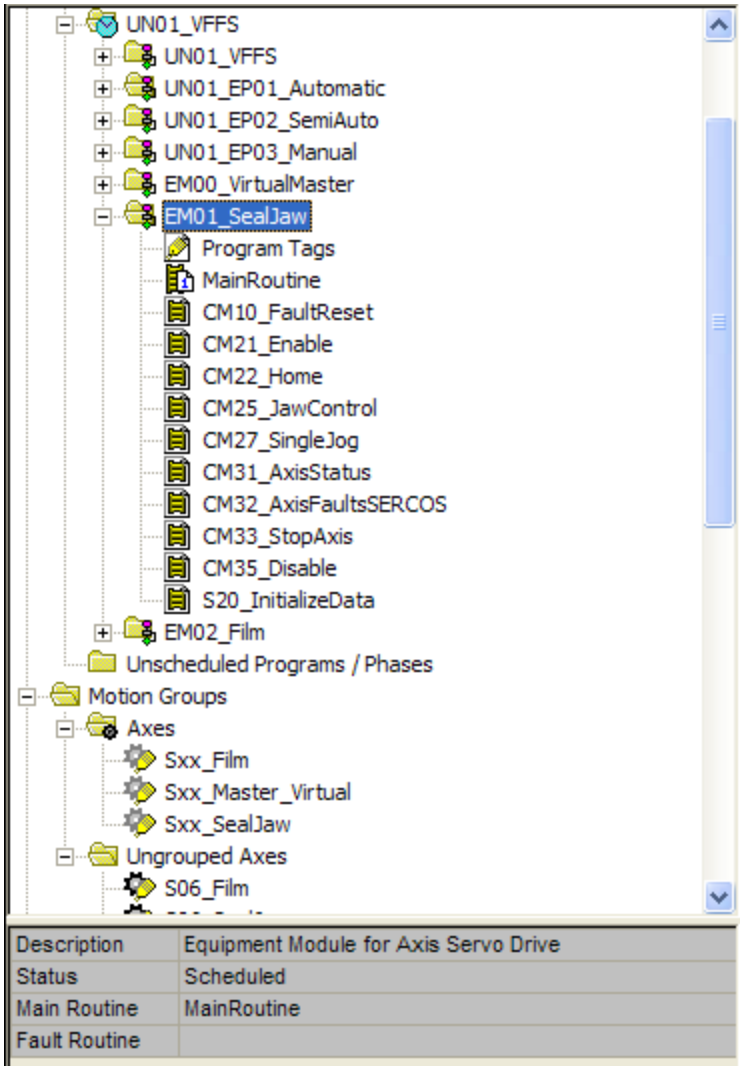
Motion using AOI



MAVFD: Using it in the Program程序中的应用

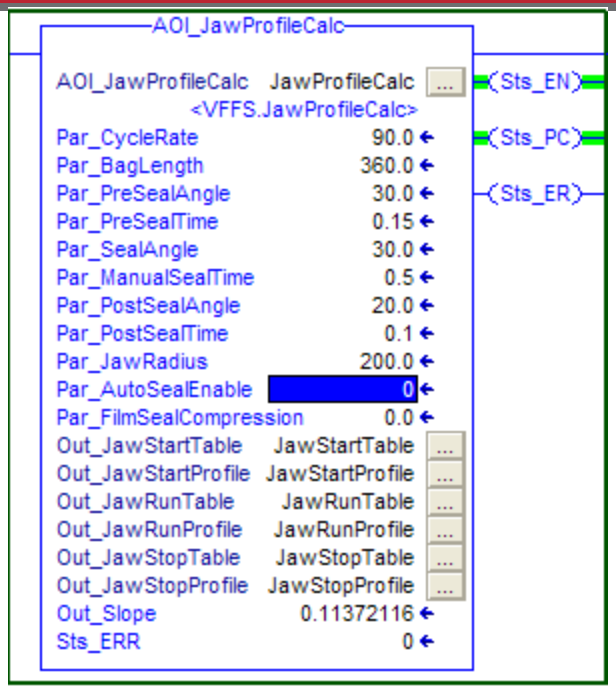


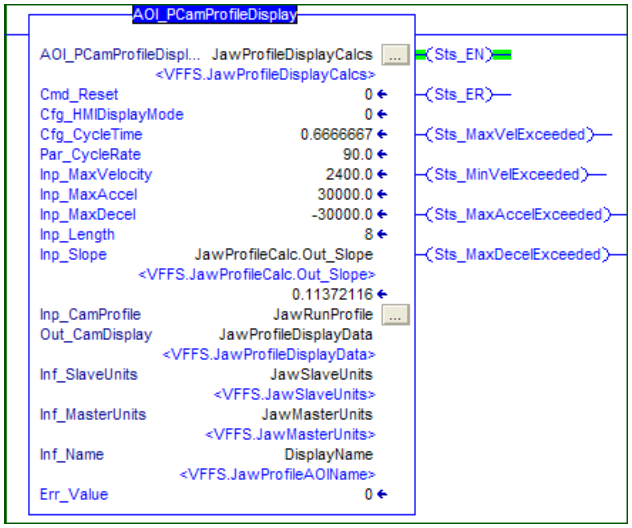
VFFS template programme模版程序



- 基于PowerProgramming模块化编程模式
- 内嵌PhaseManage状态机控制流程，适用于包装行业国际标准
- 两种横封模式
- 开放性架构，客户可以方便添加自身的工艺特点

