

Automated Packaging Cell

Coordinate conveyors, sensors, and pneumatic gates to move twenty products without a jam.

Customer AeroPack Systems	Department Packaging Automation	Difficulty Advanced	Time 2 class periods
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Production Goal: Move twenty parts through packaging without a jam.

Background

AeroPack Systems packages flight-control components. Parts occasionally arrive too close together, causing collisions at pneumatic routing gates. Your team must redesign the sequence so parts remain spaced and every route completes safely.

Learning Objectives

- Coordinate conveyor and pneumatic actions
- Use sensors instead of fixed delays where appropriate
- Create a state-based production sequence
- Test and document reliability

Equipment

- VEX CTE Workcell
- Entry, transport, and exit conveyors
- Object or distance sensor
- Pneumatic cylinders
- Twenty disks/cubes
- Python project

Student Instructions

- 1 Draw a flowchart from part entry through final destination.
- 2 Mark every point where a sensor confirmation is needed.
- 3 Run the existing sequence and record where waiting or collisions occur.
- 4 Program one-part operation using sensor confirmation before each routing action.
- 5 Add logic that prevents a second part from entering an occupied zone.
- 6 Run ten parts, identify failures, and revise.
- 7 Run a final twenty-part reliability trial.
- 8 Create a timing diagram showing conveyor and cylinder states for one cycle.

Engineering Requirements

- Transfer twenty consecutive parts with zero jams
- Preserve order of arrival
- Stop conveyors when a routing gate changes position
- Complete the final trial in under five minutes

Constraints & Safety

- Conveyor speed may not exceed 70%
- No manual repositioning during a run
- Use only approved sensors and cylinders
- Pneumatic actions must complete before the next part enters the zone

Deliverables

- System flowchart
- Final Python program
- Timing/state diagram
- Twenty-part reliability log
- Reflection

Reflection Questions

- 1 Which sensor replaced the most unreliable timer?
- 2 How did you prevent two parts from occupying one zone?
- 3 Where could a jam still occur?
- 4 What should the system do after a detected fault?

Engineering Support

Engineering Tip

Treat each conveyor zone as occupied or clear and do not release a new part until the next zone is confirmed available.

Common Mistake

Adding long waits may hide a timing problem but reduces throughput and does not guarantee safety.

Stretch Goal

Add an automatic jam timeout that stops the system and flashes the signal tower.

Career Connection

Packaging automation engineers integrate conveyors, gates, sensors, and safety logic in high-volume facilities.

Before You Submit

- Notebook evidence included
- Requirements checked
- Testing documented
- Reflection completed