Understanding Flexible Automation

The Assembly Show
October 2016

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Survey

How do you think about flexible automation?

1. Variation of products being assembled?
2. The Capital Equipment's ability to be repurposed?
3. The ease by which you can add processes?

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Agenda

Definition & Configurations

“Good” Applications

Advantages & Disadvantages

How To Decide: ROI Analysis

Challenges For Manufacturers

Challenges For Machine Builders

Advice & Tips For All of Us

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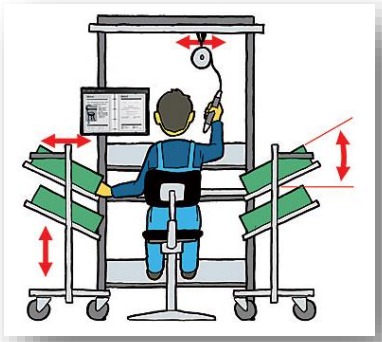
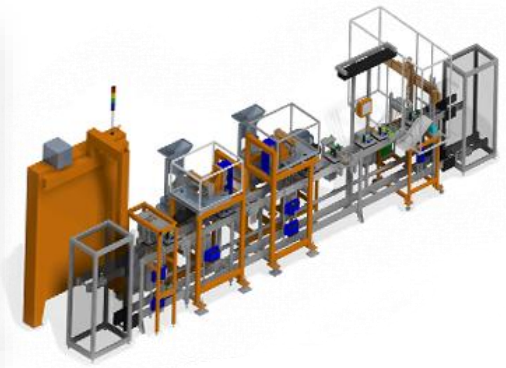
Automation Spectrum



Lean Cells



Flexible

Semi-Flexible

Fixed / Hard

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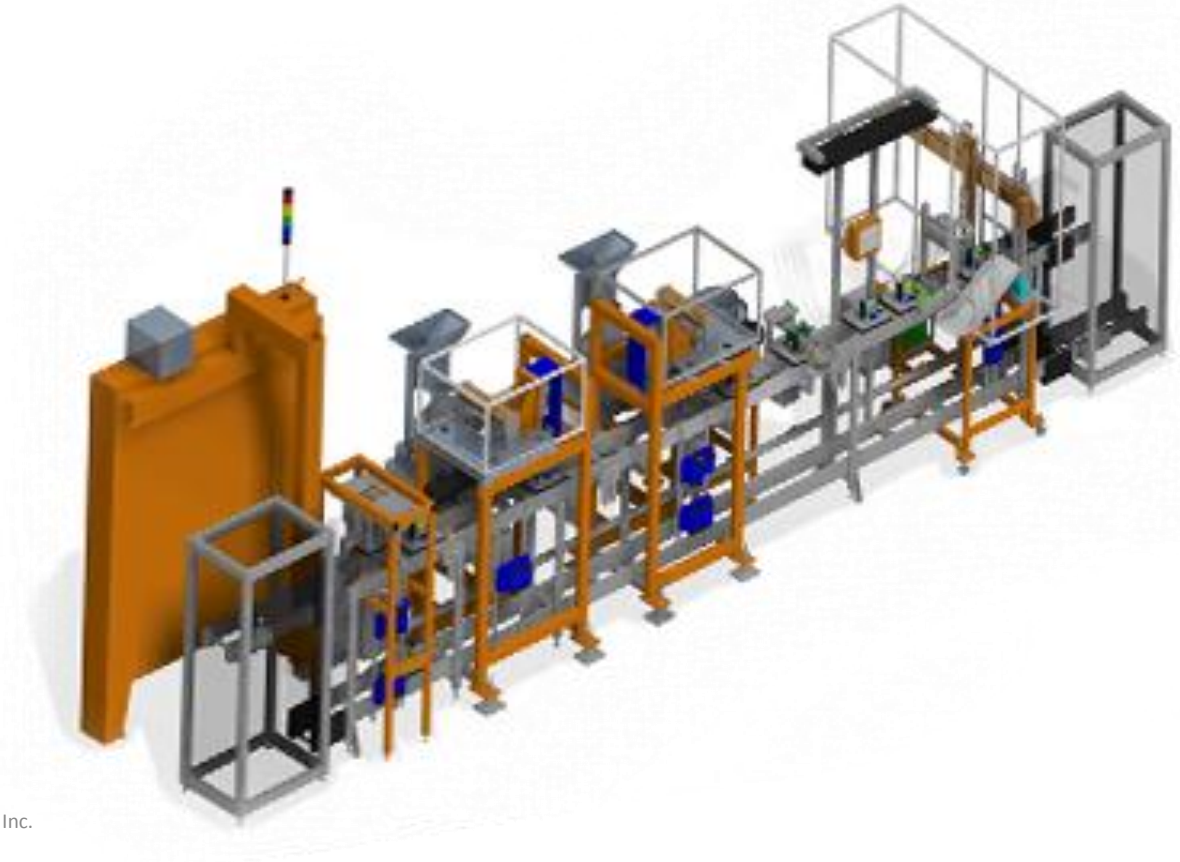
Definition: Flexible Automation

