



Introduction to the Controlled Systems

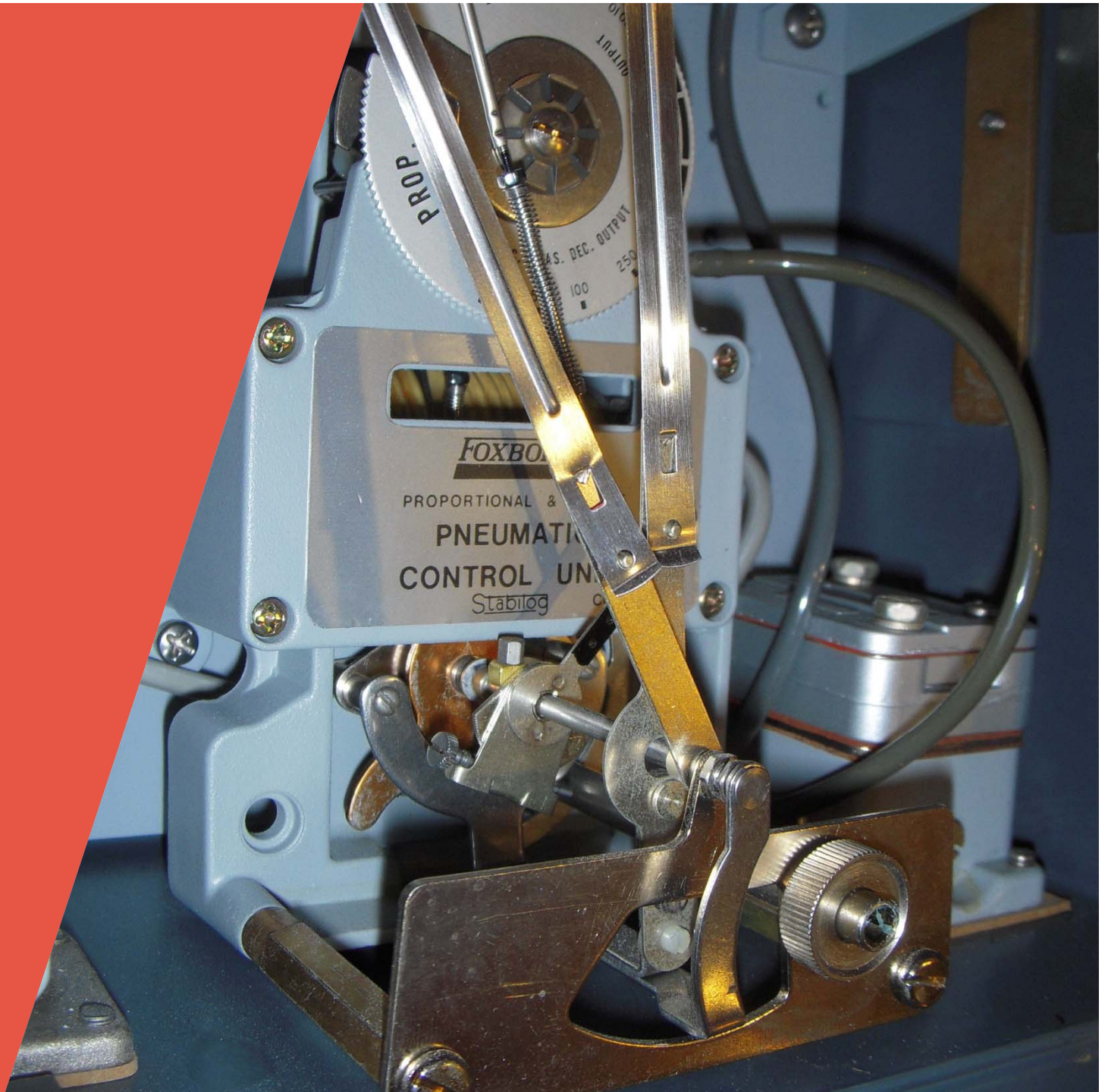
Tab 3-3A

Bureaucratic Affairs Building Exercise

Presented By:
David Sellers, Senior Engineer
Facility Dynamics Engineering



Control System Building Blocks



The Fundamental Goal of the Control System

Automatically adjust a piece of machinery to give us what we want by comparing what is going on to what we want to go on and making appropriate adjustments to the process we want to control



07/01/97

The Fundamental Goal of the Control System

You can get what you want in a very inefficient manner

See Commissioning to Meet Space Qualification Criteria vs. Energy Consumption Optimization Focused Commissioning for details

<http://www.av8rdas.com/icebo.html#EPI>



The Holistic (Green) Goal of the Control System

*Automatically adjust a piece of machinery to give us what we want by comparing what is going on to what we want to go on and making appropriate adjustments to the process we want to control **as efficiently and sustainably as possible***

The “Three R’s”

- Repeatable
 - To make, do, or perform (an action) again (and again, and again, and again)
- Reliable
 - Giving the same result on successive trials
- Robust
 - Sturdy; capable of performing without failure under a wide range of conditions

Control System Building Blocks

Automatically adjust a piece of machinery to give us what we want by comparing what is going on to what we want to go on and making appropriate adjustments to the process we want to control

Control System Building Blocks

*Automatically adjust a piece of machinery to give us what we want by comparing **what is going on** to what we want to go on and making appropriate adjustments to the process we want to control*

Inputs

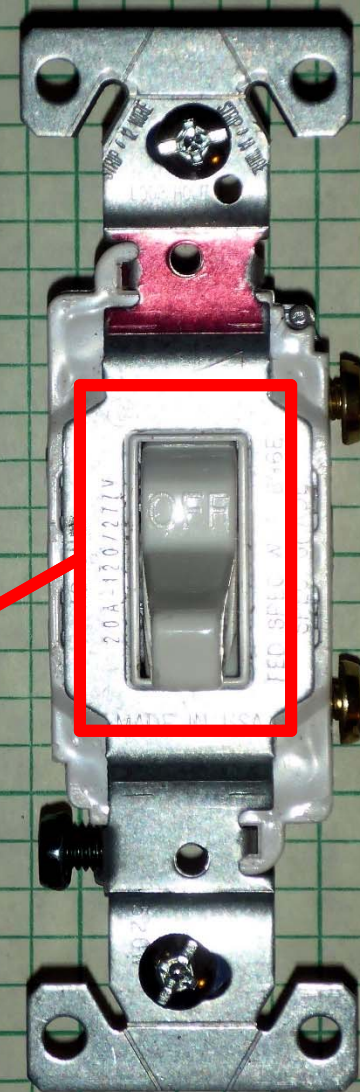
Measure the process variable

A Digital Input



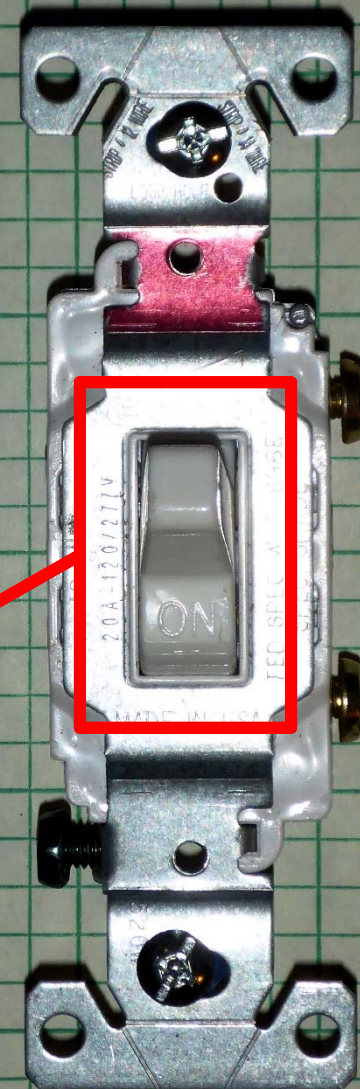
A Digital Input

With automatic operating state indication ...



A Digital Input

With automatic operating state indication ...



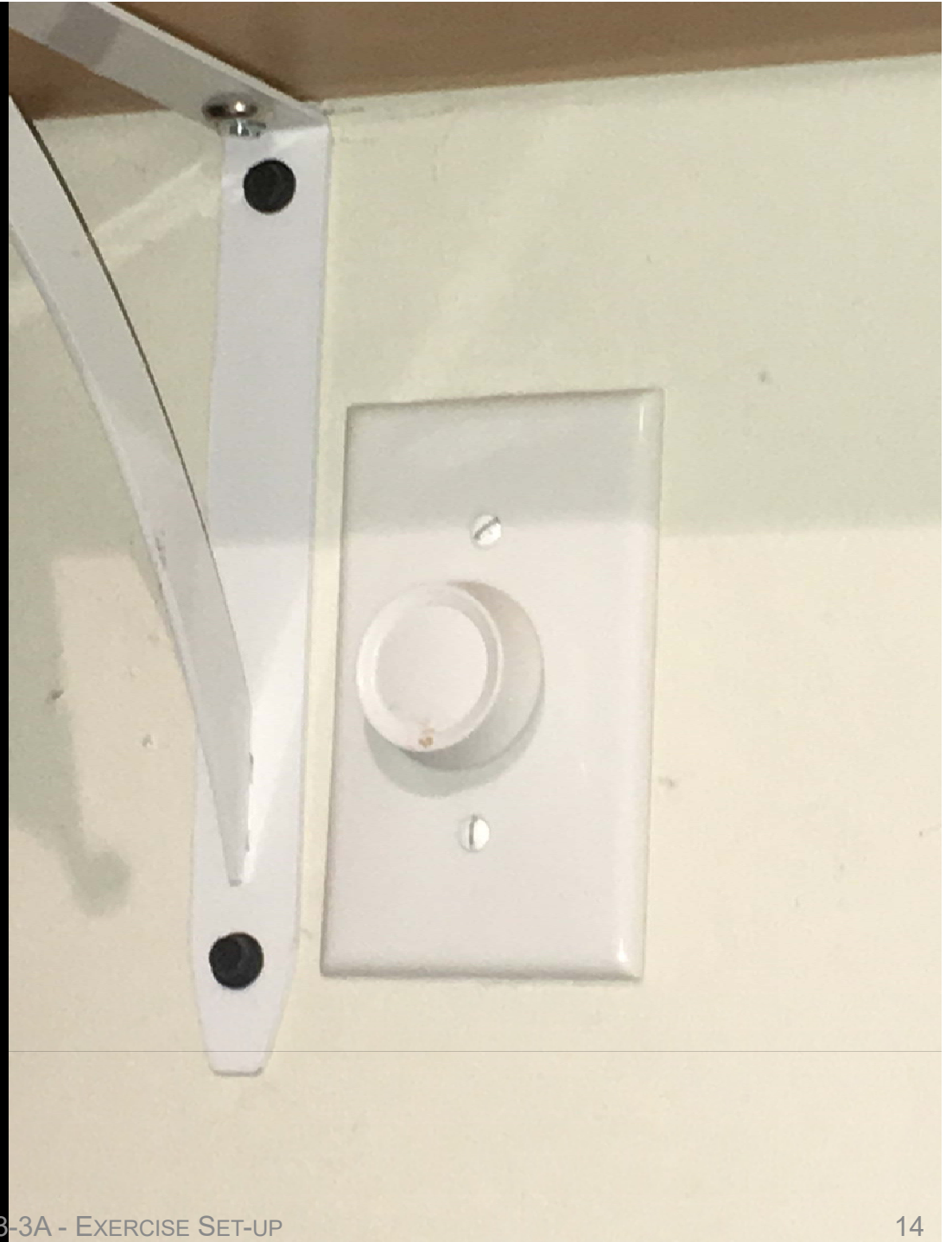
A Digital Input

... and automated fault detection

Tom McCarthy



An Analog Input



An Analog Input



Control System Building Blocks

*Automatically **adjust a piece of machinery** to give us what we want by comparing **what is going on** to what we want to go on and making appropriate adjustments to the process we want to control*

