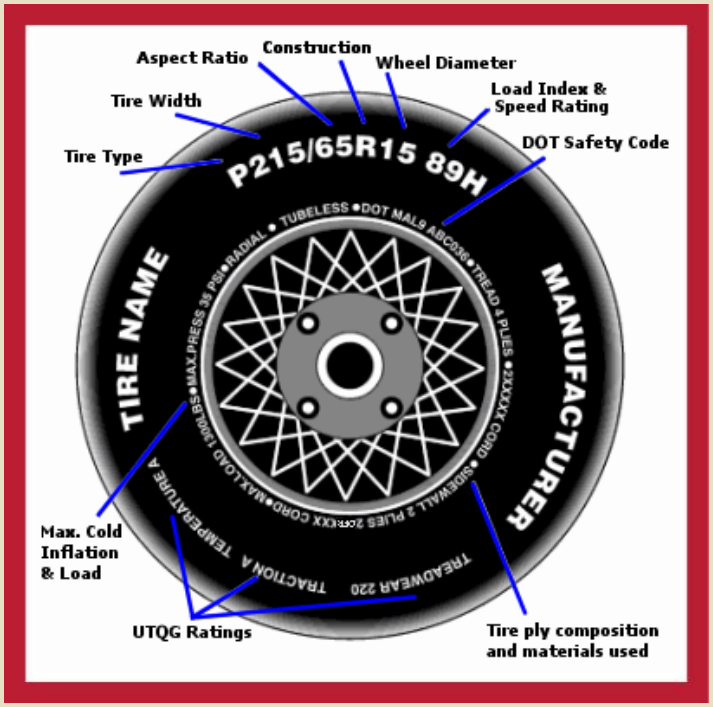
LISTEN.
THINK.
SOLVE.®



Value Matrix

- Tire Building Machine

Author: Juan Li / George Xu

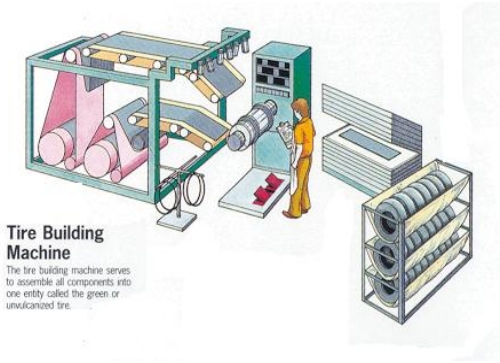
(Confidential - For Internal Use Only)

Allen-Bradley • Rockwell Software

Rockwell Automation

Tire Building Machine Briefing(1)

- Machine Description
  - Tire Building Machine is a type of special equipment use for tire manufacturing which assemble all semi-manufactured goods (such as: Tread, Sidewall, Inner Liner, Body Ply, Bead, Cord body etc.) together to build green tire according to the technologies. Normally this kind of machine is used to build radial tire.



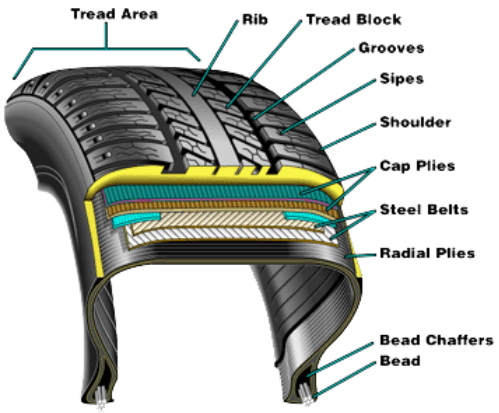
- Machine Operation
  - Typical TBM operations include the first-stage operation, where inner liner, body plies, and sidewalls are wrapped around the drum, the beads are placed, and the assembly turned up over the bead. In the second stage operation the belt package and tread are applied and the green tire is inflated and shaped.
  - The machine cycle is programmed to carry out the various operations automatically and simultaneously ,to give a balanced, single operator building cycle.
  - All sequences are controlled by PLC system.

Tire Building Machine Briefing(2)

- TBM is necessary equipment in all tire manufacturer, it is widely used to produce green tires.

