How to Program SCARA and Six Axis Robots
MM03- Rockwell Robotic Solutions

MM05- Implementing Vision in Robotics
Stäubli Group

- Technological solutions for a vast range of industries – textile machinery, industrial connectors and robotics
- A family owned industrial company which originated in 1892 in Switzerland
- Turnover surpassing one billion USD with over 4,200 employees
- 13 production facilities
- 25 business units
- Agents in 50 countries
3 Stäubli Divisions

**Textile**
- Frame Weaving
- Jacquard Weaving
- Weaving Preparation
- Schönherr Carpet Systems

**Connectors – ECS & FCS**
- Fluid Connectors
- Electrical Connectors (Multi-Contact)
- Robotic tool changers

**Robotics**
- 4-axis SCARA
- 6-axis anthropomorphic
- 4-axis Fast Picker
- Controllers & software
Robotics Division – Key Dates

- 1982: Creation of the Robotics Division
- 1982 – 1989: Distribution of Unimation robots (USA)
- 1989: Stäubli purchased Unimation from Westinghouse
- 1992: Launch of the RX robot series
- 2002: Launch of the Stäubli CS8 controller & VAL3 Software
- 2004: Launch of the TX series / CS8C controller
- 2005: Acquisition of BOSCH Rexroth SCARA product
- 2006: Launch of next generation SCARA RS series
- 2007: Launch of the RS20 Mini Industrial SCARA
- 2008: STERICLEAN & CAMEROBOT product introductions
- 2008: Launch RX170HSM & PaintiXen software
- 2009: Launch of TX200 Series Products
- 2010: Introduced Next Gen SCARA “TS” Series
- 2011: uniVAL drive & VAL Products Software
- 2012: Launch TP80 Fastpicker
- 2012: Launch TX340 SH

10 % of the turnover re-invested in R&D
SCARA Robots

- Four Degrees of Freedom
  - Advanced Control
  - One Linear Axis and Multiple Rotary Axes
- Motions
  - Rotational
  - Linear Z Axis
- Highly Accurate
  - ± 0.01 mm
- Fast and Vibration Free
  - Adept Cycle: 0.30 – 0.35 seconds

Packaging / Assembly / Material Handling
Four Sizes
Reach to wrist (200-800 mm)

TS Series SCARA

TS40  TS60  TS80  TS20
Fast Picker

- High Speed Pick and Place
  - 200 Picks per minute
  - Highly Accurate
  - Very rigid
- Sorting and Picking
  - Vision typically required
  - Conveyor Tracking typically required
- Low payload
- 4 Axis Robot
- Reach at wrist (800 mm)

High Speed Pick and Place

Staubli TP80 unique to the industry
Articulated Robots

- 6 Axis Design
  - Rotational Motions
- Most Common / Most Flexible
- 2 Kg to 250 Kg Payload
- Reach at wrist (515-3200 mm)

Staubli TX Series
Paint Robots

- 6 Axis Articulated
  - Designed for Intrinsically Safe Environment
  - Hazardous Areas
- Different Wrists
- Different Motion and Movement
- Specific to Paint
- Reach at wrist (600-2500mm)

Spray Painting
Common Industrial Robots

STÄUBLI

• SCARA
• Fast Picker
• Paint Specific
• Six Axis Articulated
Stäubli Robotics Products

- **SCARA Robots – TS Series**
  - 0.5 – 8 Kg payload / reaches from 220 – 800 mm

- **6 Axis Robots – TX / RS Series**
  - 2 – 250 Kg payload / reaches from 515 – 3200 mm

- **‘Fast Picker Technology’ – TP Series**
  - 1 Kg payload / reaches to 800 mm

- **Specialized Robots for Specific Applications**
  - Wash Down, Clean Room, Sterile, Explosion Proof, Paint
  - High Speed Machining and Industry Specific Software Packages