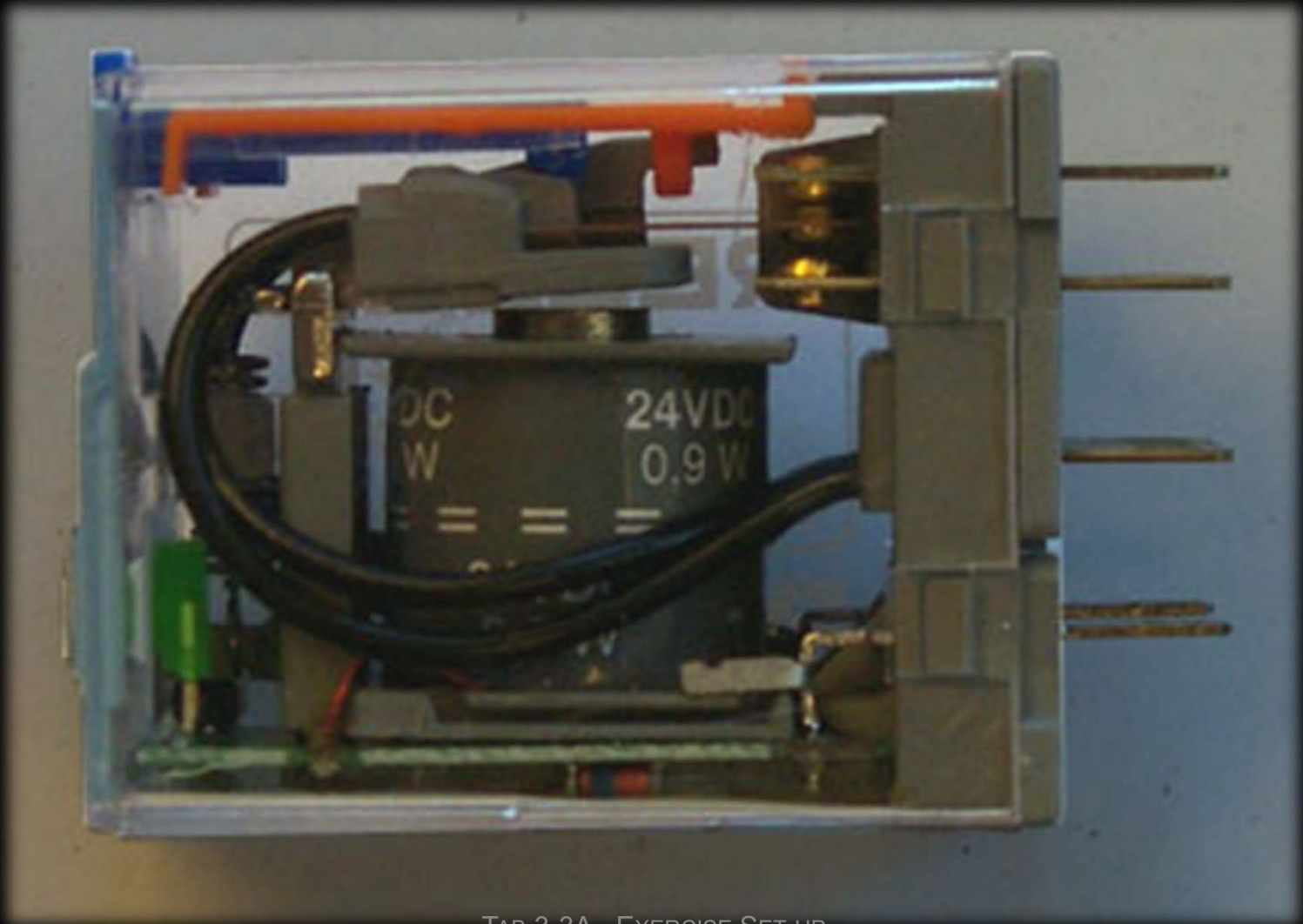
Inputs

Outputs

Measure the process variable

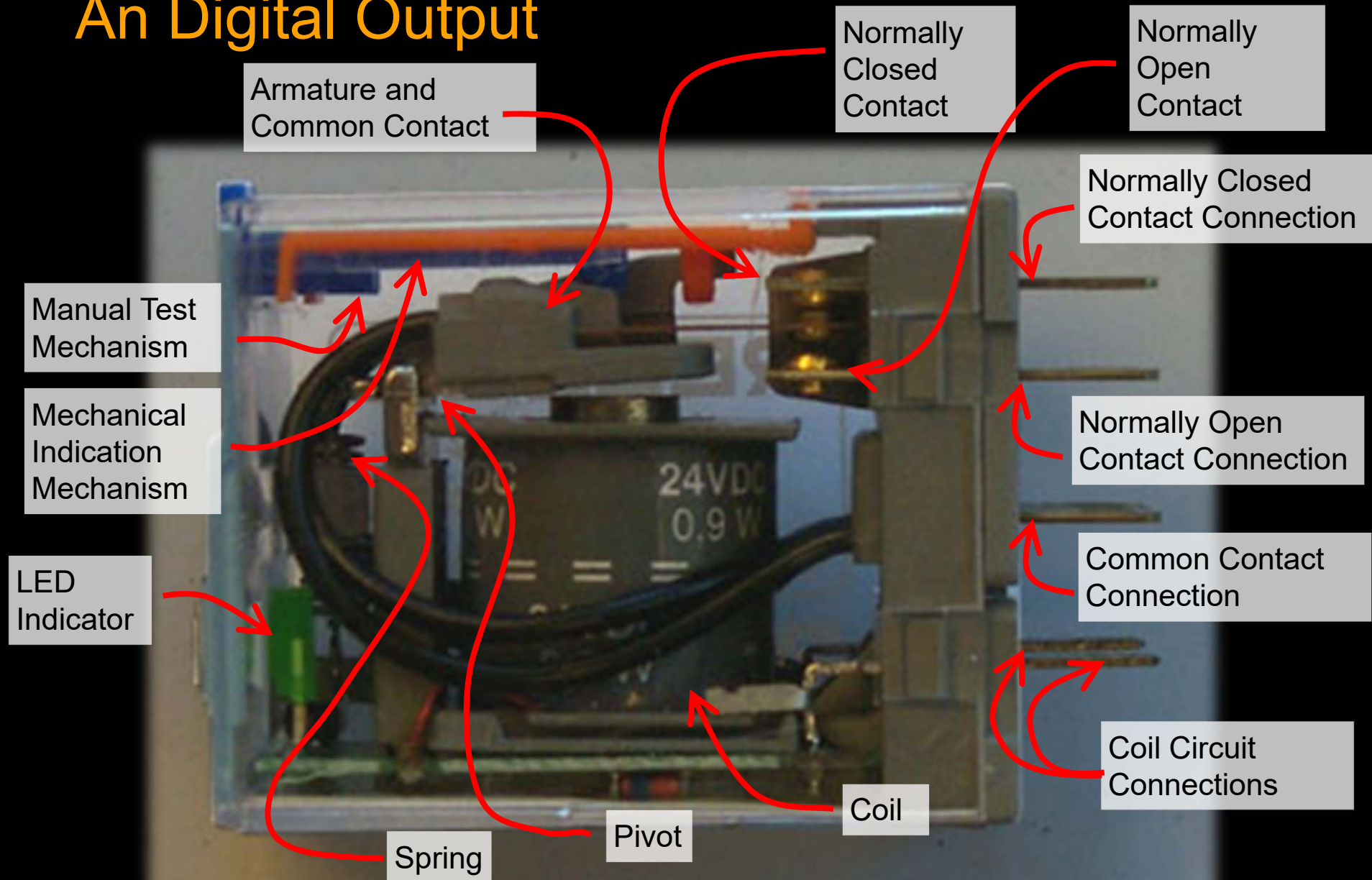
Adjust the controlled variable

An Digital Output



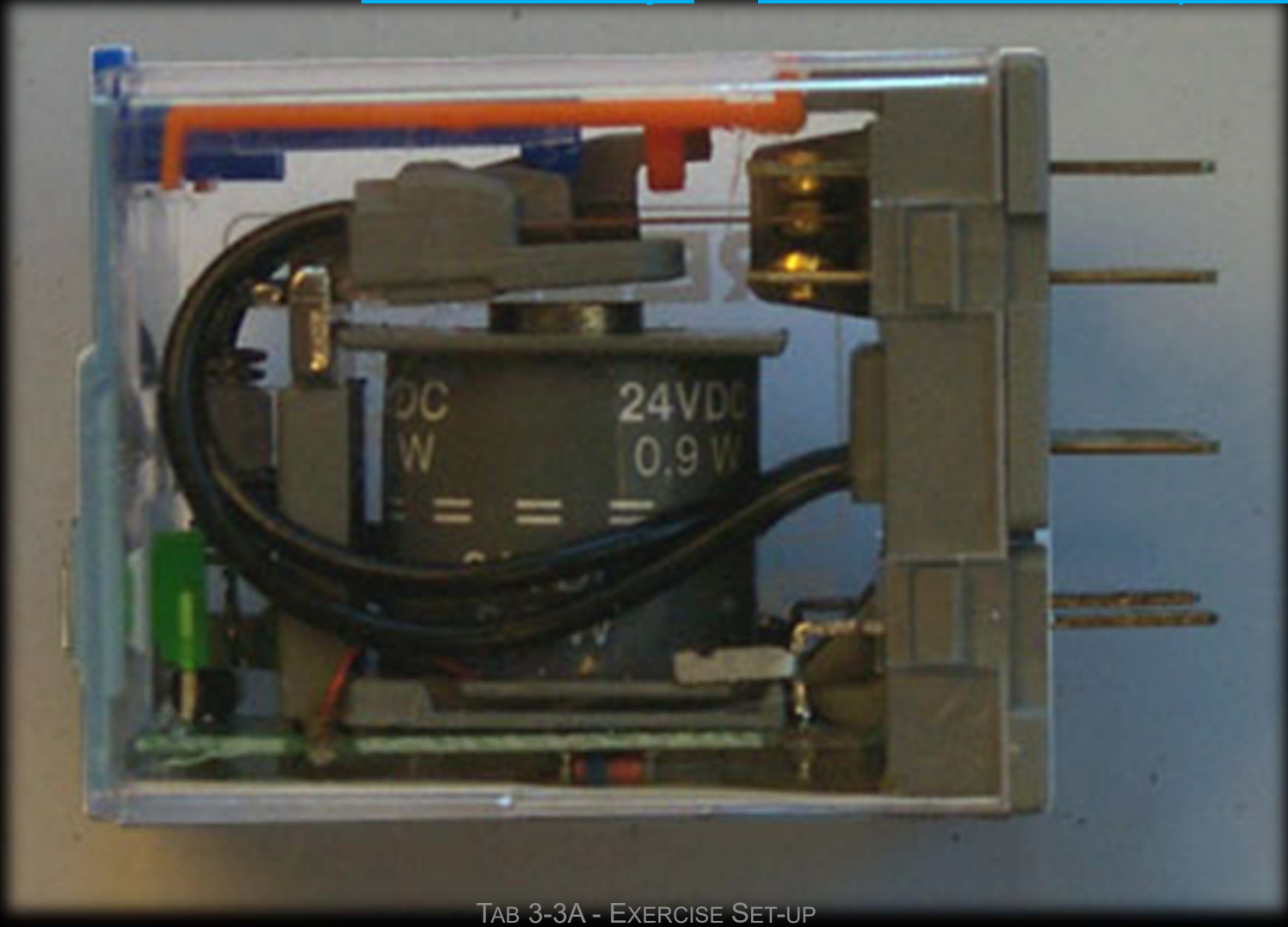
TAB 3-3A - EXERCISE SET-UP

An Digital Output

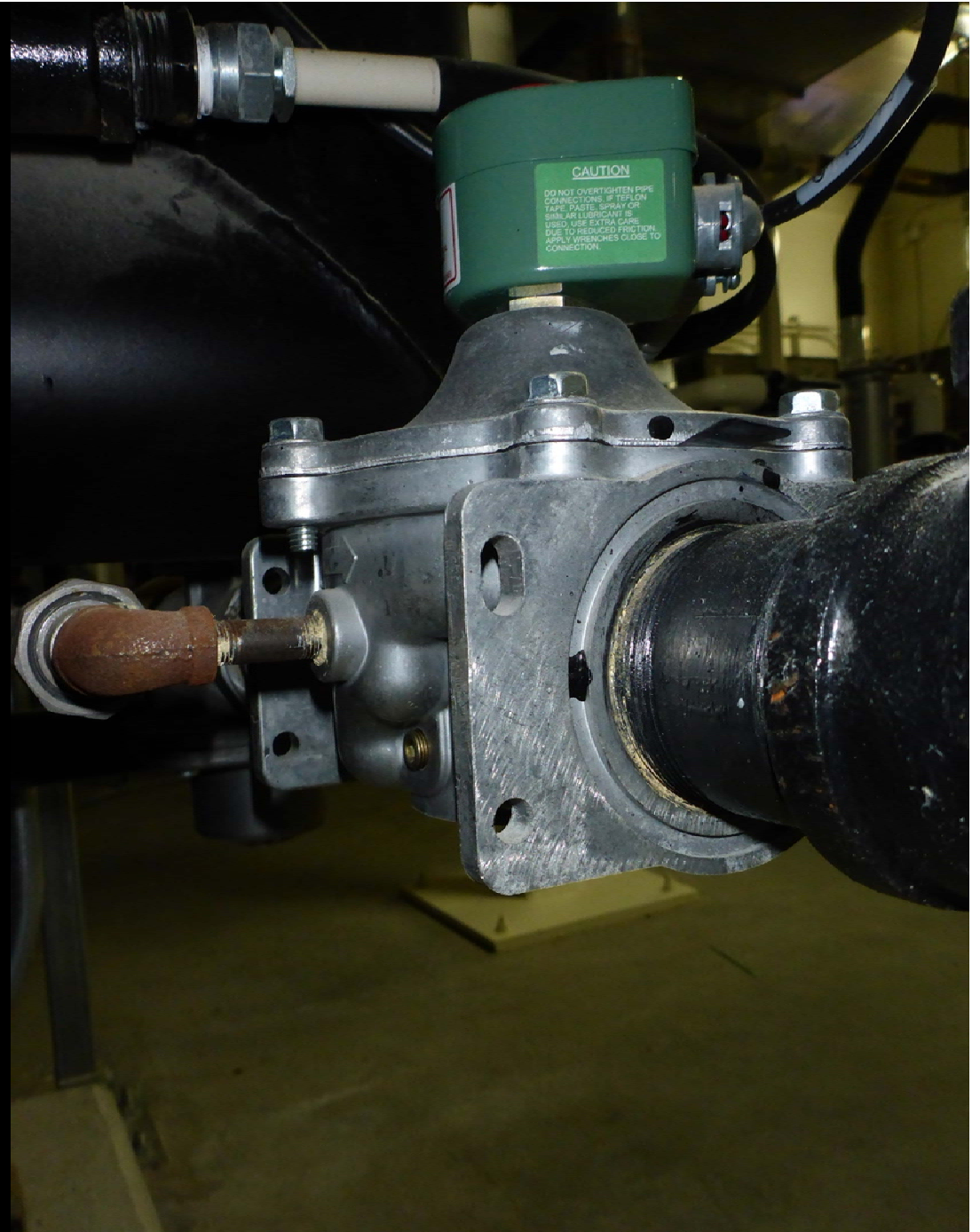


An Digital Output

For More on Relays, see [Learning about Relay Logic; What's a Relay?](#) at www.Av8rDAS.Wordpress.com