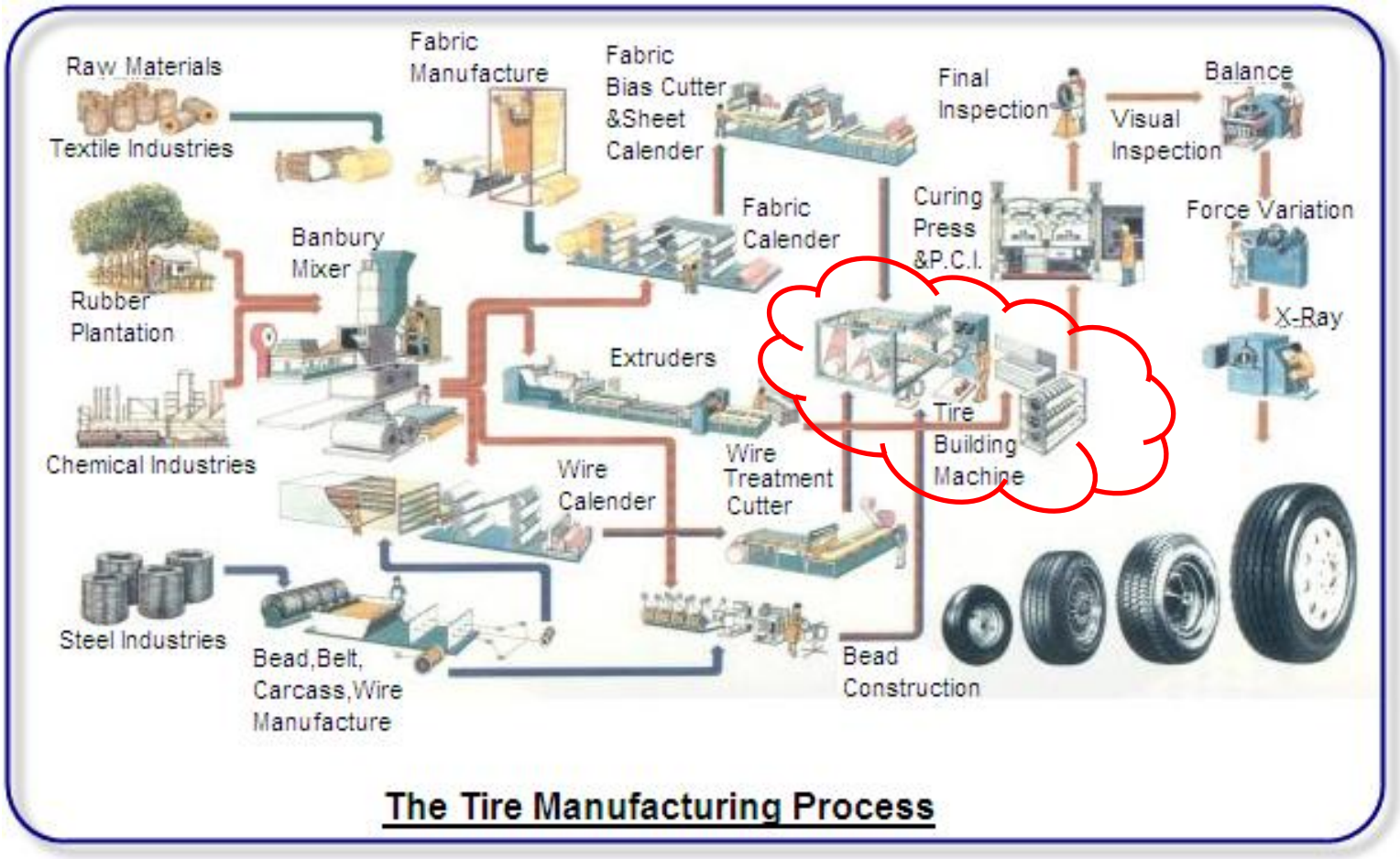
Type of Green Tire			
Vehicles	Usage	Size	Structure
PC(Passenger Car Tire)	Truck tire	Giant Tire(>=17in)	Bias Tire
LT(Light Truck Tire)	Passenger tires	Large-Scale Tire(< 17in & >=10in)	Radial Tire
TB(Truck & Bus Tire)	OTR	Small & Medium Tire(< 10in)	
AG(Agriculture Tire)			
OTR(Off The Road)			
ID(Industrial Truck Tire)			
AC(Aircraft Carrier Tire)			
MC(Motorcycle Tire)			

- A green tire is produced ready for the molding process by assembling the required components on a single machine with one operator.