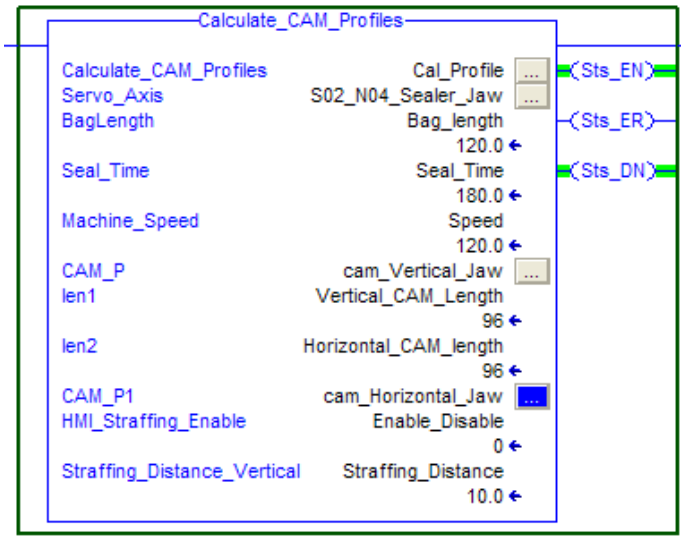
AOI Application

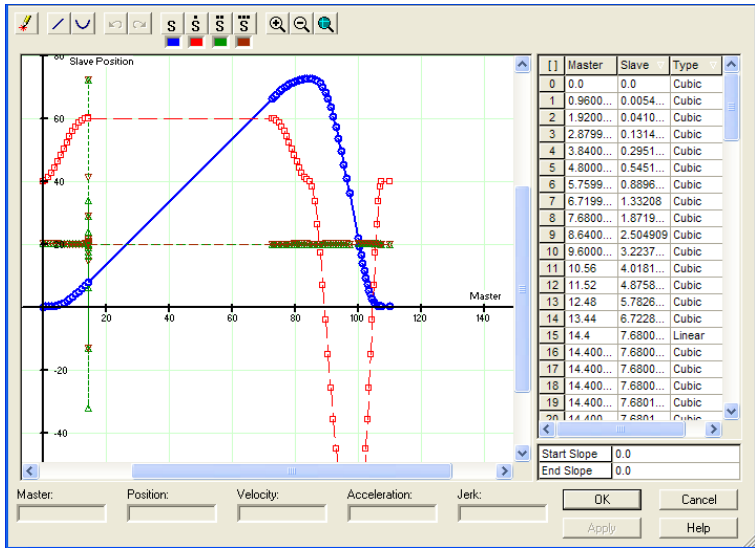


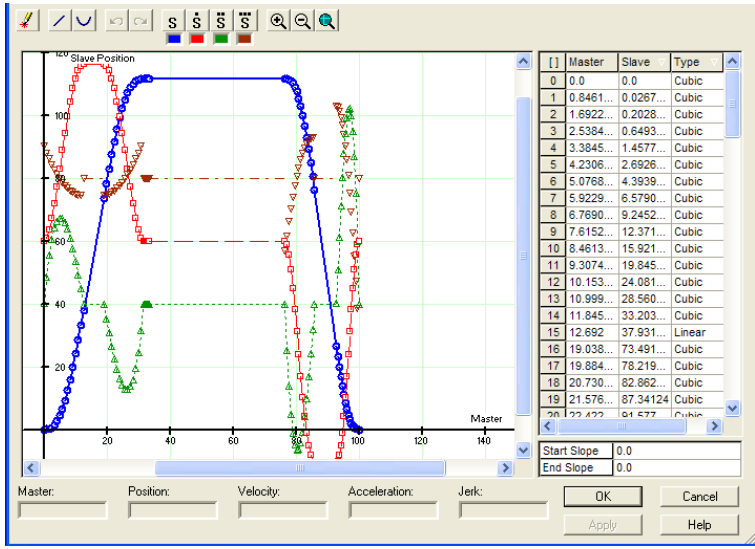


- 结构化编程
- 客户只需输入相关工艺参数，AOI执行相关功能
- 可移植性，可以方便地在不同的程序段重复调用
- 安全性，可以为AOI设置密码，其他人看不到具体的AOI程序内容