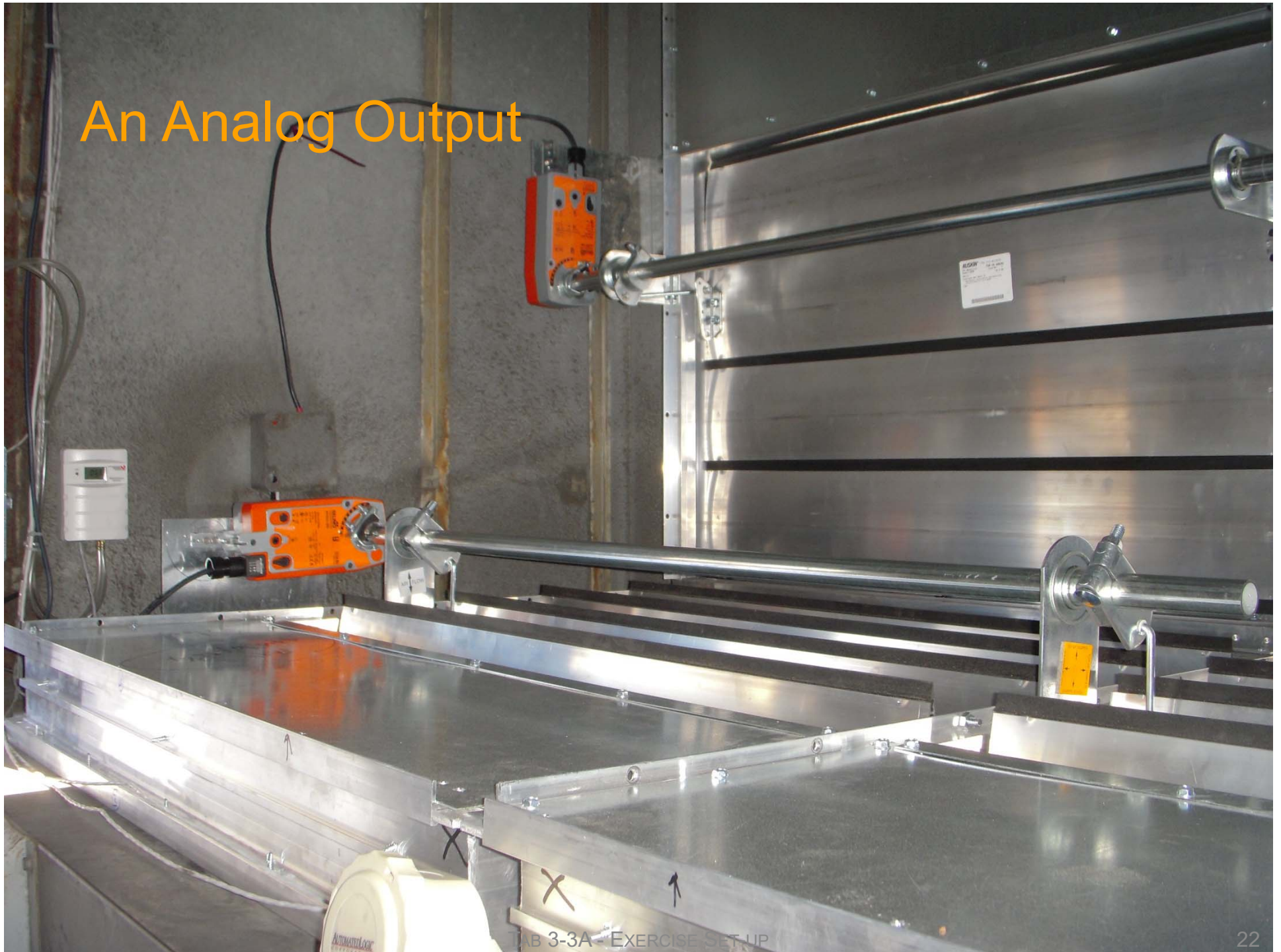
An Digital Output



An Analog Output



An Analog Output



Control System Building Blocks

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Inputs

Outputs

Control Process

Measure the process variable

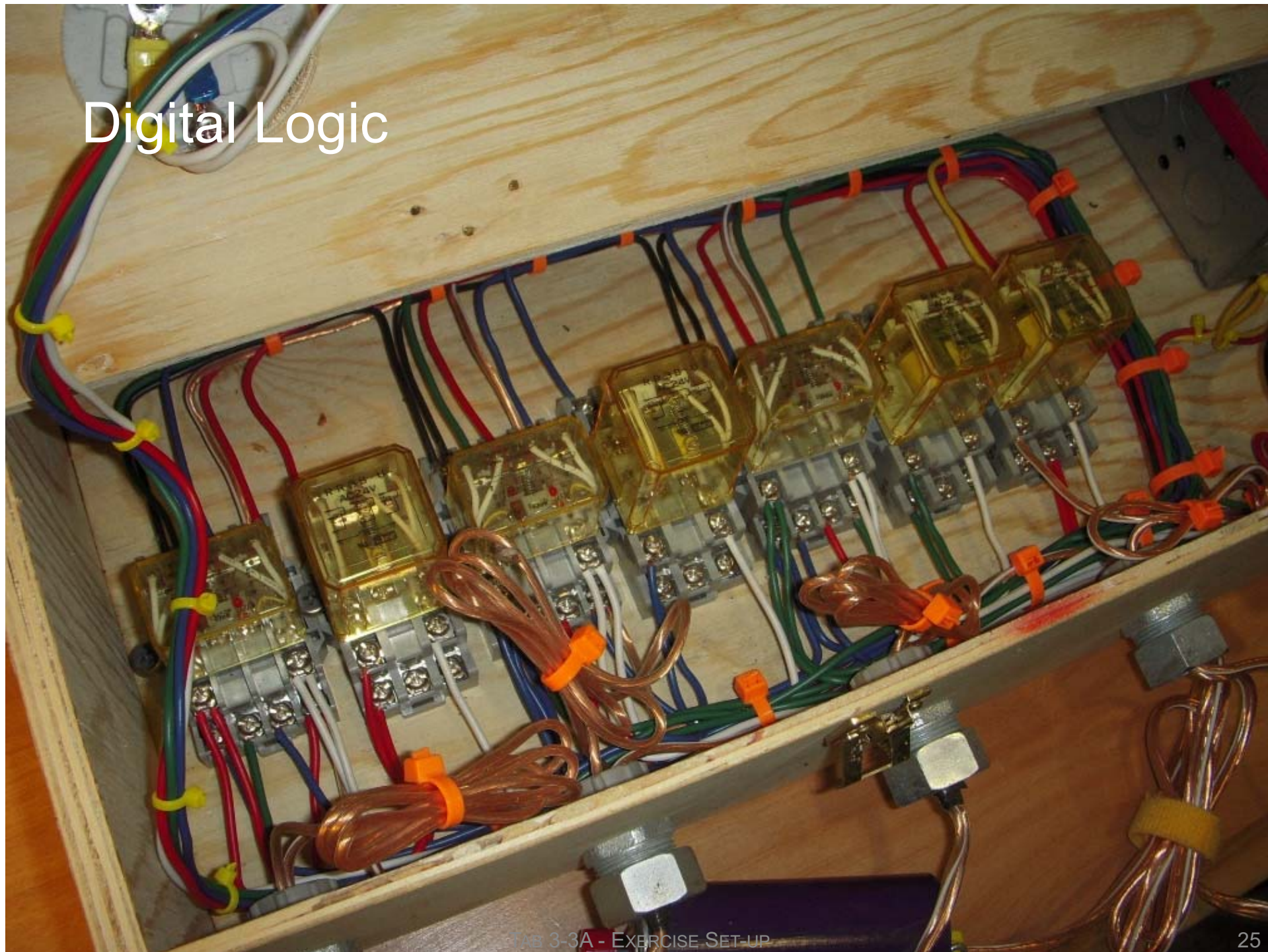
Adjust the controlled variable

Logic and algorithms that tries to bring the controlled variable into agreement with the set point