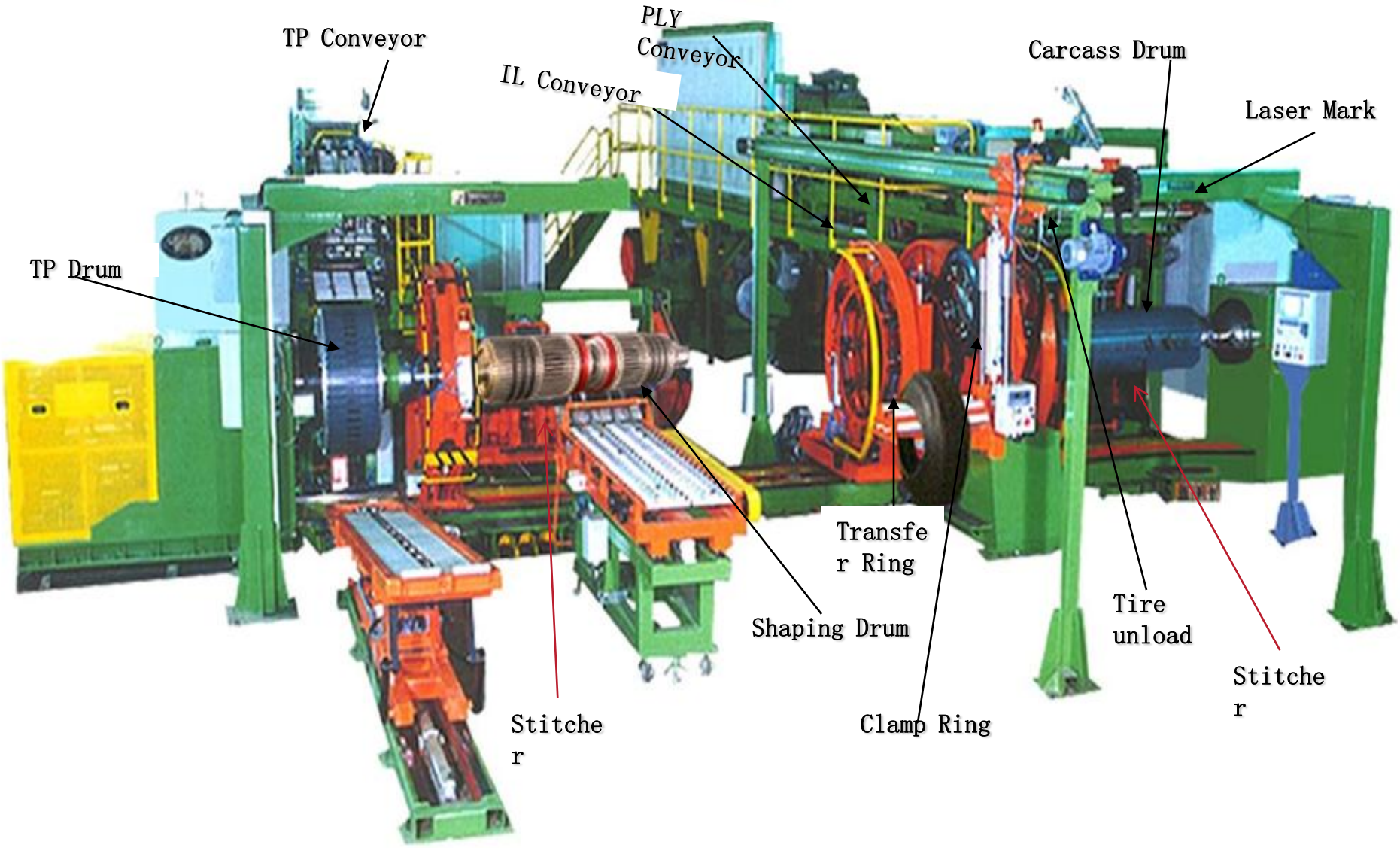


Tire Building Machine Briefing(3)

- Overall manufacturing plant scheme.



Identify Parts of TBM



TBM Categories / Challenges / Trends

- TBM Categories as:

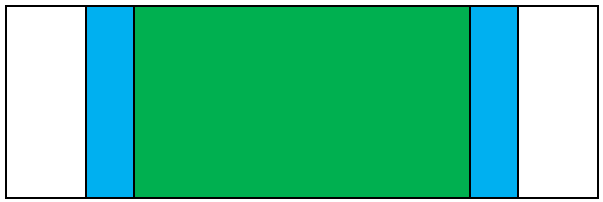
Tire Types \ Method of Building		Uni-Stage	Two-Stages
All Steel	2 drums	√	-
	3 drums	√	-
	4 drums	√	-
Half-Steel	2 drums	√	-
	3 drums	√	√

- Challenges
  - Higher throughput and higher quality
    - Highly automated machine
      - To get the period per phase as shorten as possible
      - More complicated sequencing and interlocking based on machine conditions
    - Higher accuracy of cut-to-length, JLB wind…….
    - Shorten recovery time
  - Flexibility
    - To match different type of tire
    - To match different building

- Trends
  - Higher output per unit time
    - Cam Profile to optimize the motion
    - Reduce changeover time by complex recipe management
  - Higher quality of tire building

TBM Prevalent Technologies (Uni-Stage)

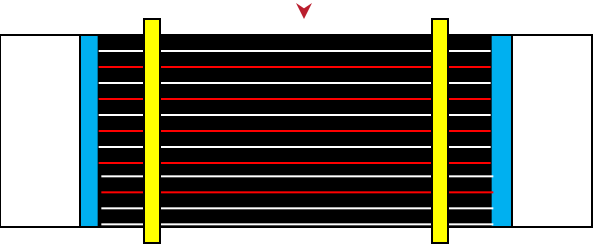
1. Apply sidewall(胎侧贴合)



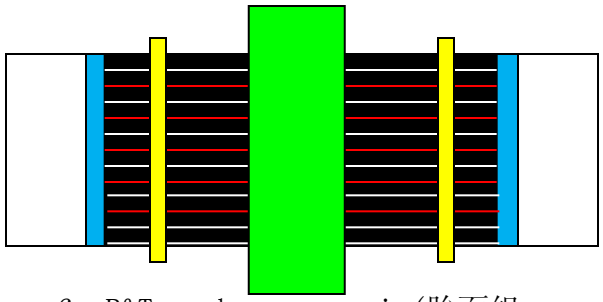
2. Apply IL(内衬层贴合)

3. Apply PLY1(帘布1贴合)

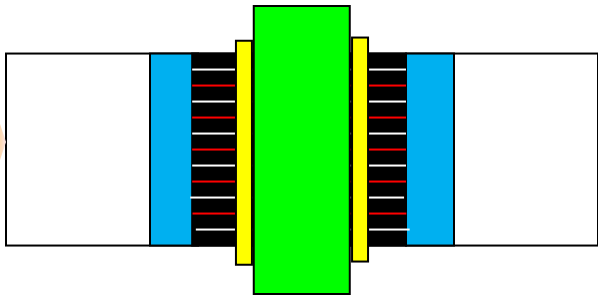
4. Apply PLY2(帘布2贴合)



