Step Controller

- Control Action: Change any settable quantity on any controllable device existing in the powerflow basecase.
- Basic Requirements
  1. Settable via: % Change, absolute change, relative change
- Feature Requests
  1. Ability to add custom control law
  2. Ability to use arbitrary Inputs
- Basic Example
  1. Step load up 5% at t = t_1
  2. Open branch at t = t_1

Ramp Controller

- Control Action: Change any non-binary settable quantity on any controllable device existing in the powerflow basecase.
- Basic Requirements
  1. Settable via: % Change, absolute change, relative change
  2. Time inputs: start time, ramp A time, hold time, ramp B time
  3. NOTE: Hold time and ramp B time can be zero for single ramp operation.
- Feature Requests
  1. Ability to add custom control law
  2. Ability to use arbitrary Inputs
- Basic Example: Ramp Pgen up 5% at t = t_1 over t_2 seconds
- Advanced Example: Ramp Pgen up 20 MW at t = t_1 over t_2 seconds, hold for t_3 seconds before ramping down 15% after t_4 seconds.

Definite Time (Digital Relay) Controller

- Control Action: Change the status bit on any controllable device existing in the powerflow basecase. (Shunts, Branches, etc…)
- Basic Requirements
  1. Binary or 'Analog' settable reference input(s) (bus voltage level, MW output, system frequency …)
  2. Threshold inputs: set level (turn on), reset level (turn off)
  3. Time inputs: set time (time $\pm$ set level before turning on), reset time (time $\mp$ reset level before turning off), reclose time (time required after a reset before a set can be performed)
  4. NOTE: reclose time can be set to zero.
- Feature Requests
  1. Ability to add custom control law
  2. Ability to use arbitrary Inputs
- Basic Example: Using a voltage sensitive basecase with an available shunt cap; ramp real power of a load. When but voltage at the cap drops below 0.95 PU for 30 seconds, insert cap.
- Advanced Example: Using a voltage sensitive basecase with a wind power plant (WWP) and an available shunt cap on the low side of the WPP transformer; ramp WPP up commensurate hydro down. When WPP high-side voltage drops below 0.95 for 30 seconds **AND** WPP MW export is positive, insert cap.