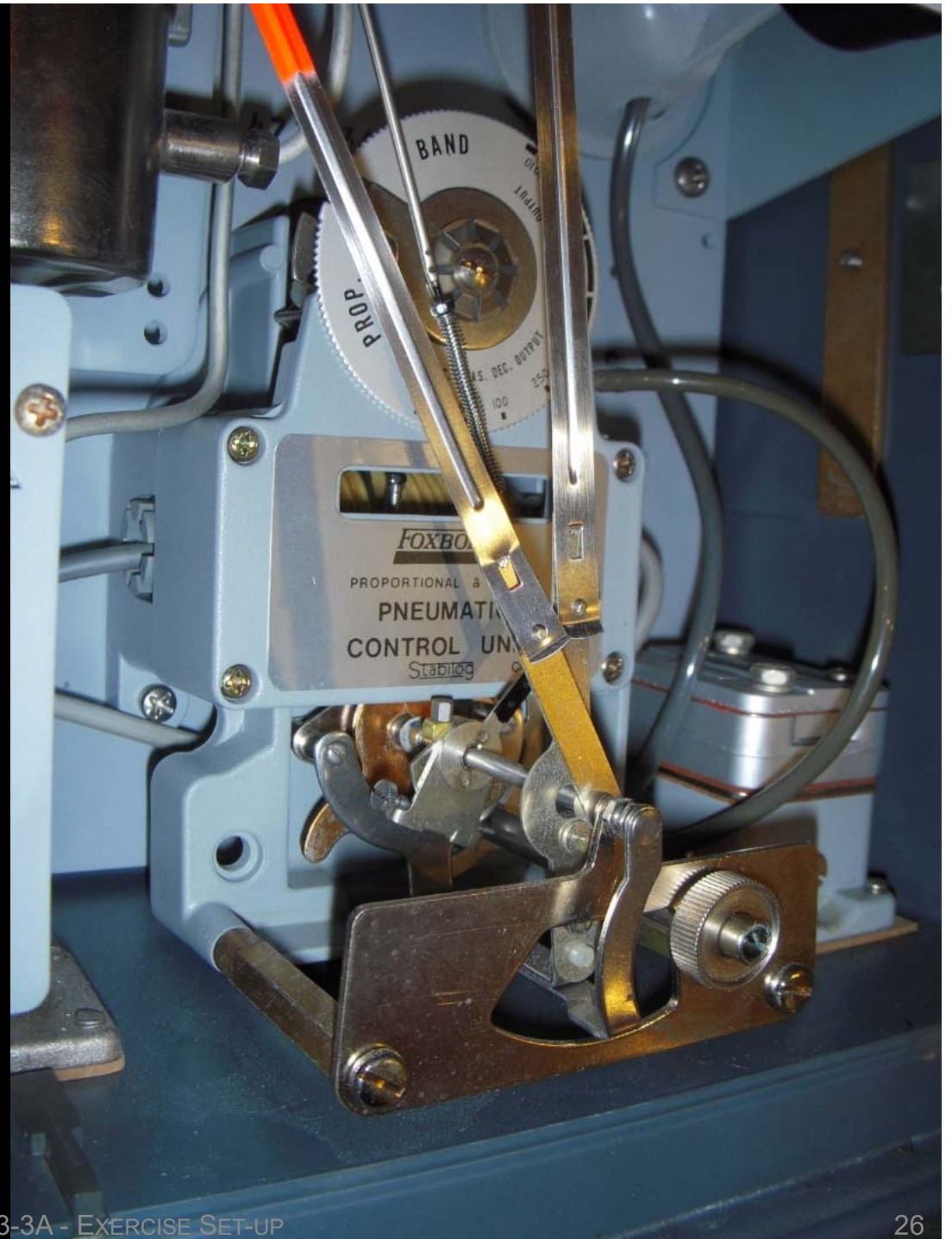
Digital Logic



Digital Logic



Analog Logic

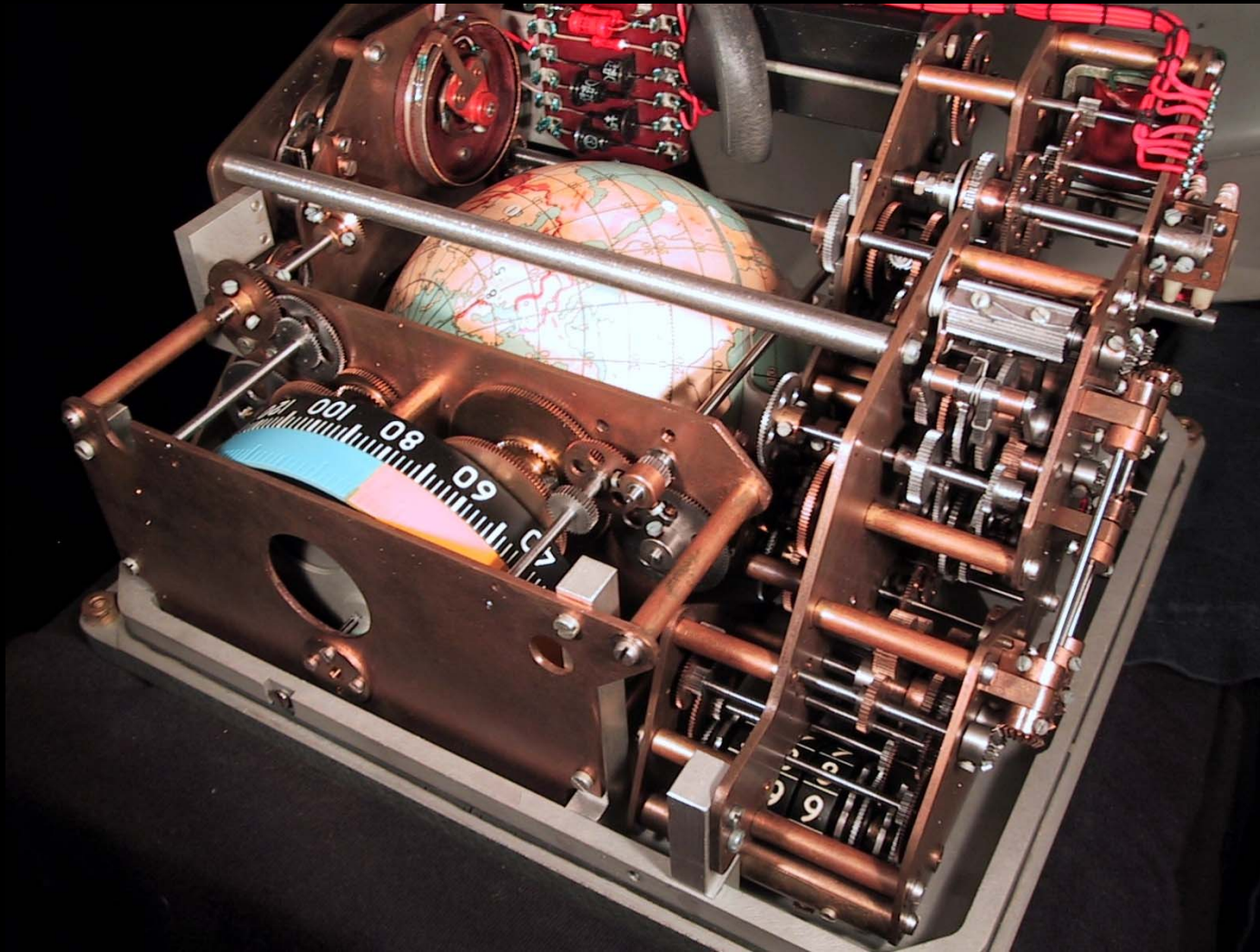


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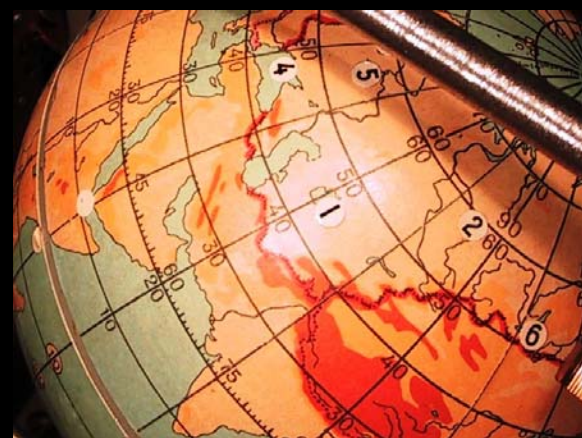
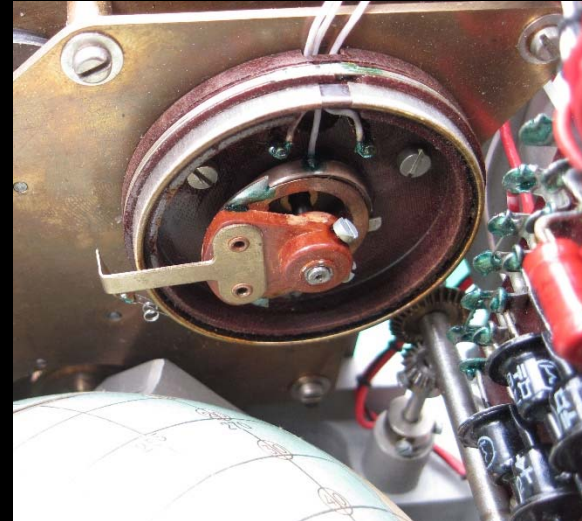
A Long, Long, Time Ago, in a Galaxy Far, Far, Away, Logic Was a Physical Thing



