X10 Systems
Practical Usage of X10 Modules

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Types of Modules

- Lamp Module
  - Works only with incandescent lamps
  - Can turn on, turn off, dim (reduce intensity) and bright (increase intensity)
  - Cannot be used with CFL (Compact Fluorescent Lamps) neither with LED lamps.
  - May implement two pre-set intensity levels
- Appliance Module
  - Works with different types of loads
  - Can turn on and turn off

Lamp / Appliance Modules

- Only receive commands (cannot transmit)
  - Lamp Module accepts commands On, Off, Dim, Bright
    - Cannot be used with lamps that do not support dimming (CFL, LED, …)
  - Appliance Module accepts commands On, Off
- Each one needs an address (house code + device code)

Lamp Module

Appliance Module

Setting a Module's Address

Setting a module's address:

– Letter (A - P) represents a House Code (16 combinations)

– Number (1 - 16) represents a Device Code

Device Code is also known as **Unit Code**

Examples of addresses: A1, B5, P16

Special Modules

- These modules issue commands
  - Send on/off commands to a specified address (house code + device code)
  - They do not have an address of their own

Thermostat

Changes in temperature triggers sending an on/off command.

Interface module

These rotary switches define the destination address (to where the command is sent); the module has no address.

Applying a signal or closing an electric contact triggers sending an on/off command.

Contact becomes closed → send ON
Contact becomes open → send OFF

Radio Frequency Devices

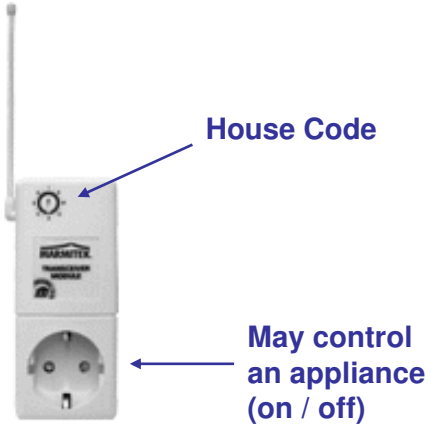
These devices have no address (they only transmit).

RF interface

Receives RF commands and issues power-line (X10) commands

RF Interface Module

- It is both a RF receiver **and** an Appliance Module
- Has only one rotary switch, to define the House Code
- The Device Code is pre-set to **1**



X10 Controllers and PC interface

- Supports bi-directional communication (can transmit and receive)
- Interfaces with a PC (CM11A uses a serial port or an USB-serial adapter; CM15A connects directly to USB)
- Allows sending any command to any address
- Monitors all commands on the power line and sends them to the PC
- Includes a real time clock (with battery)
- Supports scheduling tasks (issuing commands to modules) even with the PC turned-off. The schedules are programmed using the PC.

CM11A

CM15A

Controlling Window Blinds

- Each electric window blinds use a motor that can rotate up or down
- They require two actuators
  - One actuator may be used to turn the motor up and the other to turn the motor down
  - For safety reasons, some times one actuator is used to turn on/off, and the other is used to invert the direction (this avoids the possibility of turning up and down at the same time; note that some motors have built-in protection against this possibility)
- Actuators must stay active during an adequate amount of time to achieve the required result (opening completely, closing completely, setting at an approximated position; a synchronization process consists in opening/closing completely to be sure of the state of the blinds)
- Appliance modules can be used for window blinds control but, typically, under supervision of an adequate PC application

Controlling a Heating System

- Some heating systems use gas boilers to heat water, which is than circulated through a given space.
- This can be controlled using an electro-valve: if open, the water circulates and the boiler is automatically turned on; if closed, the water circulation stops and the boiler also stops.
- The electric valve can be commanded through a X10 appliance module. Sending an on command to the module applies energy to the valve and it will open (heating the space); sending an off command to the module will remove energy from the valve turning it off.
- The appliance module can be commanded by, for example, a X10 thermostat (see slide 5).

Appliance Module

Electric water valve

Conclusion

- X10 is a very basic technology (essentially, it allows to turn on and off devices).
- However, it can be used in many situations and in non obvious applications (e.g., controlling window blinds and heating systems).
- It is possible to develop PC applications with some sophistication that control X10 systems.
- Those applications can have remote access, using the Internet.
- However, X10 is not a robust/reliable technology; orders are sent to modules but, commonly, one cannot confirm that those orders were received and executed.
- So, don't rely on X10 for critical things...
- Trick:
  - An action can be confirmed using an Interface Module (see slide 5); if it detects the presence of energy it can send a command, which will be used as a confirmation.

Questions?