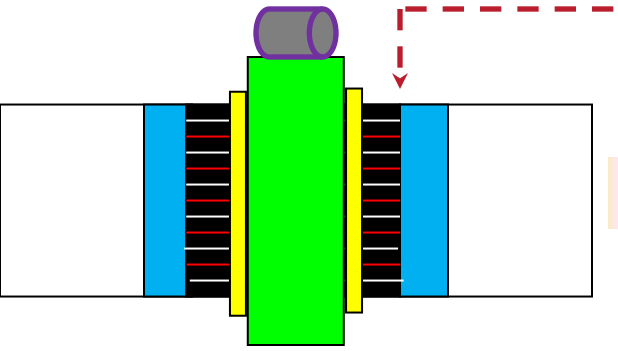
5. Bead setting(上胎圈)



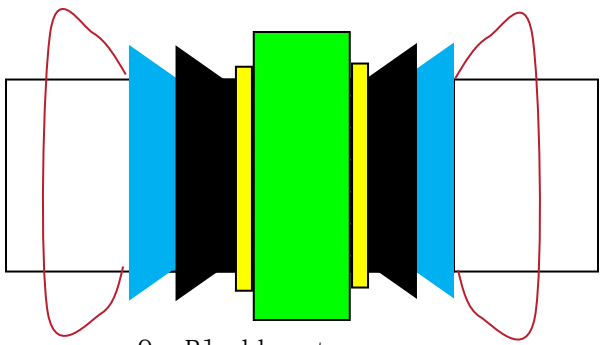
6. B&T package move in(胎面组件送入)



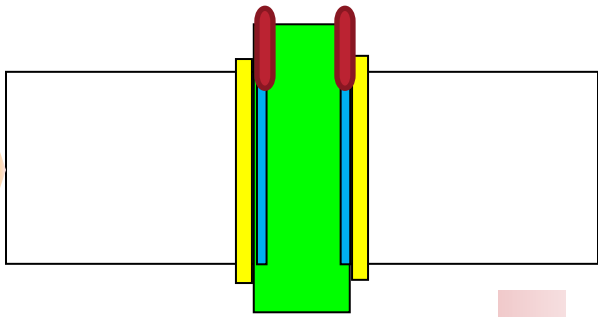
7. Shaping(胎体成型)



8. Tread stitching(胎面压合)



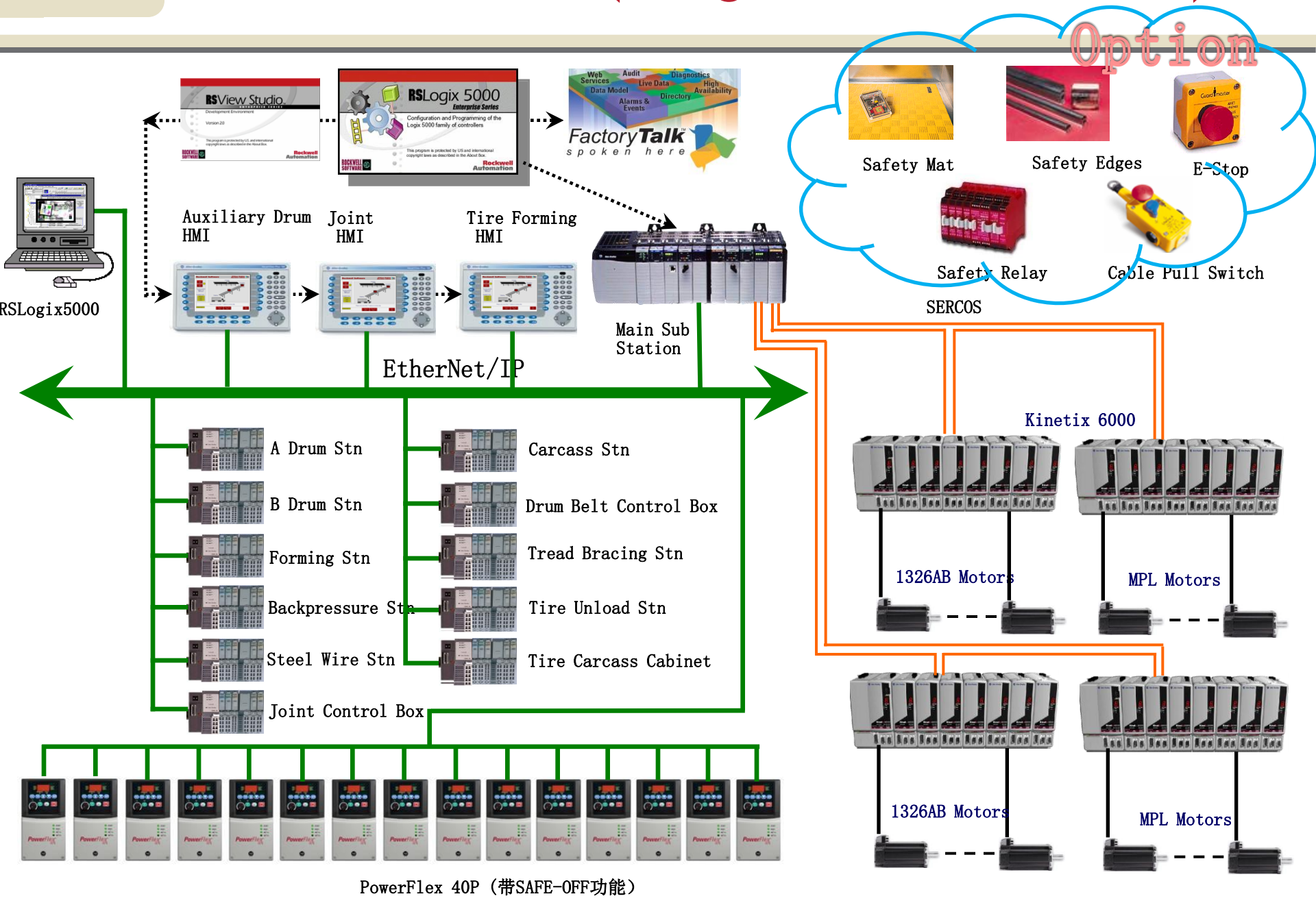
9. Bladder turn over(反包)