A Long, Long, Time Ago, in a Galaxy Far,
Far, Away, Logic Was a Physical Thing



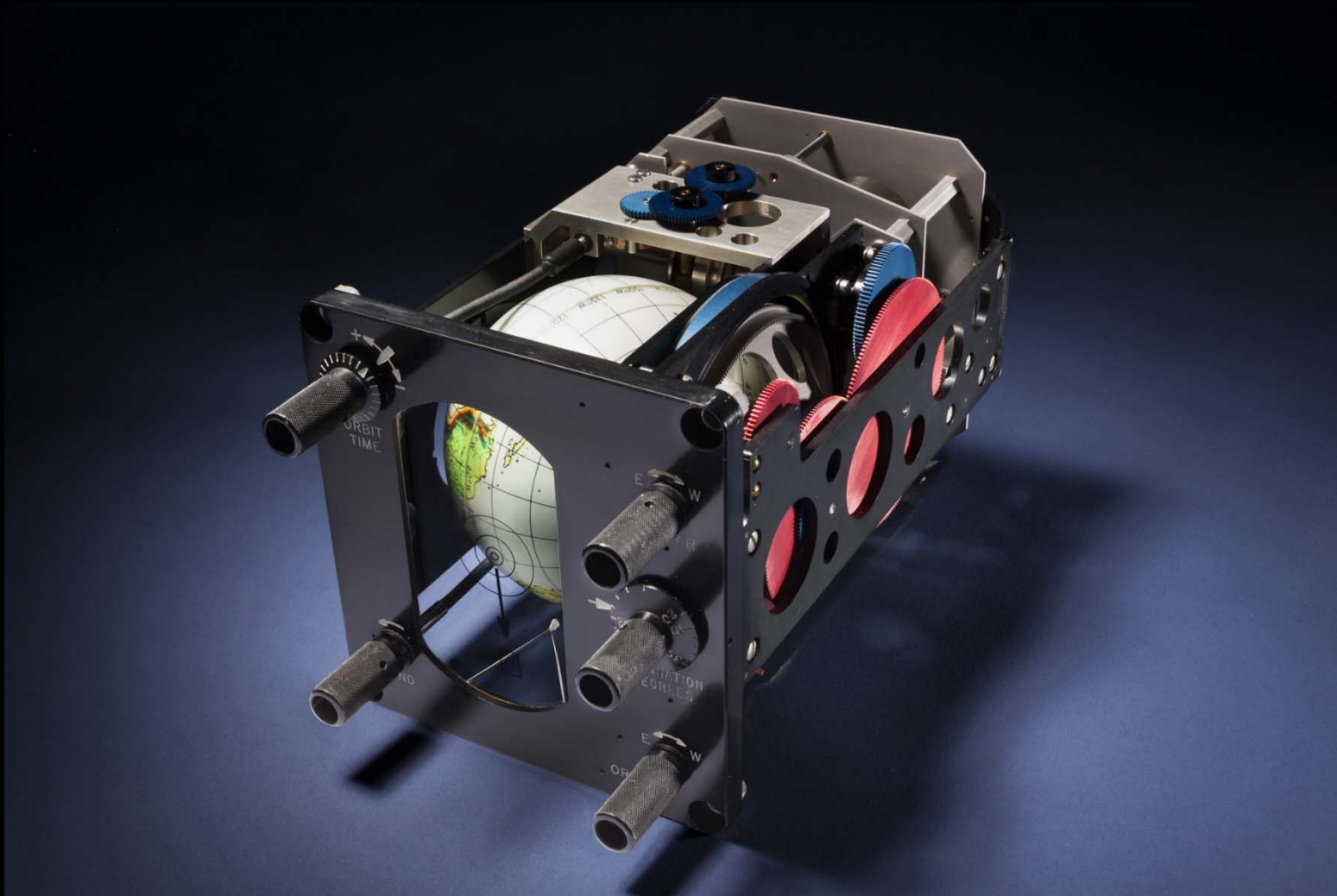
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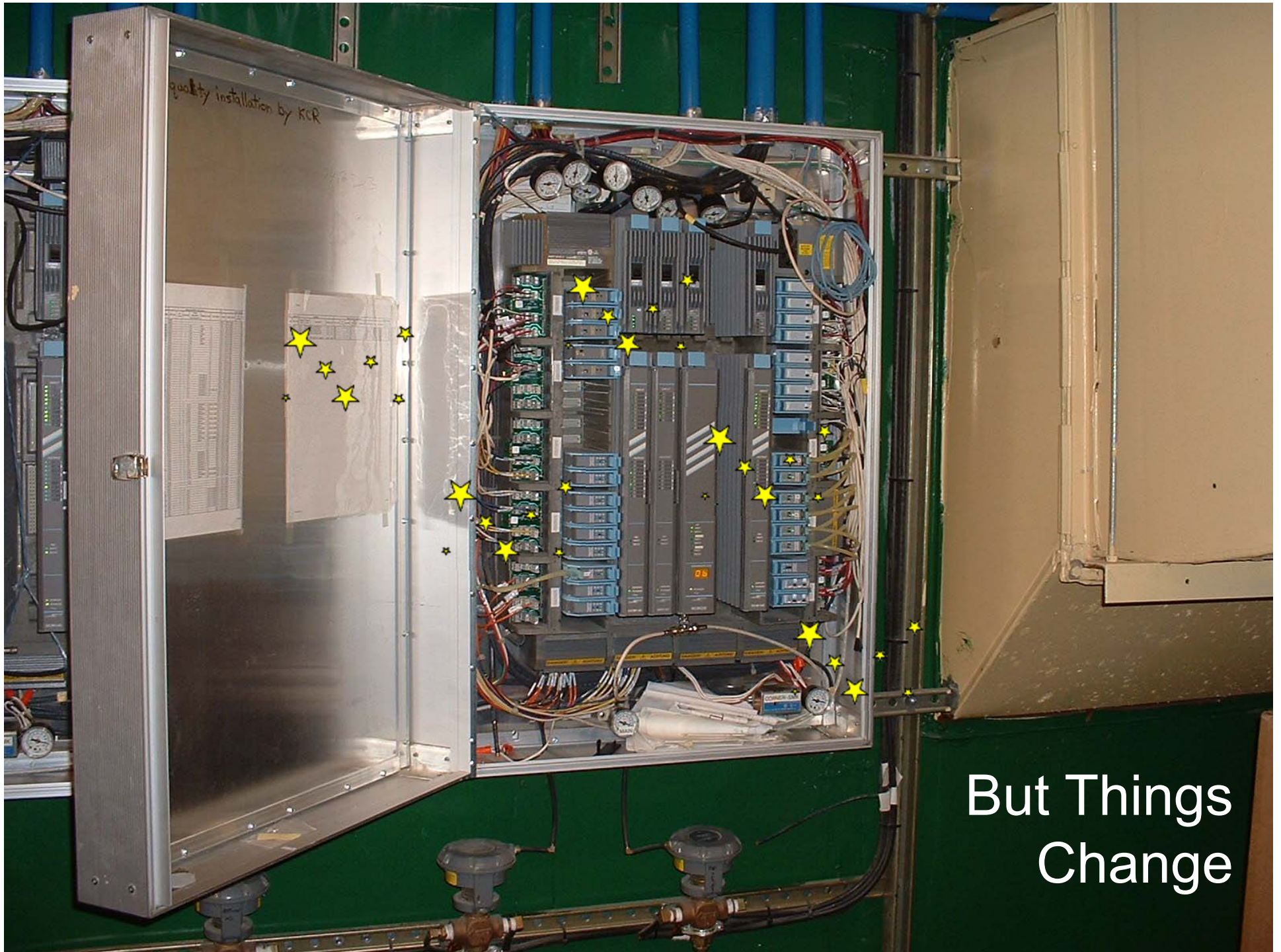
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TAB 3-3A - EXERCISE SET-UP



