

Controlling and monitoring X10 devices with MINI-MAX and PRO-MAX

X10 is a communications protocol for remote control of electrical devices. X10 is designed for communications between X10 transmitters and X10 receivers via standard household AC power line. X10 transmissions are synchronised to zero crossing point of the line. Binary 1 is represented by a 1 millisecond burst of 120 kHz at the zero crossing point, and a Binary 0 by the absence of 120 kHz. Transmitters send commands such as **TURN ON**, **TURN OFF** or **DIM** preceded by the identification of the receiver unit to be controlled. Each receiver is set to a certain house ID and unit ID, and reacts only to commands that address that receiver. Receivers ignore commands not addressing themselves.

A complete code transmission encompasses eleven cycles of the power line. The first 2 cycles represent a Start Code (binary 1110). The next 4 cycles represent House Code and the last 5 cycles represent either the Unit Code (1 through 16) or a Function Code (On, Off, etc.). This complete block, (Start Code, House Code, and Key Code) should always be transmitted twice with 3 power line cycles gap between each group of codes. Bright and dim commands are exceptions to this rule and should be transmitted continuously (at least twice) with no gaps between codes.

X10 related links and vendors of X10 equipment:

- <http://www.x10.com>
- <http://www.smarthome.com>
- <http://www.radioshack.com>
- <http://www.comfort.org.uk/support/faqx.html>

Required hardware:

- MINI-MAX/51 or PRO-MAX/51 boards from BiPOM
- X10-1 peripheral board from BiPOM
- 4 wire telephone cable with RJ11 on both ends (comes with X10-1)
- TW523 X10 power line interface module from BiPOM.
- Some X10 device(s) to be controlled.

Software description.

X10.lib - BASCOM library containing general X10 functions:

- **X10AUTO**: Checks if there is some X10 device connected to the board. Detects the power line frequency (50 Hz or 60 Hz) and automatically sets the system up.
- **X10TX**: Assembles X10 block and transmits it to the power line.
- **X10RX**: Receives X10 block and disassembles it into the House Code and Unit / Function Code.
- **X10GAP**: Provides 3 power line cycles gap.

Note. Subroutine Wait_us contains the constant, depending on oscillator frequency and should be calculated and set by user. The formula is:

$$\text{CONST} = 0.0001 \times F_{\text{osc}} / 12$$

X10_DEMO.bas - BASCOM-51 (BASIC) program.

Allows communicating to remote X10 devices using terminal emulating software on PC.

The program first detects X10 device presence and power line frequency. If device is present, it shows prompt ">", or "No X10 device" message otherwise. User should connect the device and press any key.

Directives should be entered as a command line (up to 16 symbols) containing one directive and one or more parameters. Spaces and other separators are not available.

H<house> - Internally sets the House code for future transmission. Parameter <house> is a literal symbol from "A" to "P".

U<unit> - Transmits House and Unit codes. Parameter <unit> is decimal number from 1 to 16 equal to the controlled device's assigned Unit code.

K<function>[,function, function...] – transmits House and Function code(s). Parameters <function> are decimal numbers from 1 to 29.

? – Displays Function Codes reference.

R – Enters receiving mode. Received House and Unit / Function codes are shown on terminal screen as decimal numbers. To return to the transmitting mode, press any key and wait up to 5 seconds.

To control an X10 device, assigned house code should be set first. Then Unit code and Function code(s) should be transmitted.

Example 1: Turn Unit 12, House B ON.

HB ; Sets House Code = B
U12 ; Transmits Unit Code 12
K5 ; Transmits ON command's code (=5).

Example 2: Sequentially turn unit 7, House G ON and OFF 3 times and then turn unit 15 ON.

HG ; Sets House Code = G
U7 ; Transmits Unit Code 7
K5,7,5,7,5,7 ; Transmits ON and OFF commands 3 times.
U15 ; Transmits Unit Code 15
K5 ; ON command