

Fall '15 Project – Close the Door!

Objective: Dr. Schmidt frequently rides her bike to work, but is tired of having to swap her only garage door opener back and forth between her bike and car. On days that she rides her bike, Dr. Schmidt would like to be able to press a button inside her garage, exit the garage with her bike, and then have the garage door close behind her. Your team is tasked with building a machine whose function is to press the button on her wall-mounted door control panel with a 30 second delay after activation, giving Dr. Schmidt time to exit her garage safely (and not get crushed by the closing garage door).

Rules

- The machine must be turned on via a physical component that is manipulated by Dr. Schmidt (e.g. a switch, button or lever).
- The machine must press the button on the garage door control panel 30 seconds after activation.
- After being activated by your Dr. Schmidt or your lab instructor, the machine cannot be interacted with during the timed interval (i.e. no touching).
- Your team's testing period is 3 minutes. Multiple attempts are allowed within this period.
- **The device must be designed and built by your team. Components may be sourced from vendors but must be team assembled. What is and is not considered to be team-built is to be determined by your lab instructor and/or Dr. Schmidt.**

Constraints

- The machine must be verified to be safe by your lab instructor BEFORE used by your team.
- No explosions may be used.
- The device must fit within the **24" by 24" rectangular test zone** (See Figure 1) and be less than 60" tall before being activated.
- The dimensions and details of the test set-up are included at the end of this document. Your machine will be placed in the test zone on the welding table (mimicking the shelf beneath the "close" button in Dr. Schmidt's garage), and a button will be mounted on a "wall" adjacent to the table. The center of the button will be 18 inches above the welding table. **See Figures 1 and 2 for schematic of the set-up and an image of the control panel.**
- Any safety issues are up to your instructor's judgment.
- The maximum allowable voltage in your team's device is 25V.
- If your team uses batteries, the combined maximum mass of batteries allowed is 1kg.

Control

- Once ready to test, your team's device must be activated by the instructor, and the component used to turn the machine on must be clearly labeled ON.
- External control and energy is NOT allowed, once activated your team's device must operate on its own.

Scoring

- Performance 1: (30%)
 - Button pressed within 3s of specified interval (30s): 10 points.
 - Button pressed within 2s of specified interval (30s): 20 points.
 - Button pressed within 1s of specified interval (30s): 30 points.

- Performance 2: (20%)
 - The button is pressed with sufficient force to activate. The button has been wired to set off a doorbell chime when pressed.
- Complexity (30%) will be assessed by counting energy transformations. For this project, complexity is desired and the most complex machines will receive the highest scores for complexity. During alpha testing, a minimum number of transformations for receiving full complexity points will be determined. See the following list of acceptable forms of energy:
 - Translational Mechanical (e.g. a button),
 - Rotational Mechanical (e.g. a lever),
 - Electrical (e.g. an electrical circuit),
 - Hydraulic (e.g. falling water),
 - Pneumatic (e.g. blowing air),
 - Chemical (e.g. a component that is dissolved),
 - Note: Nuclear energy is not allowed for safety reasons.
- Aesthetics/style points (20%):
 - Team name on design
 - Team logo on design
 - Design is painted or decorated

Dr. Schmidt reserves the right to revise this project description at any point in the semester to address safety and/or project definition issues.

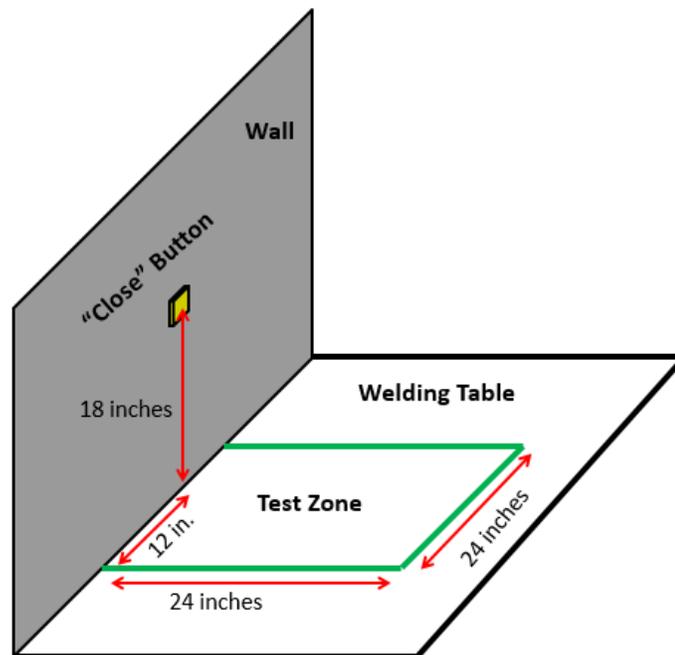


Figure 1. Schematic of test set-up. Your machine must fit in the 24" by 24" test zone (marked with green boundaries), where it will be placed for testing. Note that the center of the "close" button is located 18" above the table top.

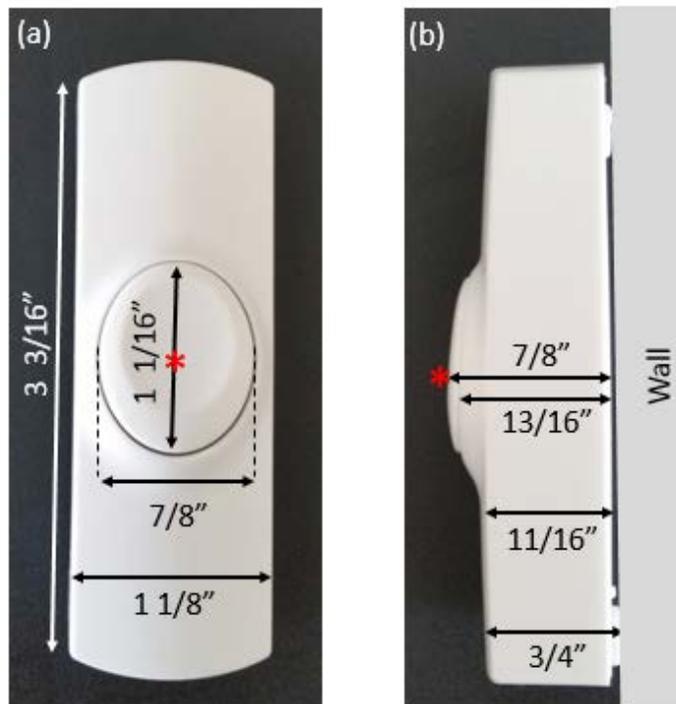


Figure 2. (a) Front and (b) side view of the wall mounted “close” button with dimensions. The center of the button is denoted by a red asterisk and will be 18” above the table top, as shown in Figure 1.