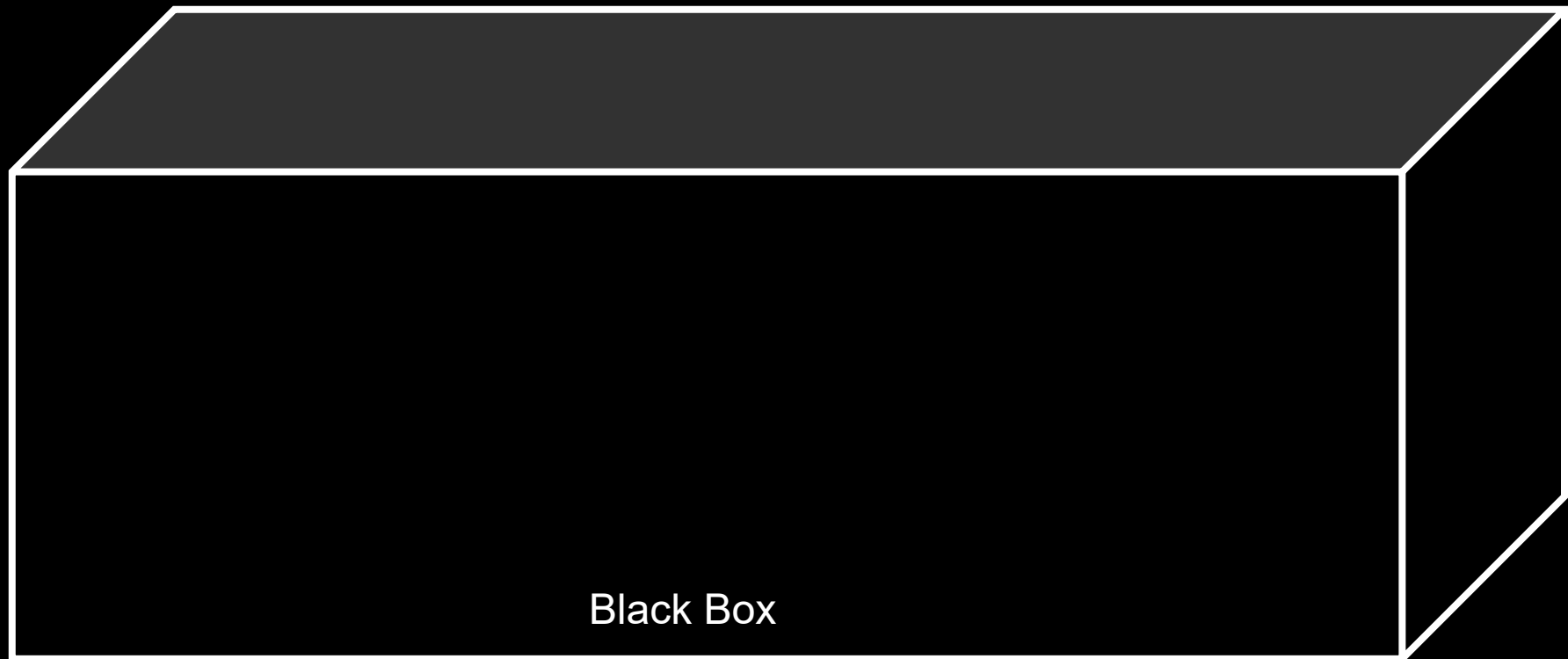
But Things
Change



But Things
Change

Not Being Able to See or Get Your Hands on What's Going On

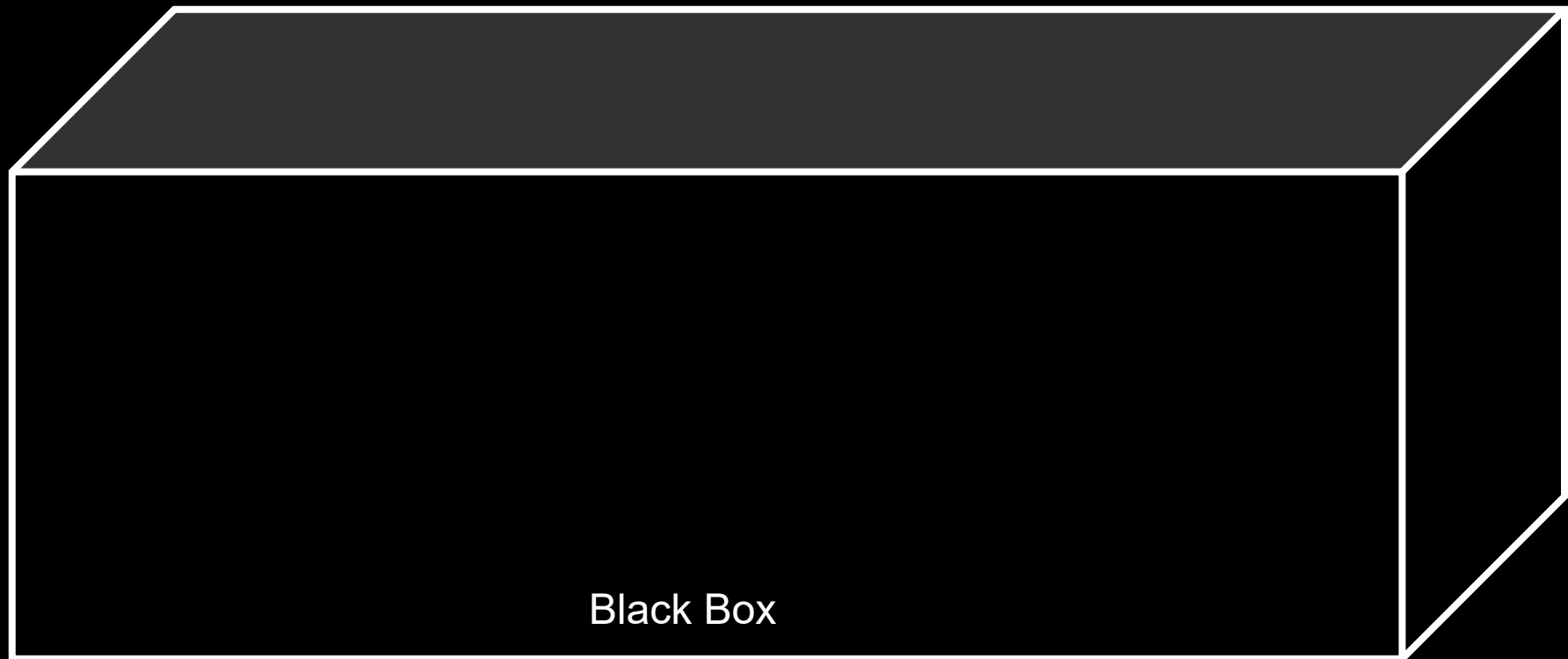
... a down side to DDC



Black Box

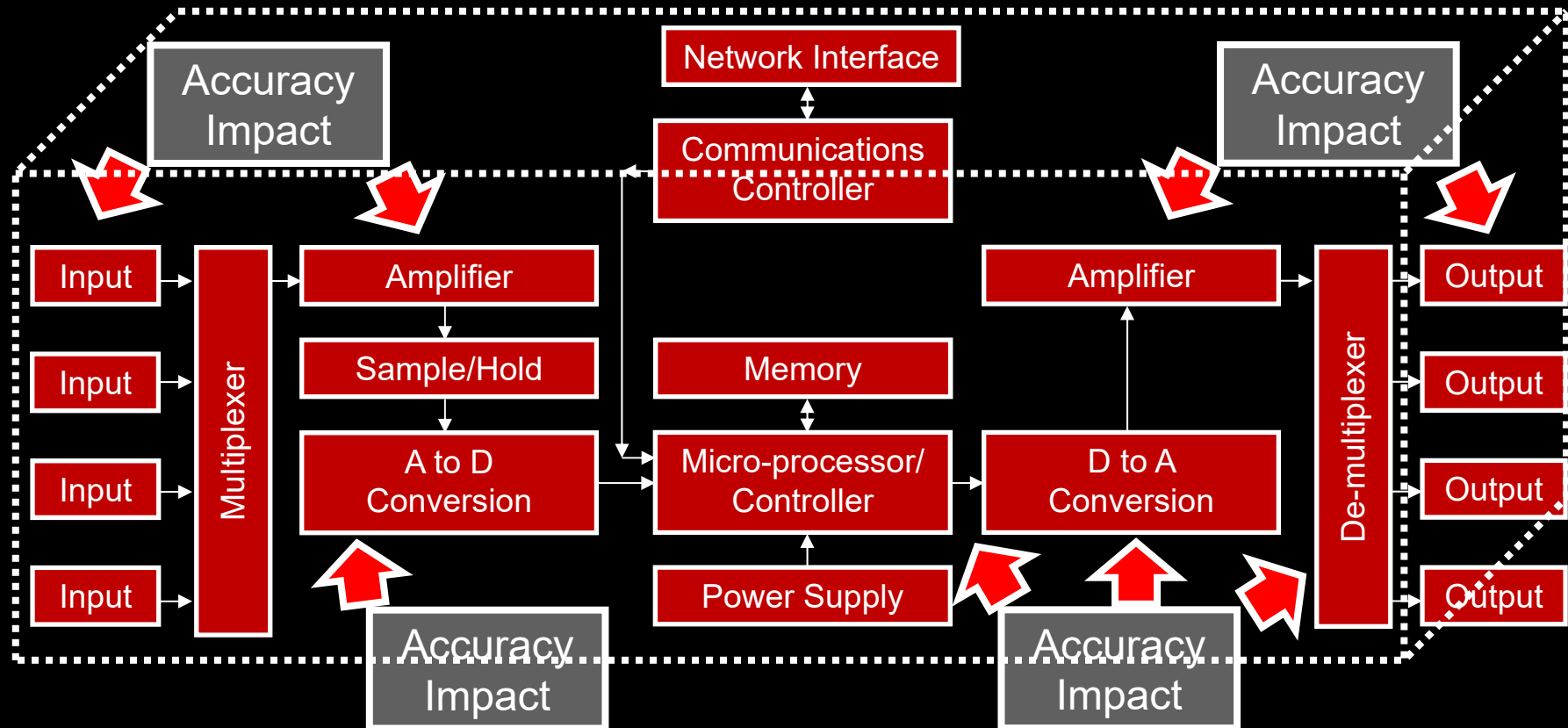
Even Though You Can't See Them ...

... the inner workings and controlling software of a DDC controller are critical to success



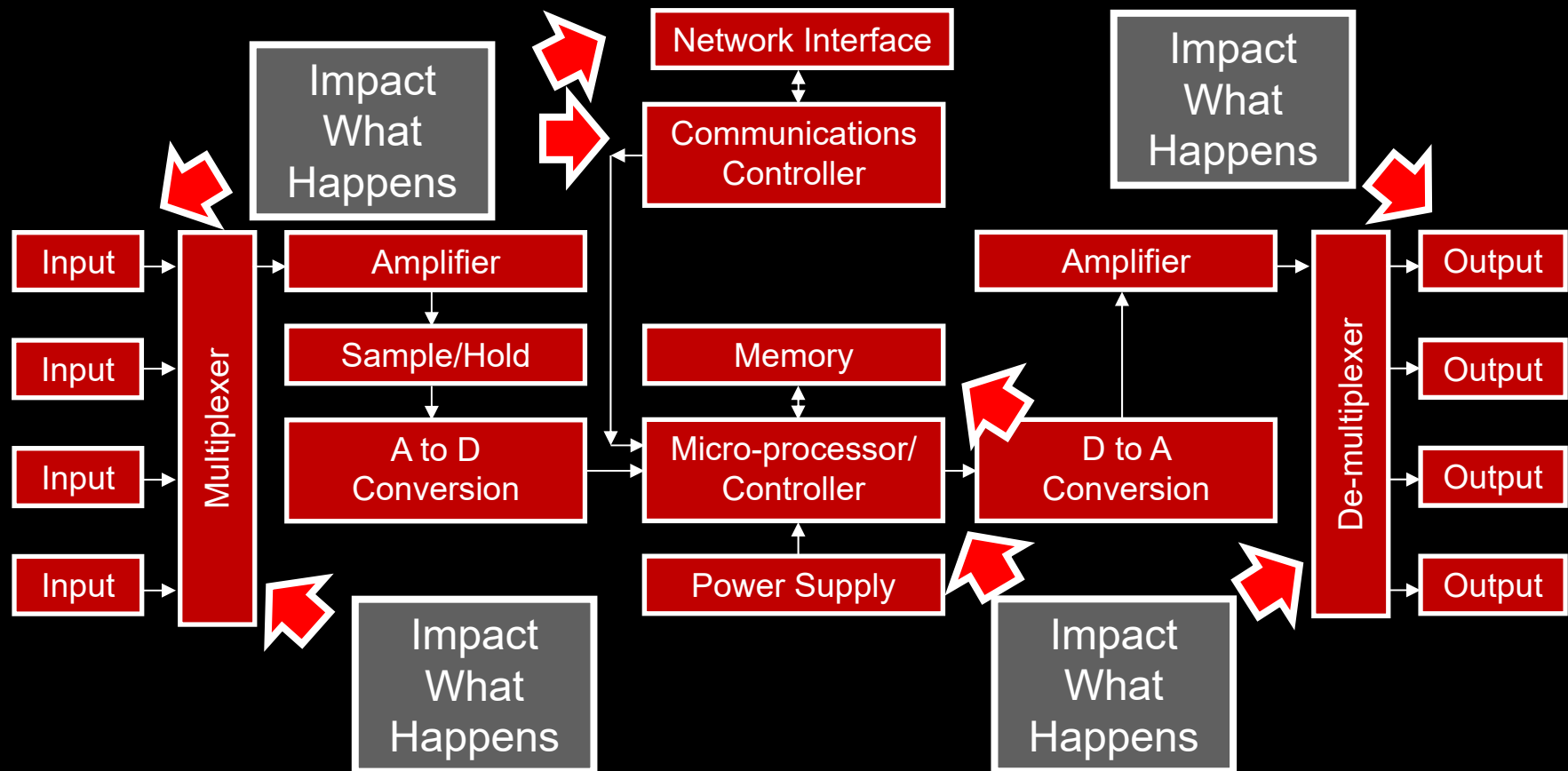
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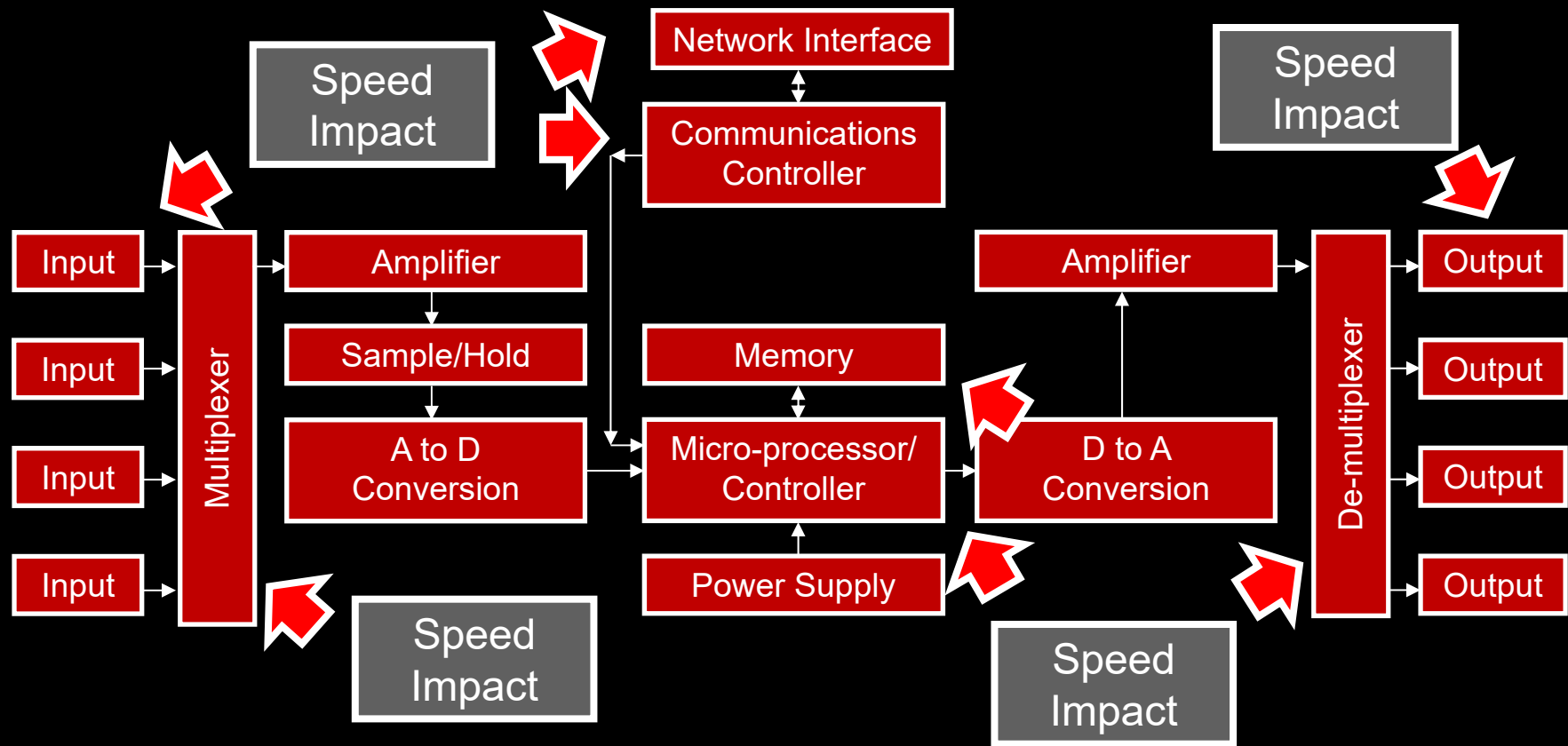
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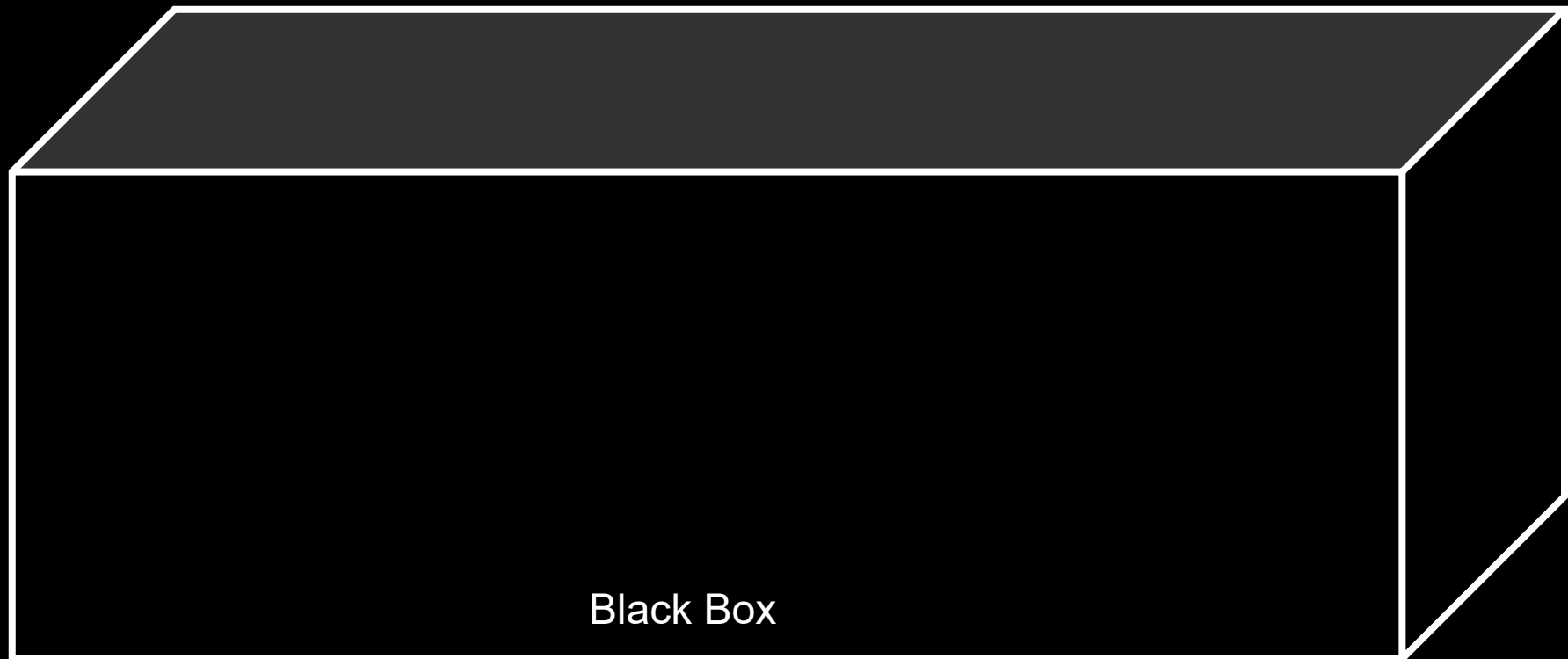
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Logic Diagrams