10. S/W stitching(胎侧压合)

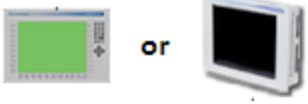
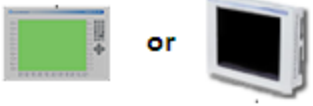
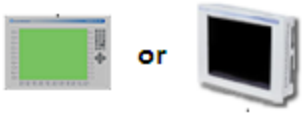
11. Green tire unload(卸胎)

Basic RA Solution (Integrated Architecture)



Integrated Architecture Expansion

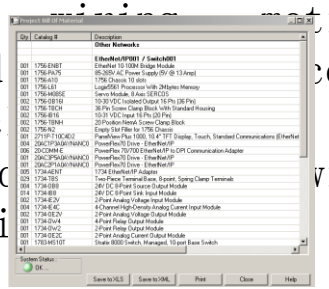
Expansion of Control Architecture for TBM

Architecture	Basic Machine	Simple Safety Function	Complex Safety Function
Control System	 Control Logix	 Control Logix + Safety Relay	 GuardLogix + Safety Relay
Network (Ethernet/Dnet)	1.EtherNet 2.EtherNet+Dnet	1.EtherNet 2.EtherNet+Dnet	1.EtherNet 2.EtherNet+Dnet
HMI			
Servo - K6K Guard Motion Build-In	Not Use	Safe Torque Off Function	Safe Torque Off Function
Power Flex 40P with Safe-Off Option	Not Use	Safety Off Function is used	Safety Off Function is used
Standard IO	 Point IO/Flex IO	 Point IO/Flex IO	 Point IO/Flex IO
Safety Sensor	Not Use		
Safety IO	Not Use	Not Use	1.1734 2. 1791 ES/DS 
Programming Software	 RSLogix5000/FactoryTalk	 RSLogix5000/FactoryTalk	 RSLogix5000/FactoryTalk

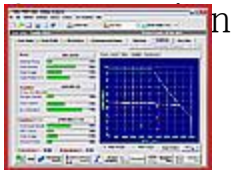
RA Tools for TBM (1)

- IAB
  - Integrated Architecture Builder (IAB) is a graphical tool designed to help you with the configuration ting of Logix control

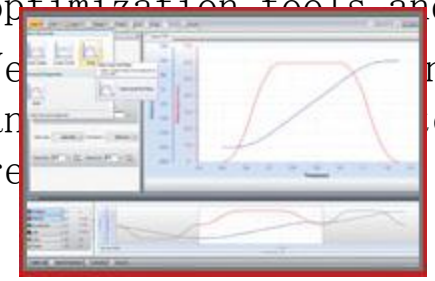
  - It helps you select hardware and generate bills of material for applications that include controllers, I/O, networks, PowerFlex drives, OnMachine cabling and tion control, and ces. Outputs inc of material and with quality graphi



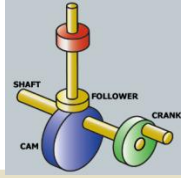
- Motion Analyzer
  - Motion Analyzer help you to design a Motion Control System, it uses sophisticated optimization tools to maximize ratios, inertia, and mechanical alternatives n control applications.



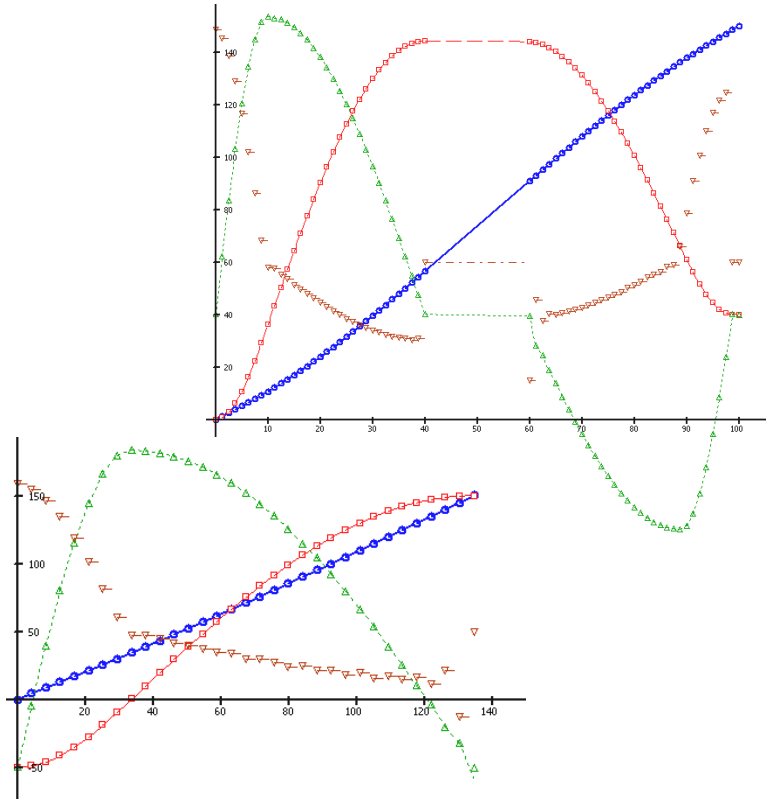
  - Create and simulate multi-segment cycle profiles to determine the best solution.
  - Improve your machine using optimization tools and utilities
  - Ve nce envelope an erm machine re