Configurable + Programmable = Adaptable

1. The automation can run multiple products
2. The primary capital components can be reused, retooled or repurposed
3. The automation scope can grow and change w/o impact on the *chassis*



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Definition: Semi-Flexible Automation

Utilizes Quick-Change Tooling

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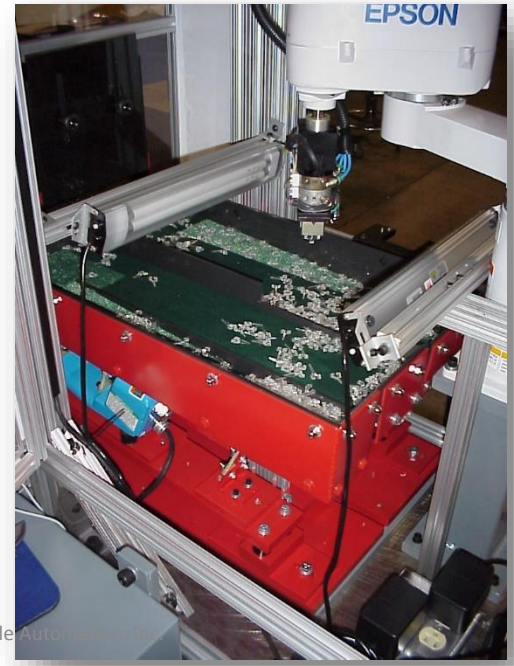
Flexible Components



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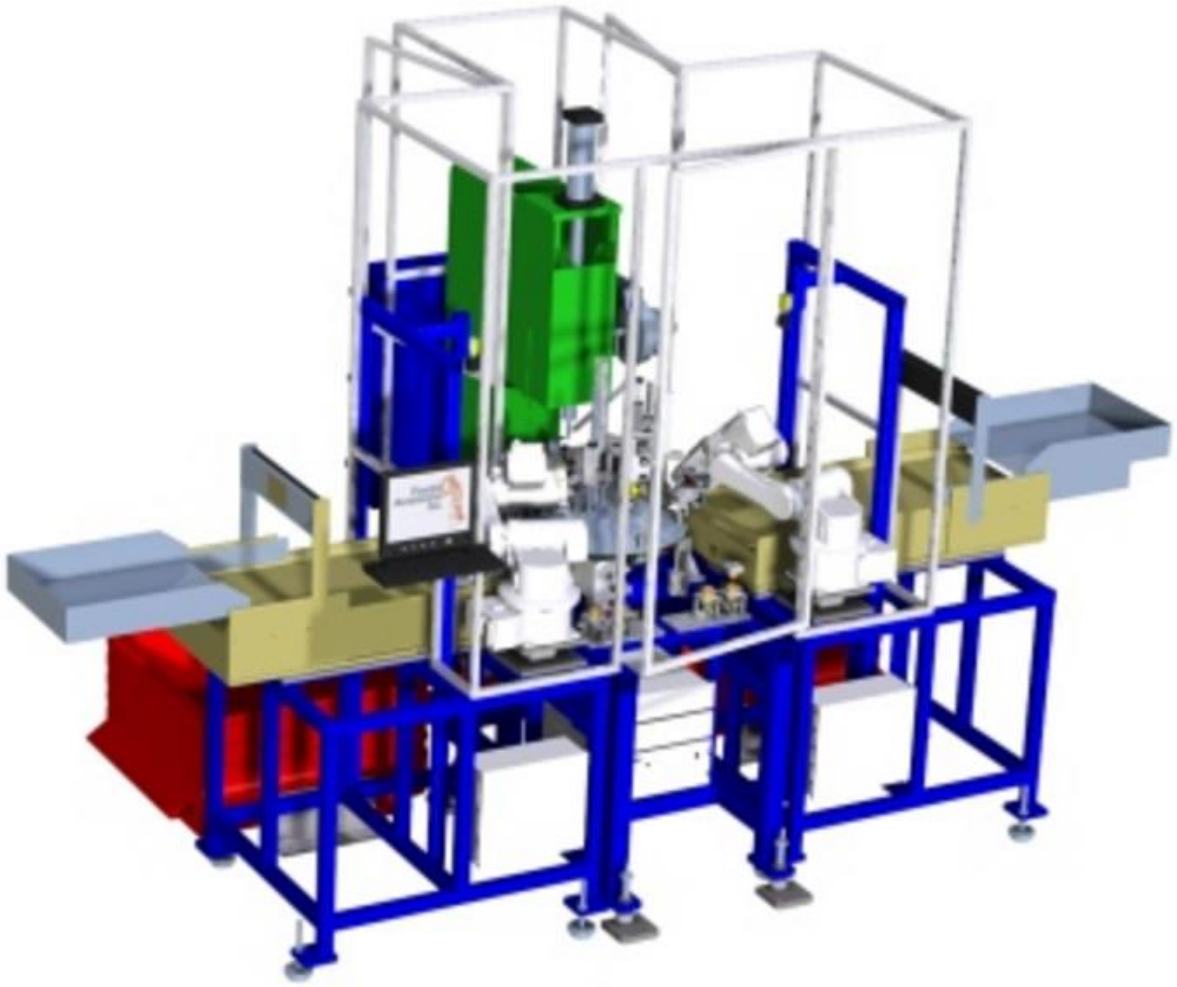
Flexible Configuration Example #1