A Way to Communicate What Goes On in the Black Box



Control System Building Blocks

*Automatically **adjust a piece of machinery** to give us what we want by comparing **what is going on** to **what we want** to go on and **making appropriate adjustments** to the process we want to control*

Inputs

Outputs

Control Process

Set Point

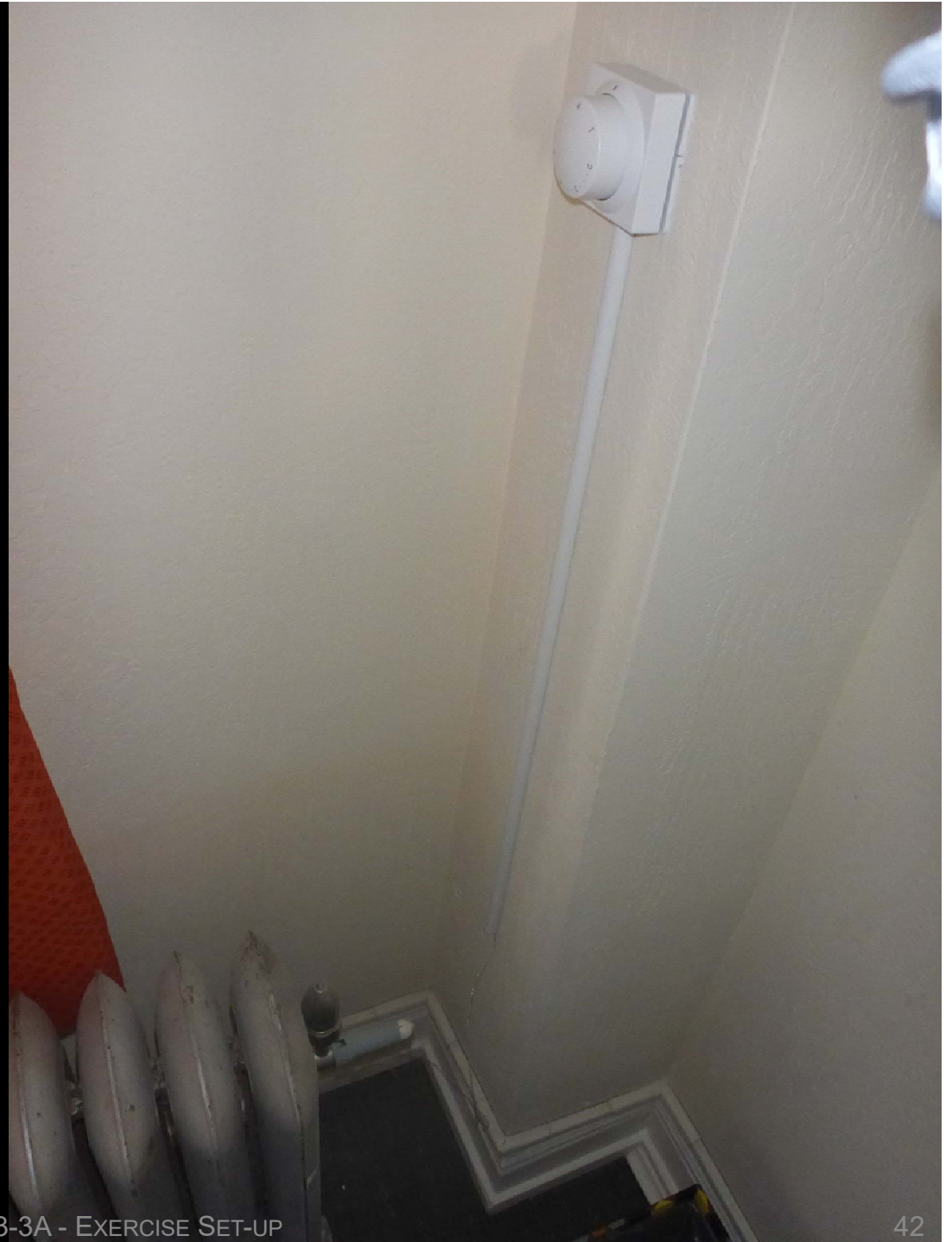
Measure the process variable

Adjust the controlled variable

Logic and algorithms that tries to bring the controlled variable into agreement with the set point

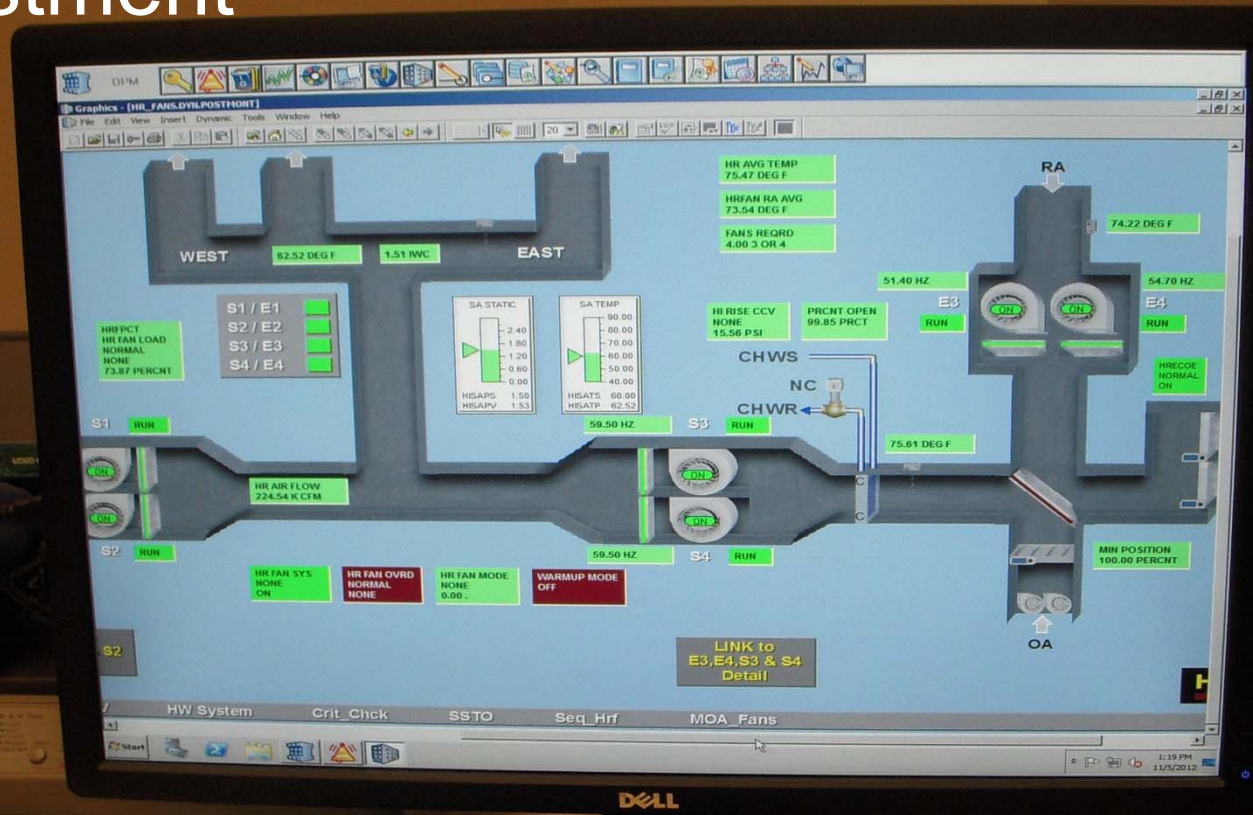
Our requirements for the process that is under control, which can be fixed or variable

