

Block Diagram Modeling Problems

1-1: The Thermostatically Controlled Home Heating System

Background: (reference: <http://en.wikipedia.org/wiki/Thermostat>). Your home heating system is very important to your comfort. Home heating systems commonly have components that include a furnace, the home, a thermostat and the effect of the outside environment.

Problem:

Draw a block diagram that shows the significant components used in the Thermostatically Controlled Home Heating System. Include the components necessary to model the relationship between thermostat temperature setting and the temperature of the home with varying outside temperature. Label all signals and blocks. (see Figure 1.7 in the text as an example).



Honeywell's iconic "The Round" model T87 thermostat, one of which is in the Smithsonian.

<http://en.wikipedia.org/wiki/Thermostat>

1-2: The Flapper Valve Flush Toilet

Background: (reference: http://en.wikipedia.org/wiki/Flush_toilet)

A **flush toilet** is a **toilet** that disposes of human waste by using water to flush it through a drainpipe to another location. As with many inventions, the flush toilet was the result of a long development. Modern toilets incorporate an 'S', 'U', 'J', or 'P' shaped bend that causes the water in the toilet bowl to collect and act as a seal against sewer gases. Since flush toilets are typically not designed to handle waste on site, their drain pipes must be connected to waste conveyance and **waste treatment systems**.



Although introduced much later in Europe and the Americas, circa 26th century BC: Flush toilets were first used in the **Indus Valley Civilization**. The cities of **Harappa** and **Mohenjo-daro** had a flush toilet in almost every house, attached to a sophisticated **sewage system**. In 1819, **Albert Giblin** received British patent 4990 for the "Silent Valveless Water Waste Preventer", a siphon discharge system. In 1858, the first flush toilets on the European continent may have been the three "waterclosets" installed in the new town house of banker *Nicolay August Andresen* on 6 Kirkegaten in **Christiania**, insured in January 1859. The toilets were probably imported from England, as they were referred to by the English term "waterclosets" in the insurance ledger. In the 1880s: **Thomas Crapper's** plumbing company built flush toilets of Giblin's design. After the company received a royal warrant, Crapper's name became synonymous with flush toilets. Although he was not the original inventor, Crapper popularized the siphon system for emptying the tank, replacing the earlier floating valve system that was prone to leaks. The invention and use of the modern flush toilet is responsible in large part for our ability to have large cities without experiencing devastating disease. In previous centuries, large European cities, i.e. London, experienced regular

Some nice pictures that will help you understand the flush toilet action appear here:
http://commons.wikimedia.org/wiki/Category:Toilet_flush

Problem:

Draw a block diagram that shows the significant components used in the operation of the modern flapper valve flush toilet. You should (1) take a close look at any home toilet available (remove the tank top and look inside) as well as the internet.