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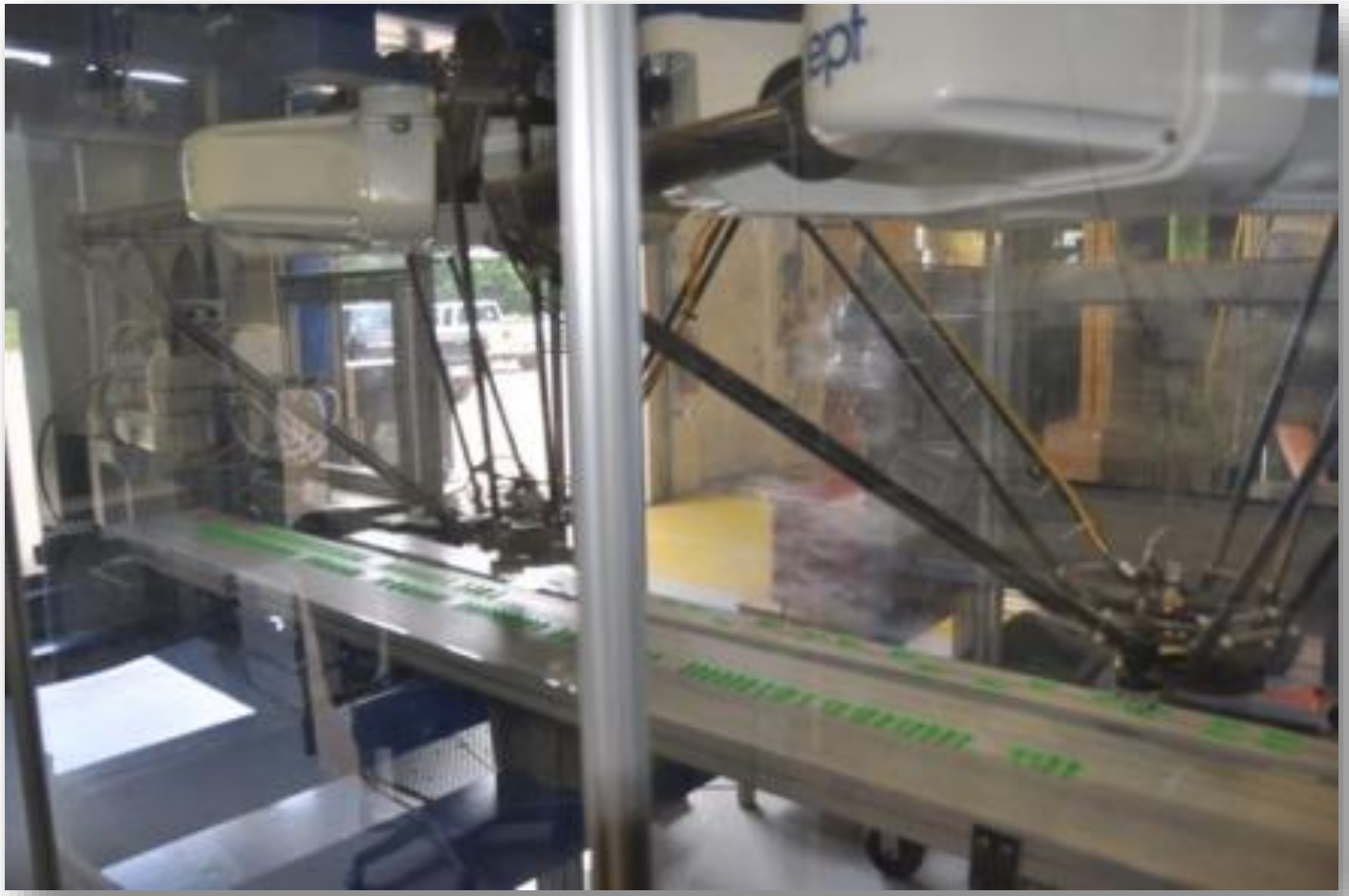
Flexible Configuration Example #2