A Set Point Adjustment

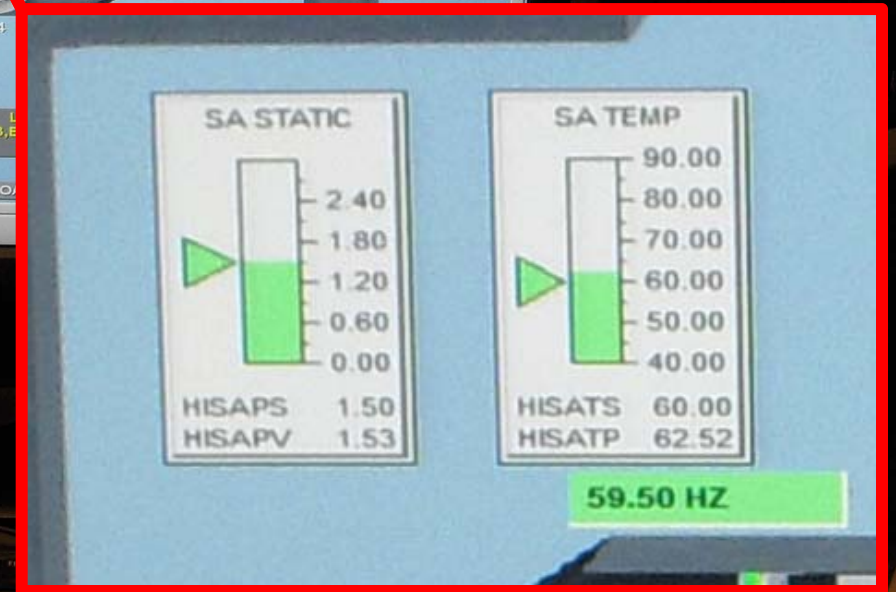
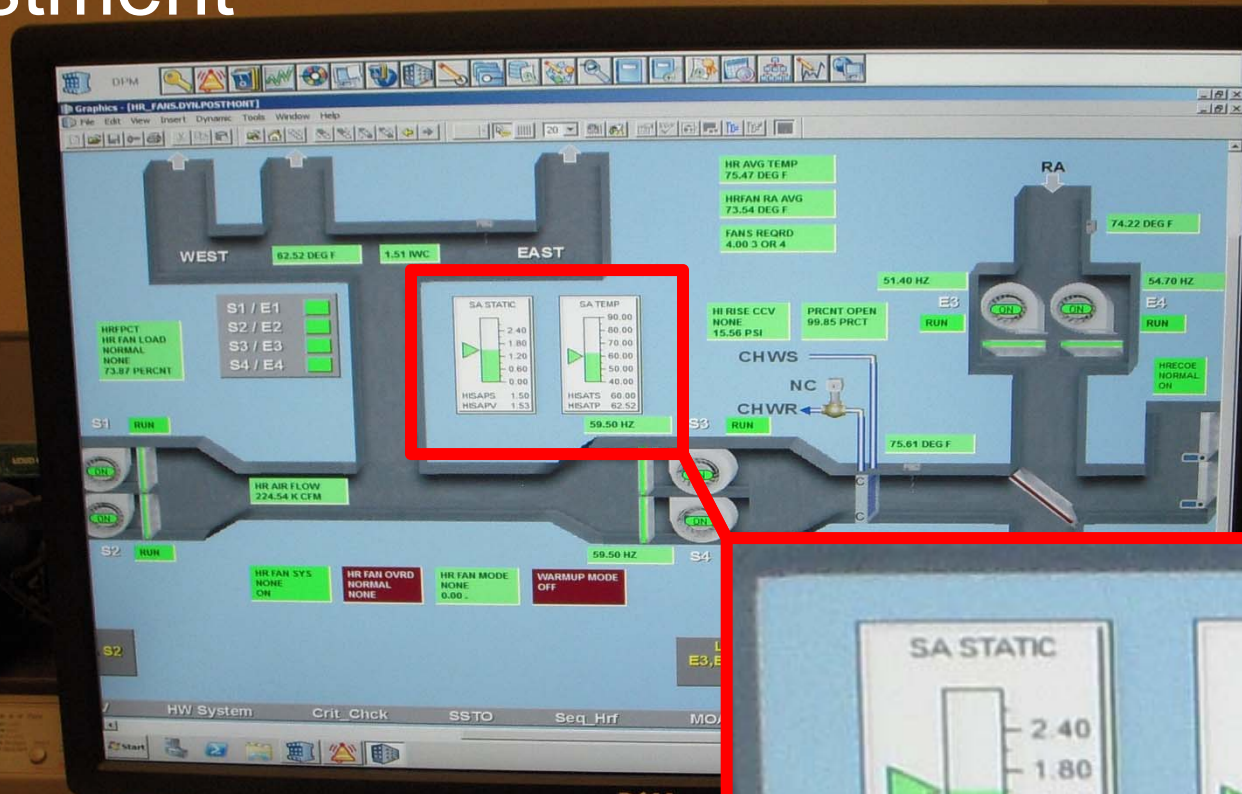


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A Set Point Adjustment



A Set Point Adjustment



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Control System Building Blocks

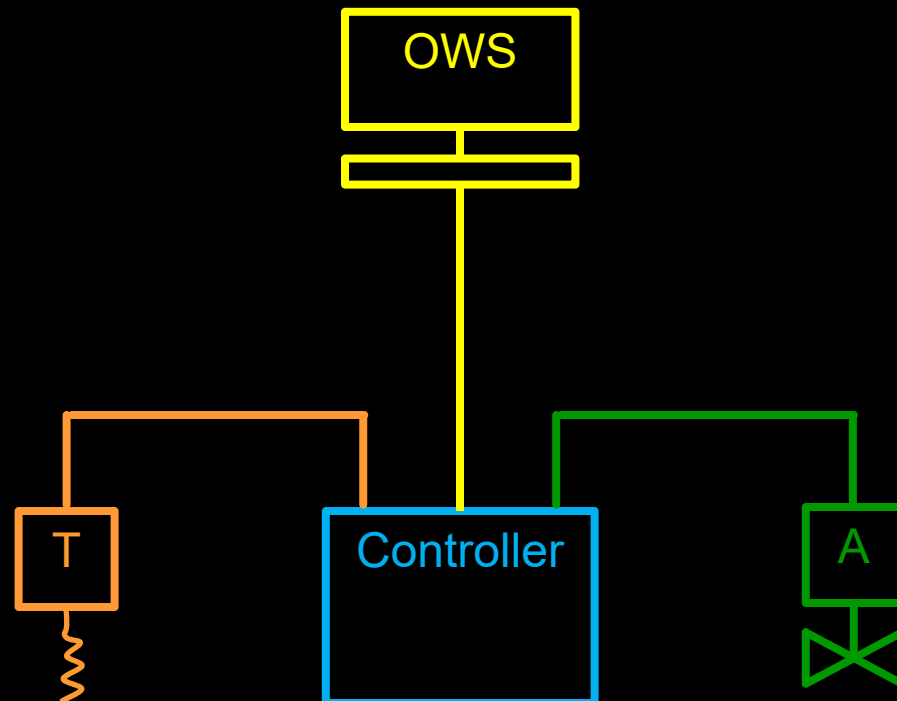
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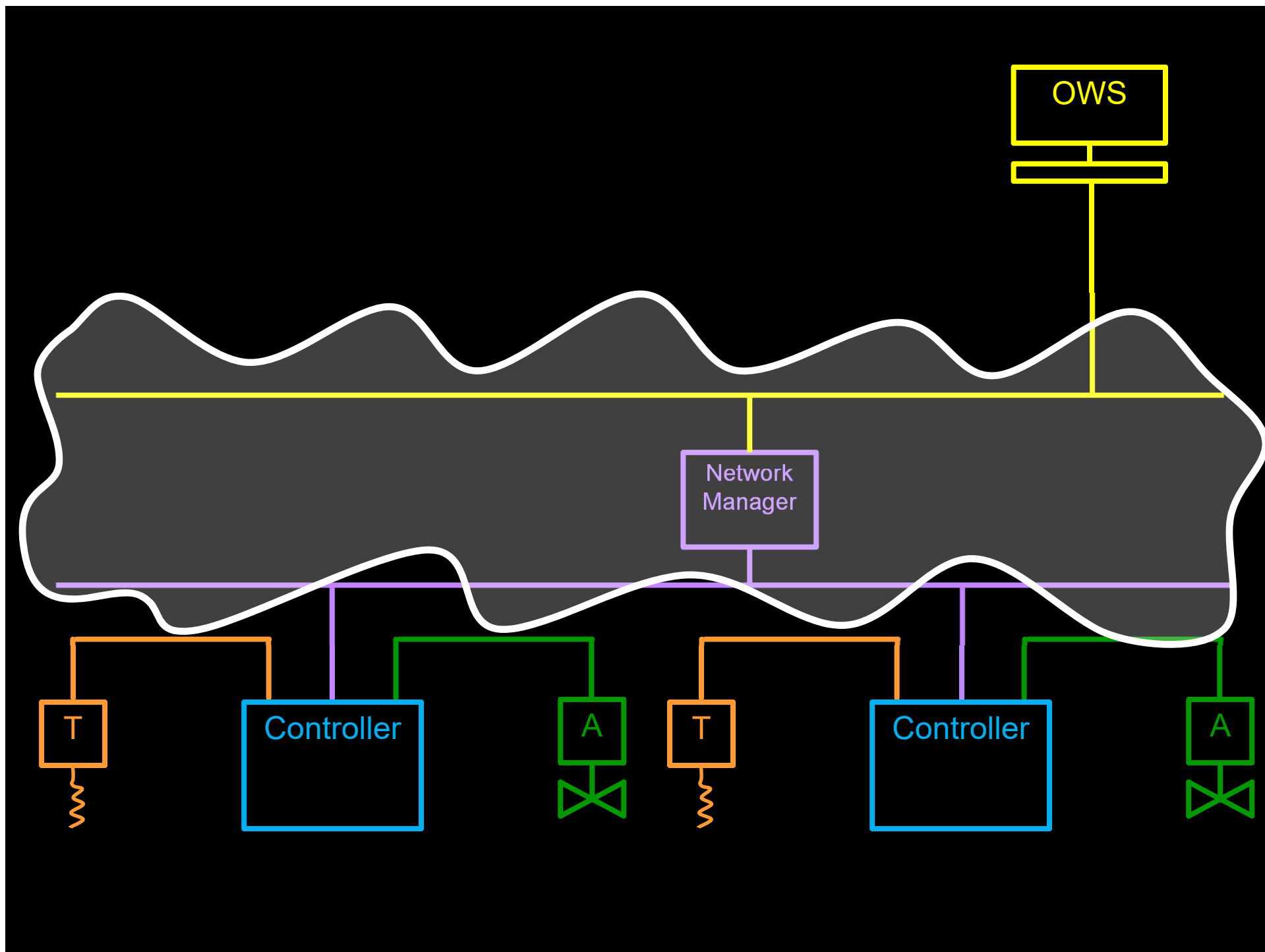
Inputs

Outputs

Control Process

Set Point





The Bureaucratic Affairs Building