- **Controls and Software**
  - All on one Control Platform - CS8 Series
  - Software Packages tailored to the user
Wide range of products for a variety of applications
- Semiconductor
- Aerospace
- Medical / Life Sciences
- Plastics
- Consumer Products
- Electronics
- Food
- Automotive
- Solar / PV
A completely logical, segmented and integrated product development program

Corporate wide integration of products and market segments.
Specialty Industrial Robots

• Clean Room
• Machining
• Food Grade
• Wash Down
• Sterile
• Stainless Steel
• Hazardous Duty

CR Models
HSM
HE Models
Stericlean Models
EX Models

Modifications to the base design.
Stäubli Product Environmental Classification

- **Standard Models**
  - ISO cleanroom class 5-6
  - Grade D or C Environment
  - No Particular Specification

- **HE(2)**
  - Wash Down
  - Corrosion Resistant
  - Food Grade Oil

- **CR Models – Cleanroom**
  - ISO cleanroom class 4
  - Grade C or B Environment
  - Clean / disinfect with cloth wipe

- **Stericlean Models**
  - ISO cleanroom class 3
  - Grade A Environment
  - \( \text{H}_2\text{O}_2 \) Vapor or Liquid Compatible

ISO 14-644-1 standard (FS209E)
HE(2) Model Robots

- Specifically Designed for Wash Down Applications without requiring a cover
- A complete range of 6 Axis TX Series Robots with CS8C Controllers
  - Wrist and other critical parts made from Stainless Steel
  - Smooth surface finishes eases sanitation and draining
  - Fully enclosed and sealed design with pressure purge to prevent water intrusion and internal condensation.
  - Sanitary design includes internal wiring and pneumatic lines to decrease contamination sources.
  - Wrist is capable of low pressure immersion and is resistant to corrosion
  - Connections are under the base to isolate them from water
  - Robot base is sealed to its mounting surface to prevent water intrusion
  - Corrosive Resistant Coating both inside and out
  - Withstands high pressure cleaning
  - Food Grade Oil
Robot arm suitable for “sterilization” process: ISO Class 3 / Grade A environment
- Resistant to Vapor $\text{H}_2\text{O}_2$
- Human arm like automated operator in isolator environment
- Allows increase in sterility duration and decrease in the number of sterilization operations
- Robot motion during sterilization allowing decrease in shadow zones
- Reliability proven by the leaders in life science and Cleanroom industry
Current Technology

- Manual
- Parallel or “Delta” Class Robots
- Mechanical or pneumatically driven mechanisms
- Use of multiple picks with slower technologies
- Newest technology in the Robotics Industry – the Stäubli TP80 Fast Picker
Large work envelope

Staubli TP80

1,600 mm diameter

100 mm
- Payload to 1 Kg
- Reach 800 mm with 100 mm Z Axis Stroke
- Speed for the 25 / 300 / 25 cycle
  - 0.1 Kg = 200 PPM
  - 1 Kg = 170 PPM
- Repeatability less than +/- 0.05mm for entire range of motion

Images:
- Large Work Envelope
- Slim Forearm
- Internal User Cables
- Smooth Sealed Design
- High Speed
- Rigid Structure
- Simple Mounting
- No Vision Interference
A completely logical, segmented and integrated product development program

Corporate wide integration of products and market segments.
What is a VALProduct?

- A ValProduct is an industry dedicated user interface software.
Val Product Range

- **PaintiXen**: Stäubli painting process software

- **ValPlast**: IMM tending software. Easy interfacing based on Euromap/ SPI standards.

- **ValHSM**: Machining Software including spindle management and 3D trajectories import.

- **ValTending**: Pick & Place and machine tending software

*Ready to use market solutions*
Val Product Range

VAL-Software

- **VAL** products
  - VALtending
  - VALhsm
  - VALplast
  - VALtrack
  - PaintiXen

- **VAL3** programming language
  Advanced robotics programming to create high end and customer specific applications.

- **uniVAL** Drive
  A “Ready to plug“- solution to drive Stäubli robots with generic industrial motion Controller (KEBA, Schneider Electric, Rockwell...)