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Flexible Configuration Example #3

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“Good” Application Traits

- Similar products for the same purpose
  - Share common or similar:
    - Components
    - Geometry
    - Assembly processes
    - Testing & Inspection methods
  - Product families
- Medium cycle time requirements / medium volume
  - Recall the automation spectrum

Lean Cells → Flexible Automation → Semi-Flexible → Continuous Motion

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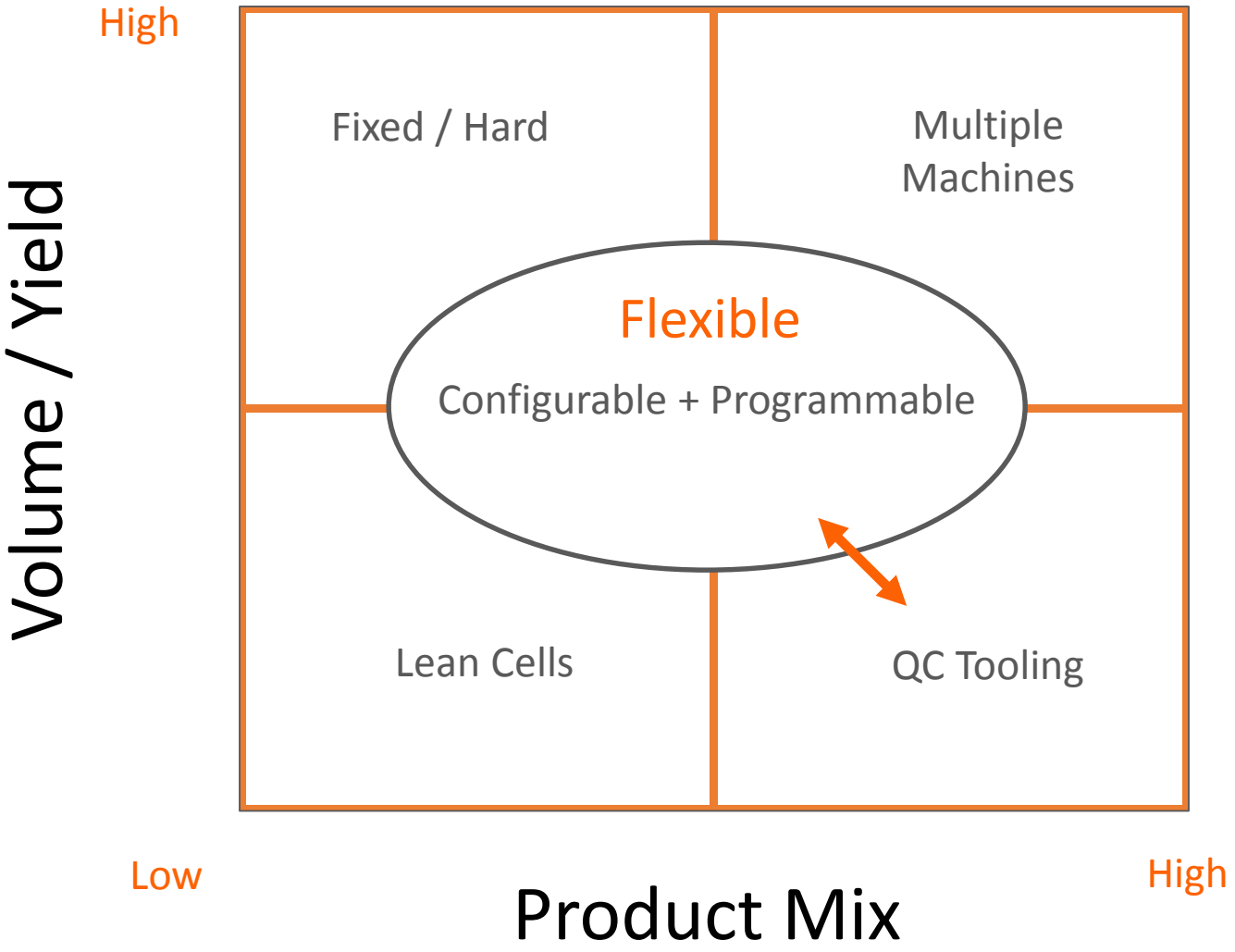
Flexible: When?