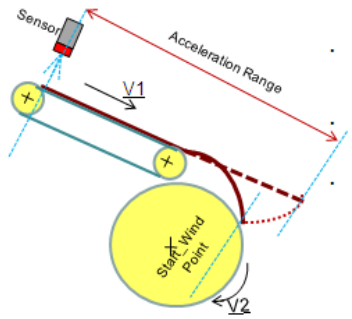


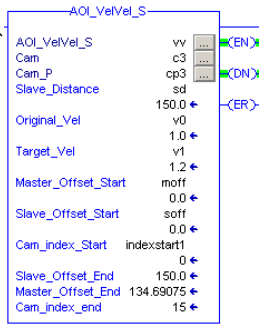
RA Tools for TBM (2)

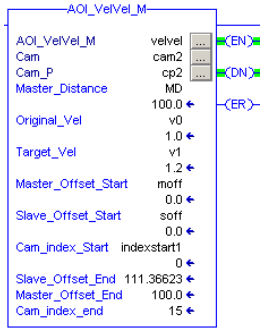


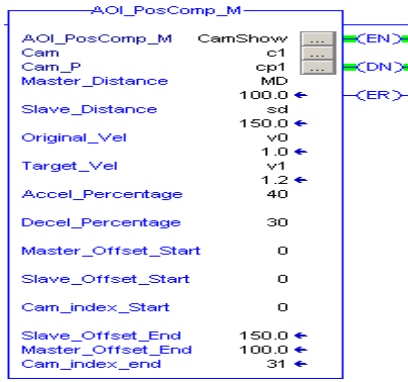
- Ghost Writer Lite
  - Ghost Writer Lite is a tool which can help you to optimize your cam profile to get right acceleration at right time and smoothen the motion jerk.
  - We supply 3 basic AOIs for customer to generate profiles, include:
    - Velocity to Velocity base master distance
    - Velocity to Velocity base slave distance
    - P nsation (c profile h winding)





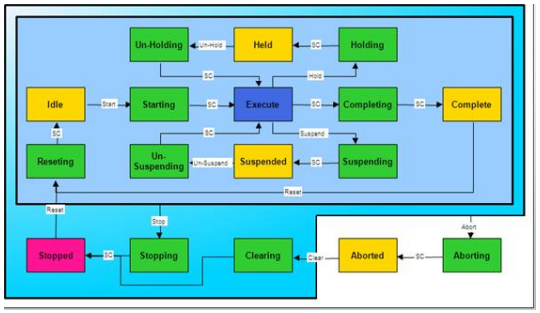


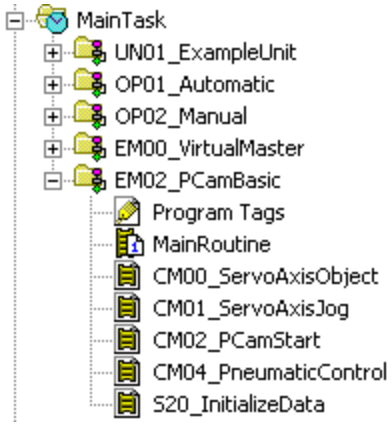


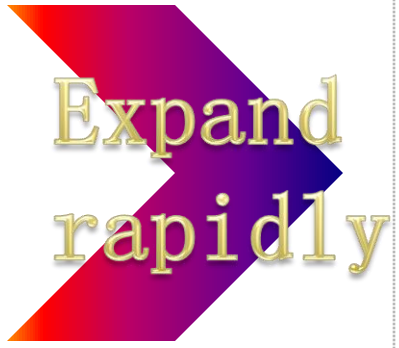


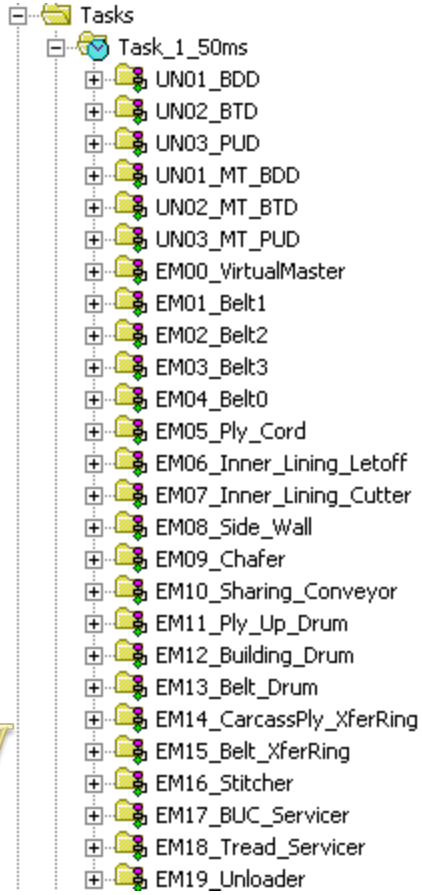
RA Tools for TBM (3)