- **VALtending** can be stand alone or integrated with a RA PLC for Pick & Place applications
Val Product Benefits

• **Simplicity**
  – Intuitive Menu driven software
  – No programming knowledge required
  – Production interface
  – Dedicated terminology
  – Homing strategy included / Return to the safe position

• **Performance**
  – Faster commissioning
  – Palletizing module
  – Conveyor tracking module
  – 3D CAD import module
  – Can be stand alone or integrated in a line

• **Safety**
  – 3 users level
  – Working mode management
  – E-Stop management
uniVAL Business Case

- Machine Builders and End Users are already using OEM Controllers
  - Already trained in programming, debugging and maintenance
  - All System Functions are in a familiar format - Machine Control, I/O, Programming, User Interface
- Robot performance is same as a standard Stäubli developed arm algorithms
  - Drives and Controller are Staubli Standard / Works on entire Stäubli line of robots
  - Servo tuning, joint synchronization, stop modes, arm algorithms, offsets and arm safety by Stäubli
  - Fully compatible with Stäubli SRS software and all maintenance and service functions.
  - Stäubli SP1 Teach Pendant menus are still usable along with manual jogging functions
- Easy integration and flexibility of additional external axes systems.
- Motor / Drive / Robot replacement does not require servo tuning
- System responsibilities are clearly defined for system performance, warranty concerns and service issues.
• RA Partnership
  • Informal, Technical Discussions

• Products
  • SCARA & Articulated Arm
  • Applications: Plastics, paint, Food, Life Sciences, Mechanical and Specialty

• Logix Integration
  • Level 1 EtherNet/IP
  • AOI library (21 functions)
• Logix AOI Library

Staubli Unival Controller

Logix AOI Library – 21 functions

Staubli Manipulator

Powered by WERNER ELECTRIC
Stäubli Robot Advantages

- Specific industries where they specialize
- Enclosed design for clean applications
- SCARA is more rigid than all competitors
- Unique designs.
  - No one else has uniVAL / TP80 / Stericlean / HE / HSM
  - No one else builds their own gear drives
- 6 Axis Design with trajectories and range of motion unlike anyone else
- 6 Axis is a highly rigid design
  - More precise, accurate and rigid than any one else
- Only line of Certified explosion proof robots on the market
Special Features

- Low maintenance (TX series: oil change every 40,000 h)
- High speed & precision by patented Stäubli gearbox*
- Low energy consumption
- High cleanliness
- Easy operation
- Worldwide sales and service network

High Reliability

- Long lifetime
- Long maintenance intervals
- No batteries in the arm/ controller needed for position storage
Staubli JCM Drive

- Gear reduction system is permanently pressed into arm casting for increased performance
- Repeatability from +/- 0.01 mm
- Higher path precision, flexibility and speed
- Reduced Maintenance
- Zero Backlash
- Stäubli Patented Technology
Stäubli Robotics Products Features

• Precision
  Industry leading repeatability & speed
  Repeatable throughout the entire range of motion

• Range of Motion
  Exceptional Trajectory and Full Range of Motion

• Mounting
  Floor, Ceiling, Wall mount options up to 20 Kg
  Floor or Ceiling mount options up to 80 Kg

• Environment
  Fully enclosed structure for maximum protection
  ISO Class 5-6 (Class 100 Standard)

• Quality / Uniqueness
4 Things to Remember about Stäubli Robots

- **Quality in Products and People**
  - Patented JCM Style Motors / Hand Assembly Process to assure Quality
  - SCARA Design is robust

- **Market Specific Precision Products**
  - Arms are developed with features and benefits specific to solve your problems.
  - Controls and Software packages are designed to compliment the needs of your industry
  - Best in Industry Repeatability / Highest Speeds / Unrivaled Reliability

- **Product Support**
  - Over 100 technical support personnel located in all geographic areas and industries

- **Company Culture**
  - Long term relationship based with customers, vendors and employees Team Approach
Motion & Mechatronic Solution Area

- SCARA & Six Axis Staubli Robots
Thank You!