

500✓ (thermostat) Specify a thermostat for a gas burner. The thermostat operates concurrently with other processes

thermometer || *control* || *thermostat* || *burner*

The thermometer and the control are typically located together, but they are logically distinct. The inputs to the thermostat are:

- real *temperature* , which comes from the thermometer and indicates the actual temperature.
- real *desired* , which comes from the control and indicates the desired temperature.
- binary *flame* , which comes from a flame sensor in the burner and indicates whether there is a flame.

The outputs of the thermostat are:

- binary *gas* ; assigning it \top turns the gas on and \perp turns the gas off.
- binary *spark* ; assigning it \top causes sparks for the purpose of igniting the gas.

Heat is wanted when the actual temperature falls ϵ below the desired temperature, and not wanted when the actual temperature rises ϵ above the desired temperature, where ϵ is small enough to be unnoticeable, but large enough to prevent rapid oscillation. To obtain heat, the spark should be applied to the gas for at least 1 second to give it a chance to ignite and to allow the flame to become stable. But a safety regulation states that the gas must not remain on and unlit for more than 3 seconds. Another regulation says that when the gas is shut off, it must not be turned on again for at least 20 seconds to allow any accumulated gas to clear. And finally, the gas burner must respond to its inputs within 1 second.

§ see book Subsection 9.0.0 and 9.1.5