- Power Programming and Template
  - We developed a template for OEM engineers to do the coding works basing on Power Programming V4.0, PackML is included. This can save engineers' developing time and make the works more professional.
    - Servo Axis handling
    - VFD handling
    - OEE / Cam recovery as options
    - Steps sequencing
    - Kinds of Screens



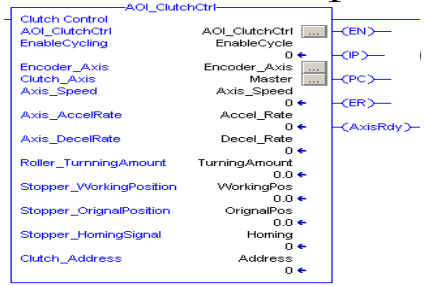






RA Tools for TBM (4)

- AOIs and Faceplates(example)
  - AOI



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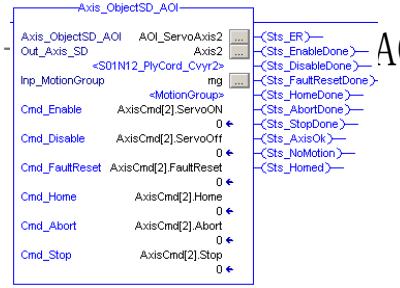
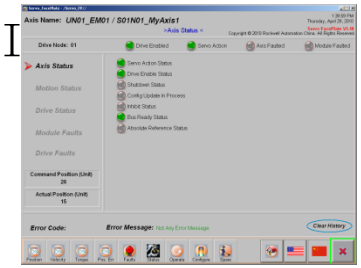
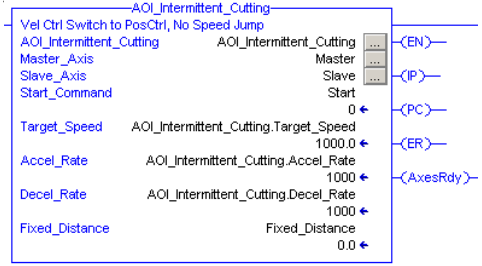


AOI



  - AOI MAT MAR MAM



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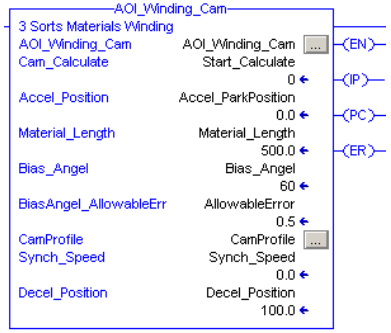
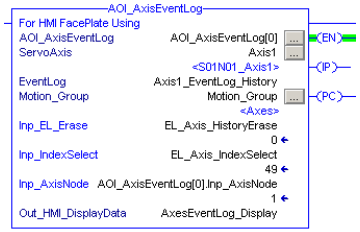
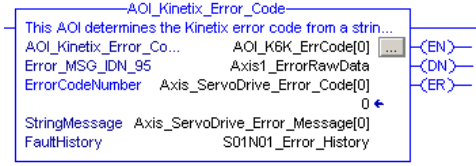
  - AOI for Material Winding

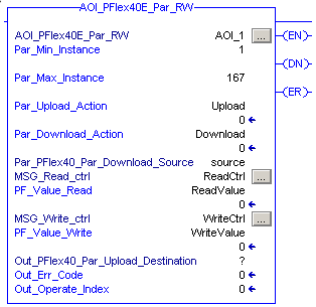


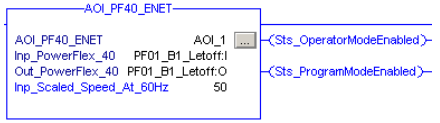
  - Axis EventLog and Error code





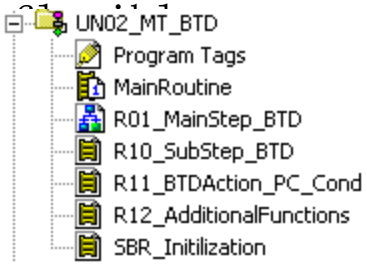
  - PowerFlex Parameters RW & Handling

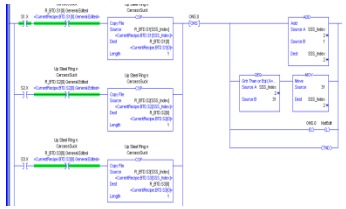


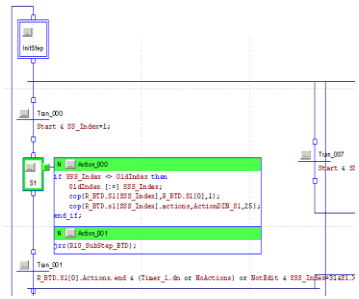


RA Tools for TBM (5)

- Step Sequencing
  - We use multiple programming languages to do the step sequencing, SFC+LAD make the work easier and better understanding for engineers. The steps operation become much







- Data Tracking
  - This function help end-user to backup the very useful information about the key parameters' changing. For example: Who changed the data, when the data been changed, the original value of the data and the updated value of the data.
  - FactoryTalk SE (with VBA)
  - Microsoft Access

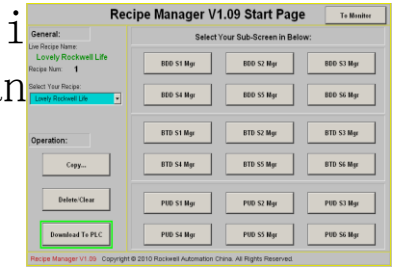
4.3 VBA Working Principle

For the principle of VBA codes, here I list one data comparison codes for reference.

