Industrial Automation Technology

”Low-Cost Machine Design using Application Specific Automation Innovations”

Innovation Stage at Pack Expo 2017

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Who is Delta?

Manufacturer & Provider of Products & Solutions of

- Power Electronics
- Automation
- Infrastructure

Quick Facts

- Established 1971 in Taiwan
- Rooted in the US since 1982
- 70k employees worldwide
- $8.1B in annual revenue
- Innovative Design & Quality Mfg Competency
- #1 Global Power Supply Manufacturer
- #1 Thermal Management Solution Provider
- Leading Provider of Industrial Automation Technology and Solutions

Industrial Automation Business Group Mission

To elevate our living environment through advanced automation technology and value added innovation.
The burning issue

How to design a machine with sustainable controls that is scalable & competitively low cost – without sacrificing performance?

What innovations are out there to help OEM machine builders?
The Application of Automation In Packaging

Relevant Applications

- Feeding
- Feed-to-Length
- Rotary Cut / Seal
- eCAM Following
- Electronic Line Shafting (ELS)
- Linear Flying Shear
- Pick-N-Place
- Orienting & Placing
- ABS Rotary Indexing
- Winding / Unwind

Industries: F&B, Med Device, Pharma
Machine Design Considerations

Integration, Maintenance & Serviceability

Product Lifecycle & Future Proofing

Time To Market

Quality Cost Delivery

Scalability & Cross-Application Use

Performance & Change-over Flexibility
The Heart of a Machine
is the control system

- 10-40% of machine cost
- Makes Automation possible
- Raises Productivity
- Enables Innovation in Machine Design Considerations
Control System Selection
Navigating the Control Continuum

Centralized vs Distributed

Distributed

“Distributed Control”
- Critical Motion profiles are generated and executed locally in the NODE
- Distributed intelligence
- “Lean” upper controller
- Easy to upgrade performance
- Multiple programming locations

Centralized

“Centralized Control”
- Critical Motion profiles are generated and coordinated in UC
- Performance muscle within upper controller
- Powerful upper controller
- Coordinated Programming

UC = Upper Controller (Ex: PLC)
NODE = drive unit (Ex: Servo Drive)
Control System Selection
Navigating the Control Continuum

Which is better?
Depends on the application

Distributed ——— Hybrid ——— Centralized

Stand-alone machinery modules

Complex Control of Machine Automation

What if I need:
- Complex control of motion & stand-alone?
- Scalability of machine size or app usage?
- Competitive low cost?
- Simple setup & maintenance?
- Future proof capability?
“Everything should be made as simple as possible, but not simpler.”

- Albert Einstein
“Low-Cost Machine Design using Application Specific Automation Innovations”
The Simple Technology Innovation that doesn’t Sacrifice Performance

“Automation Control Module”

- An Intelligent Servo Drive with Motion MACROs built-in
- Pre-Engineered App Functions
- Flexible Parameterized Setup
- Simple Sequencing Thread
- Fast Local Execution
- Flexible Peripheral Connections
- Scalable Motor & Environment
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup

Technology Innovation:
- Parameterized Setup Wizard
- Pre-Engineered Motion MACRO with eCAM
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup
- Match web speed in cut zone

Technology Innovation:
- Seal Zone and Speed Comp parameters
App 1: Rotary Knife / Seal

Technology Innovation:
- Knife Quantity is a Parameter
- Fractional pulse & rollover automatically calculated

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
App 1: Rotary Knife / Seal

Technology Innovation:
- Built-in programmable thread for sequencing
- eCAM Disengage & Engage timing
- Position tracking while E-STOPPED
- Temporary offset if line-stop condition

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
- Recover from ESTOP

Show video of recovery
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
- Recover from ESTOP
- Future Proof → add registration

Technology Innovation:
- High Speed 5 usec Registration for dynamic phase shift
- Registration Window Masking
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
- Recover from ESTOP
- Future Proof → add registration with Slip Compensation

Technology Innovation:
- Filtered correction rate, 0-100%
- Skip pocket

Tension too high causes film stretch
Tension too loose causes film slip
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
- Recover from ESTOP
- Future Proof → add registration
- Multiple size machines
- Some motors wash-down or Hygienic

Technology Innovation:
- Scalable across 100W to 15kW sizes
- Motor environment isolated from controls and power section
App 1: Rotary Knife / Seal

Application Requirements:
- Simple Setup
- Match web speed in cut zone
- Changeover one or multiple knives
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- Future Proof → add registration
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Technology Innovation:
- Scalable across 100W to 15kW sizes
- Motor environment isolated from controls and power section

Hygienic* or Wash-down

* Courtesy of ELWOOD

High vibration
App 2: Flying Filler / Shear
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App 2: Flying Filler / Shear

Application Requirements:
- Accurate fill for contoured bottle
- Accurate valve control timing

Technology Innovation:
- Custom eCAM profiling with cubic curve interpolation (5-points)
- High speed 5 usec PLS output
App 2: Flying Filler / Shear

Application Requirements:
- eCAM for accurate contour fill
- Accurate valve control timing
- Coordinated 2\textsuperscript{nd} axis
- No synch delay

Technology Innovation:
- Minimized 50 nsec delay between axis
App 2: Flying Filler / Shear

Technology Innovation:
- Switch between CAM tables @ cycle end
- Re-Calculate CAM table on the fly

Application Requirements:
- eCAM for accurate contour fill
- Accurate valve control timing
- Coordinated 2nd axis
- No synch delay
- Accommodate multiple bottle types inline

Data Array

- eCAM 1
- eCAM 2

Array Length

- 800
App 2: Flying Filler / Shear

Application Requirements:
- eCAM for accurate contour fill
- Accurate valve control timing
- Coordinated 2nd axis
- No synch delay
- Accommodate multiple bottle types inline
- Future proof – upgrade to linear motor

Technology Innovation:
- Flexible motor type for direct drive
App 3: Labeling / Feed-To-Length
App 3: Labeling / Feed-To-Length

Application Requirements:
- Accurate label placement
- High speed operation

Technology Innovation:
- Dual-Registration input @ 5 usec with auto re-arm
- Event Triggered Phase Alignment
App 3: Labeling / Feed-To-Length

**Technology Innovation:**
- Cue processing
- Negative edge to disengage eCAM

**Application Requirements:**
- Accurate label placement
- High speed operation
- Flexible label size
Portable Technology to Applications
1-Axis to Multi-Axis

Lin Fly Shear / Fill

Winding / Traverse

Gantry Control
Point-To-Point
Linear Actuator

Rotary Dial Table
ABS Indexing

Packaging / Labeling
Feed-to-Length

Rotary Knife / Seal
Orienting & Placing

Printing /
Electronic Line Shafting /
E-Cam
Low-Cost Machine Design using Application Solution Innovations

Machine Design Considerations

- Integration, Maintenance & Serviceability
- Product Lifecycle & Future Proofing
- Quality Cost Delivery
- Time To Market
- Scalability & Cross-Application Use
- Performance & Change-over Flexibility

“Everything should be made as simple as possible, but not simpler.”

Automation Control Technology Module

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