CAM Profile

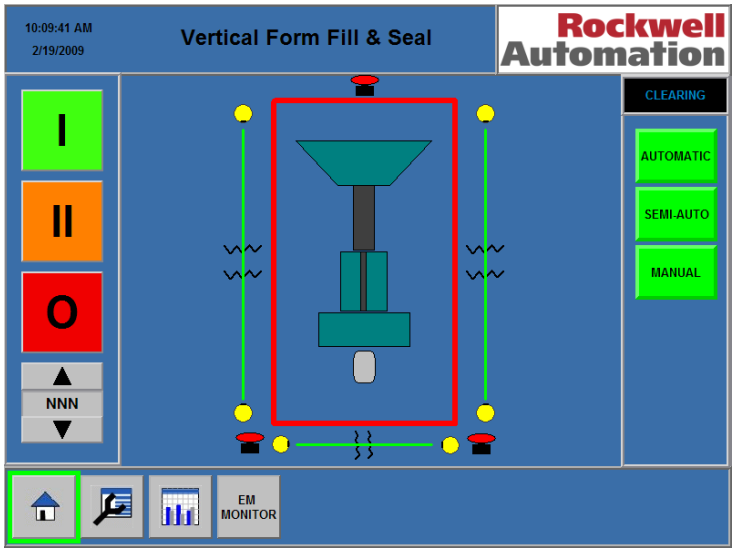


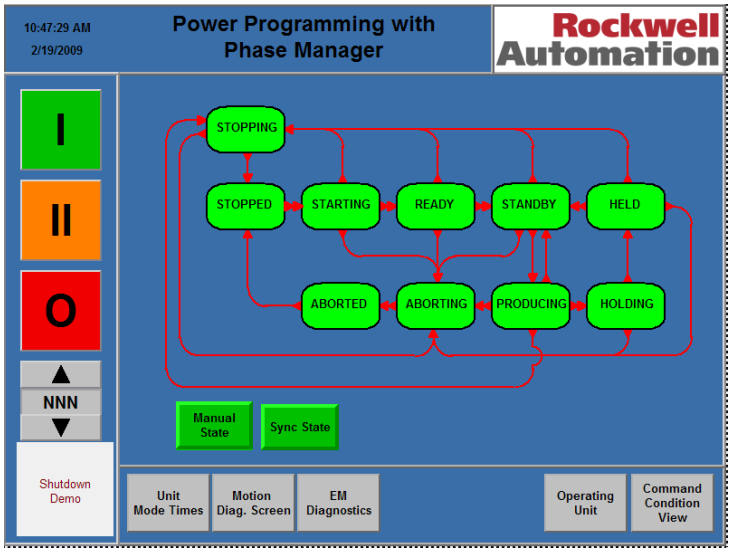


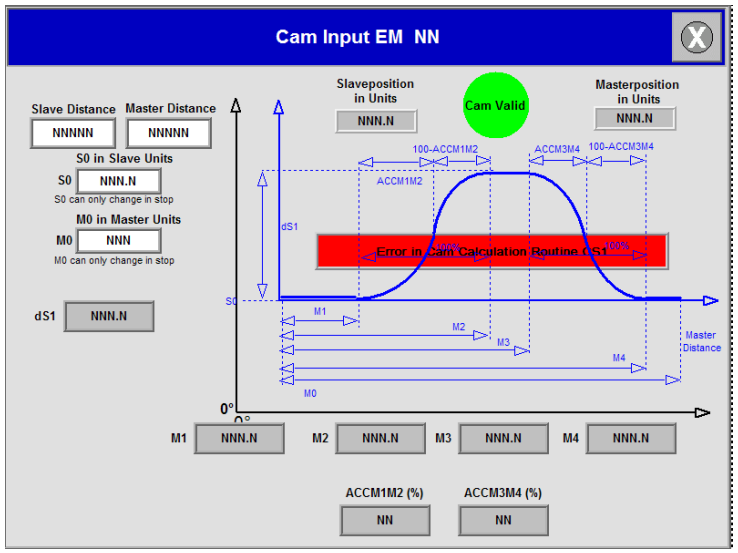