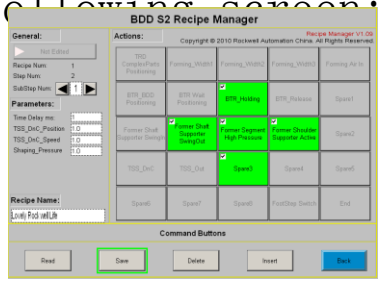
```
If OriginalD1 <> NewD1 Then
  gsqls = "SELECT * FROM Information WHERE ID is null"
  rs.Open gsqls, cn , adOpenDynamic, adLockPessimistic

  CurrentInfoID = NumericInput6.Value + 1
  rs.AddNew
  rs.Fields("ID") = CurrentInfoID
  rs.Fields("Old_Data") = OriginalD1
  rs.Fields("New_Data") = NewD1
  rs.Fields("ParameterName") = StringInput1.Value

  rs.Fields("Owner") = StringDisplay1.Value
  rs.Fields("Year") = NumericDisplay2.Value
  rs.Fields("Month") = NumericDisplay3.Value
  rs.Fields("Day") = NumericDisplay4.Value
  rs.Fields("Hour") = NumericDisplay5.Value
  rs.Fields("Minute") = NumericDisplay6.Value
  rs.Fields("Second") = NumericDisplay7.Value

  NumericInput6.Value = CurrentInfoID
  ExecuteCommand "set [Unit]MessageNumber  " & CurrentInfoID

rs.Update
```

RA Tools for TBM (6)

- Recipe Manager
  - We use 3 layers to organize the whole machine recipe data.
  - Using Access database and VBA codes to help FactoryTalk SE to manage recipes. The Start Page shows the operation of whole recipe, i Copy, Download an



  - Customer can edit the items of recipe by following screen:



- Recipe Monitor
  - Recipe Monitor provide clear machine status to operators, they are able to obtain information easily, such as: the current step, current actions.
  - The figure below shows the dy rent ac

  - We can share related document .

Value/ Differentiation

- Working Methodology
- Architecture
- Tools
- Technology modules
- Benefit parameters
  - Faster design, development and deliver
  - Easy to learn
  - Easy to diagnose
  - Easy to maintain
  - Easy to operate
  - Time to market
  - Mechanical stability and Life
  - Speed/thruput
  - Lesser wastage
  - Compliance

Process/Methodology of work

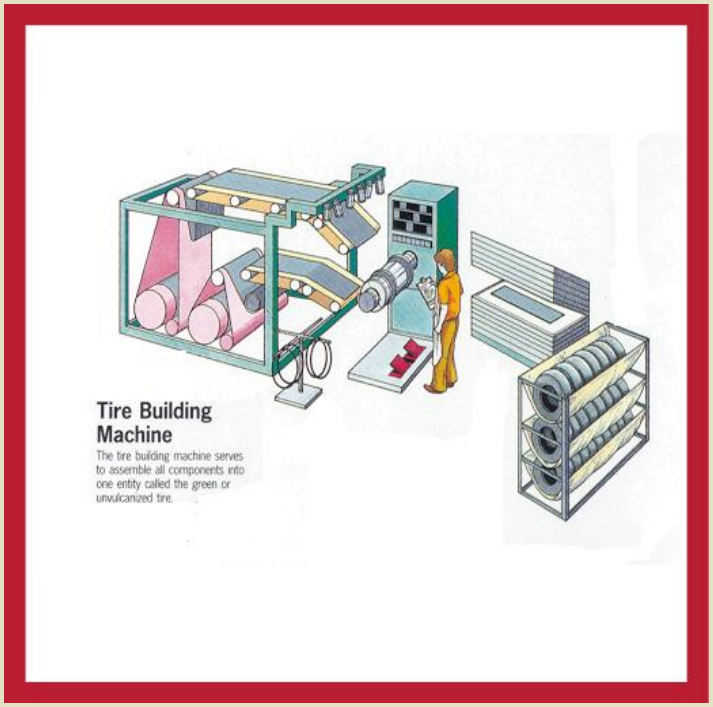
- Role
- Machine Study
- FDS of machine and technical Offer
- Commercial Offer
- Project Scheduling
- Offline Development and OEM (Channel) Participation
- Machine trials
- Handing over and disengagement

References from the region

- OVP or Customer ref who has acknowledged the Value
  - AoStar
  - Seyen Shanghai Inc.
  - QingDao GaoXiao
  - TianJing SaiXiang
  - …

MESNAC 软控
since 2000
MESNAC 软控
心期待 共未来

LISTEN.
THINK.
SOLVE.®



Thanks!

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