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Flexible Advantages

- Better capital utilization
  - Multiple product codes (tooling) for one machine (capital equipment)
  - Primary capital components can be leveraged over a longer lifespan
  - Throughput scalability
- Lower costs to increase quality, mix, and volume
  - Processes and inspections can be added later
  - Future retooling for new products
  - Additional stations to eliminate bottlenecks / increase throughput
- Fewer operators than multiple machines
  - Less training
  - Better quality
- Reduced floor space

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Flexible Disadvantages

- Higher upfront costs
  - Verses simple automation or lean cells
- Lower throughput
  - Verses dedicated, continuous motion
- Puts all your eggs in one basket
  - If machine goes down, all products suffer
- Requires maintenance expertise
  - Machine technicians and programmers
  - Or an integrator with a Rapid Response Division

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Do you really need “flexibility”?

- “Sure, you can make a line that can build X, Y and Z, but at what cost?”

- “Would it be more cost-effective to build dedicated lines for each one?”

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ROI on Flexibility: How To Analyze?

- Ask, understand, plan, and analyze based on the answers to the following questions:
  - Does purchasing budget and analyze ROI by family or by product?
  - What ability is there to leverage expensive components?
  - What are the floor space constraints?
  - What are the expected *initial* volumes of X, Y, and Z?
  - What are the expected *future* volumes of X, Y, and Z?
  - What is the expected production life of product X, Y, and Z?
  - What are the expected future process changes?
  - What is the likelihood of needing to produce product AA?

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Challenges For Machine Builders

- Receiving full disclosure of product mix @ RFP
  - Geometry, scale, and tolerances
  - Interfaces
  - Test specifications
- Volume optimization for uncertain volumes
- Tolerance and finish quality
  - Spring story…
  - Stamping finish story…
  - One sloppy part = OK, five sloppy parts = ☹
- Spoon and fork, or spork?

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Challenges For Machine Buyers

- Budget constraints
- Maintenance capabilities
- Volume prediction
- Machine down? Ability to recover
  - Putting all your eggs in one basket

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Advice For All of Us: Tolerances

- Understand the component tolerances
  - Geometry, interfaces, appearance
- Analyze probability curves for tolerances and risk assessment
- Test the entire tolerance range
- Understand component performance specification vs physical specification
  - Machines are sensitive to physical variation
- Understand lot variation

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Advice For All of Us: Expectations

- Understand the expected volumes and lifespans
- Clearly define machine performance expectations for each code of product
- Flexible automation may save a lot of money or cost you more money over fixed automation / multiple machines
  - Pick the right chassis
  - Beware of tunnel vision

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Tips: Machine Concept

- Group products by similar scale and geometry
  - Up front planning = flexibility and better ROI
    - One size fits all can be very expensive
    - One size fits one can be very expensive to change later
- Match the chassis to the budget and the expected need for future scalability / flexibility
  - Lean Cells → Rotary Dials → Conveyor Loops
    - Conveyors are more flexible than rotary dials, but they cost more initially
- Apply servo actuators versus cylinders with fixed positions
  - Supports infinite adjustability

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Tips: Interfaces

- Establish common *mechanica*l interface and control
    - End of Arm Tools
    - Nests
    - Sensor mounts

- Establish common *electrical* interface and control
    - Networks are flexible
        - Allow flexibility with additional I/O and monitoring beyond hardwired I/O
        - Remote I/O hardware is hardened, IP Rated, NEMA Rated, Intrinsically Safe and UL Classified
        - HMI, Drives, Motors and Sensors can all be added to Networks
        - Network bridges can create VLANs for
            - Deterministic control
            - Business and data collection networks
    - Leverage Human Machine Interfaces
        - Touchscreens far more flexible than hard buttons

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Tip: Costs

- Understand your true total cost of integration and operation
  - The lower cost, simple component is often not the cheapest to integrate and/or operate
    - Wiring and plumbing costs
    - Programming costs
    - Debug labor
    - Ease of adjustment
    - Maintenance
    - Upgradeability

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