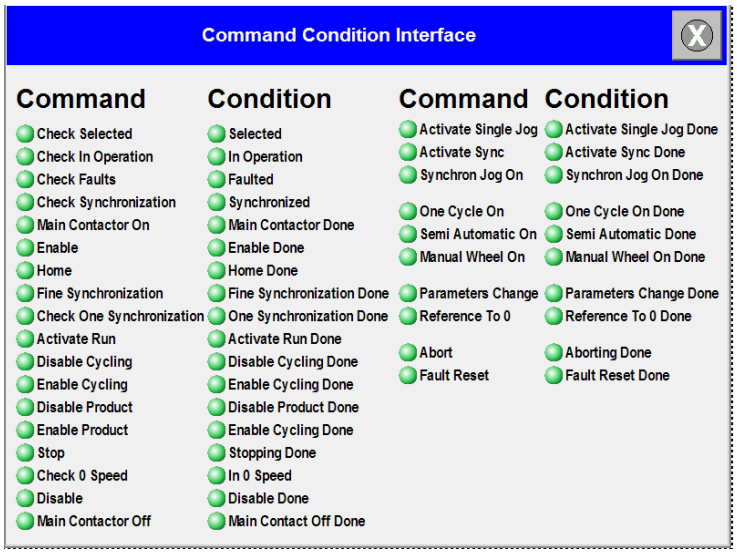
- Vertical Jaw横封模式的凸轮曲线设计
- Follow CAM上下跟随伺服运动曲线
- Seal CAM横封开合伺服运动曲线

Template Display界面规划

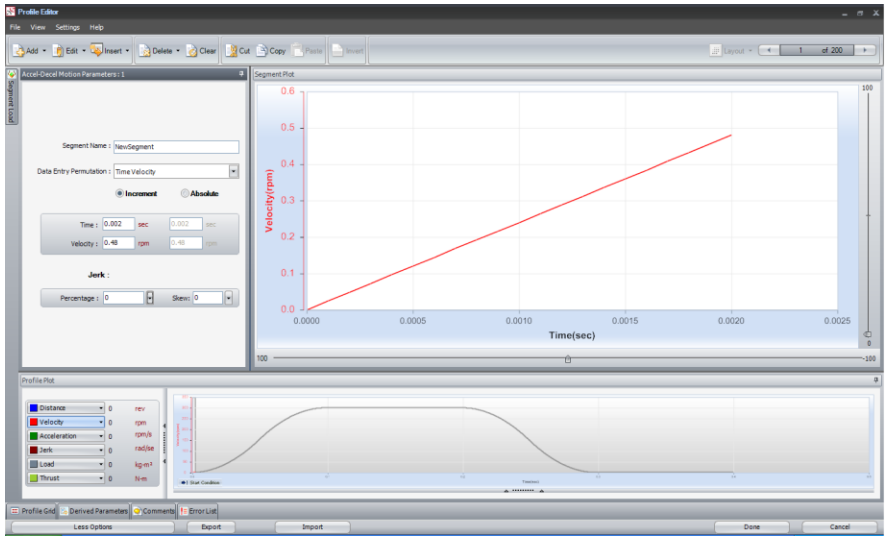


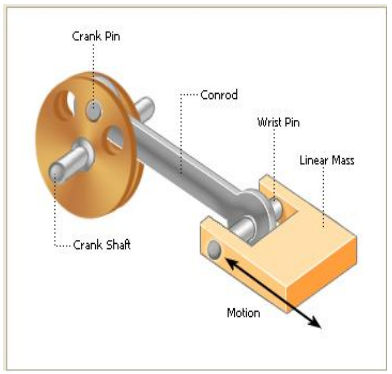


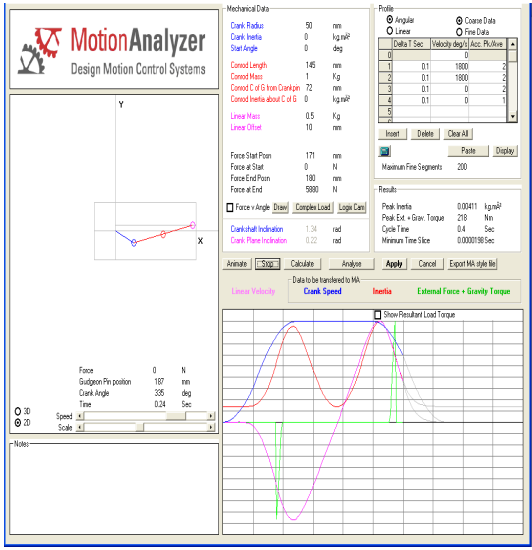


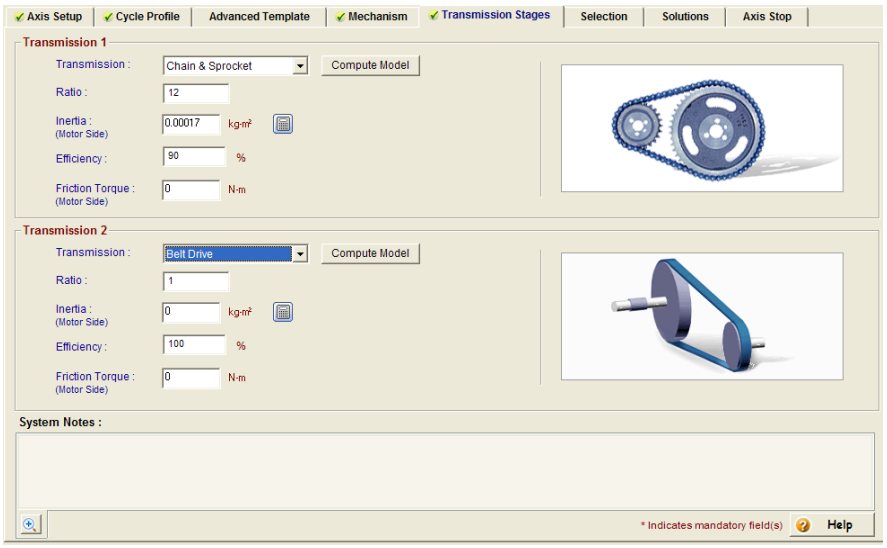


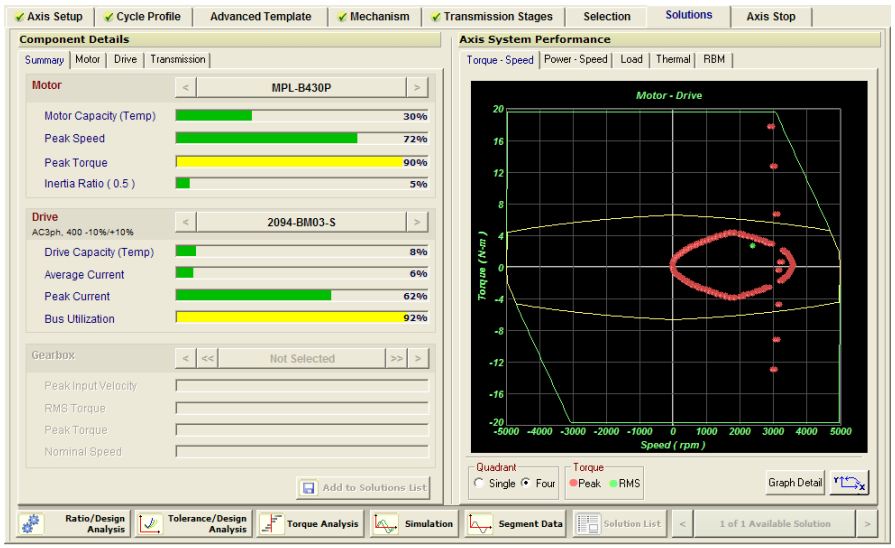
Tool Software-Motion Analyzer











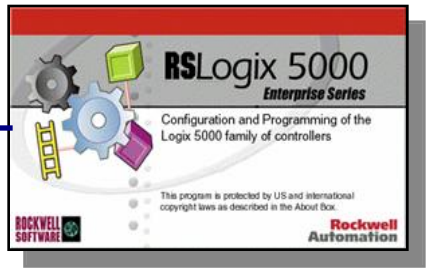
VFFS all servo Solution - Control Logix Migration全伺服方案

PanelView Plus

Ethernet I/P

ControlLogix

CompactLogix L4



Sercos

Kinetix 6000 or Ultra 3000

24 VDC Inputs

24 VDC Outputs

Thermocouple Inputs

Isolated DC Outputs

Registration Sensor

Rockwell Automation VFFS Experience成功应用

- Examples of VFFS machines using Rockwell Automation Solutions应用罗克韦尔方案的VFFS成功案例
  - **Packaging Technologies**
    - Chubmaker 4100 VFFS using CompactLogix & Kinetix
  - **Prodo-Pak**
    - PV-250 VFFS machine using ControlLogix & Kinetix 6
  - **Rovema**
    - Packaging OEM standarizes on Kinetix Integrated Motion
    - Expands product line by 300% in less than 2 years
  - **Triangle Package Machinery Co.**
    - Advantage VFFS Bagger & Selectacom Weigher using ControlLogix
    - VFFS Baggers using ControlLogix & Kinetix Servo Drives
  - **Wolf Verpackungsmachinen**
    - VCI 250 VFFS powder bagging machine using ControlLogix
  - **Wrapade**
    - V-600 series Vertical pouch machine using ControlLogix &

VFFS - Takeaway我们提供什么

- Hardware solutions to maximize your machine's performance
- 硬件解决方案来最优化您的机器性能
- Tools, training and knowledge to reduce manufacturing time and costs
- 工具，培训和相关知识来降低制造时间和费用
- Technology and domain expertise to help differentiate your machines
- 技术和相关领域的专家意见来帮助您定位您的机器
- Global support and business partnering to help you remain competitive
- 全球化支持和商业合作伙伴关系帮助您保持竞争力

Rockwell Automation has the broadest solutions and the expertise to help you optimize your VFFS machine

Rockwell Automation Global OEM Resources
罗克韦尔自动化全球OEM资源

- **Global Consulting Team**
  - Resources: 180
  - Extended team: 220
- **OEM Success**
  - Over 1600 OEMs engaged
  - 800 New opportunities
  - Helps machine builder be more successful by reducing Total Cost
- **OEM Team Linkage to End Users**
  - Press releases and value propositions
  - User project planning
  - Success tracking
- **Industry Leadership**
  - OMAC / ISA
  - PMMI
  - VDMA
  - UCIMA
  - MHIA
  - AIMCAL
  - INDA
  - CEMATEX
  - International Standards Groups
- **OEM Tools**
  - Modular Programming Guidelines
  - Power Programming
  - Add-on Instruction (AOI) library
  - Sample Code and HMI Face Plates