1 Introduction

The HB01 is a combination of a humidity sensor and a barometric pressure sensor, capable of transmitting its data over the power lines by means of the X10 extended code protocol. It is available for 110V/60Hz or 220V/50Hz power nets.

With a few exceptions, it confirms to the specification of X10 for extended code 1, type1 devices (ftp://ftp.x10.com/pub/manuals/xtc798.doc).
This document has been extended with commands for requesting humidity, pressure and pressure changes.

The HB01 is not taking any decisions based on humidity, pressure or pressure change it detects. It is only capable of transmitting the measured data. The controlling PC program should compare the measured values with threshold levels and take the necessary actions.

Note:

Like all home automation products, the HB01 should never be used for life saving or life-preserving situations.

2 Technical features

2.1 X10 communications:

- 120kHz X10 frequency very stable and accurate (obtained from X-tal)
- 3 phase transmission (optional)
- Short transmission cycles (ca. 0.6 seconds; uses extended data format)
- Collision detection and back-off algorithm
- 220V/50Hz or 110V/60Hz units
- X10 addresses fully programmable (different house code/unit code combinations possible for humidity sensor, pressure and pressure change)
- A led indicates a transmission from the HB01

2.2 Barometric pressure sensor

- Reports barometric pressure and pressure change/hour on request.
- Reports pressure and pressure change/hour automatically when the value is changed (maximum rate once per 15 minutes)
- Pressure resolution: 0.5mBar
- Pressure change resolution: 0.125 mBar/hour
- Pressure accuracy: 0.5mBar
- After power up, or after a programming action, barometric pressure will automatically be send once

2.3 Humidity sensor

- Reports Relative Humidity on request
- Reports Relative Humidity automatically when the value has changed (maximum rate once per 15 minutes)
- Humidity resolution: 1%RH (Relative Humidity)
- Relative Humidity accuracy: 3%

3 Using the HB01

3.1 Installation

Before plugging the unit into a wall outlet, the power/frequency should be checked (at the bottom of the unit).

3.2 Addressing

The HB01 contains 3 addressable items.

- The current barometric pressure.
- The pressure change during the last hour
- The current relative humidity

The X10 address of each of these items can be programmed at the same or at a different House- and Unit Code combination.
Default all the items are mapped at House Code M and Unit Code 2.

3.2.1 Changing addresses

The default addresses can be changed as follows:

- Press the button on the HB01 one time. The Led begins to blink slowly.
- Send an extended command with the HC/UC and the TC (Type/Command) for which you want to change the address. This has to be done within a minute after the button is pressed.
- Continue with other HC/UC/TC combinations you want to change. Again you have 1 minute time to send the command.
- After the last combination has been sent, wait for the Led to stop blinking.

3.3 Data exchange

3.4 Power line data

On the power line an Extended Code 1 transmission resembles the following form:

Start	House code	Ext code	Unit code	Data	Command
1110	HC/HC'	EXT/EXT'	DC/DC'	DATA/DATA'	COM/COM'
4 bits	4 bits	5 bits	4 bits	8 bits	8 bits

A total of 31 main cycles, which take 0.620 ms in a 50Hz situation and 0.5 ms in a 60Hz situation.

3.5 Computer interface

The HB01 is tested in combination with a CM11A, but it should operate with other (compatible) devices.
The communication between a controlling PC and the CM11A is described in the following chapters.

3.5.1 Sending Extended Code

The protocol may be shown as:

PC	CM11 Interface
5 bytes →	Header:Function Code:Unit Code; Data:Command
1 byte ←	Checksum
1 byte →	Acknowledge
1 byte ←	interface ready to receive

The header for an extended transmission is always:

Header: 7 6 5 4 3 2 1 0
0 0 0 0 0 1 1 1

Bits 7 to 3 are always zero because the dim level is not applicable to extended transmissions.
Bit 2 must be set to '1' as in all PC header transmissions.
Bit 1 is set to '1' as the extended transmission is always a function.
Bit 0 is set to '1' to define an extended transmission rather than a standard transmission.

The function code byte is:

Function Code: 7 6 5 4 3 2 1 0
<Housecode>0 1 1 1

For Extended Code 1, the function code must be 0111.

The unit code byte contains the encoded unit in the lower nibble.

Finally, the data and command bytes may take any value between 0x00 and 0xff.
Note that the checksum is one byte and is defined as:

checksum = (header + function code + unit code + data + command)&0xff

3.5.2 Receiving Extended Code

PC	CM11 Interface
	← 0x5A, poll from interface
0xc3, Ready →	
	← 0x05 (5 byte transmission)
	← 0x01 (byte 1 = function)

	← house and function (ext. code1)
	← unit address
	← data
	← command

3.5.3 Command and data structure

Extended Code 1 has been defined by X-10 and is meant for data and control purposes. Type 1 is dedicated to sensors.

Every Extended Code 1 transmission is initiated by sending a start code and a house code followed by the function code for Extended Code 1: 0111. Only units with Extended Code 1 capability will recognize this command and will interpret the following unit code, and if addressed also the data and command byte.

Data	**Type-Command**	**Description**
X X X X X X X X	00010001	Request Average Light Data from the Unit addressed in the HC/DC fields
X X X X X X X X	00010010	Request Instant Temperature from the addressed unit.
X X X X X X X X	00010011	Request Status from addressed unit.
X X X X X X X X	00010100	Request Instant Light Data from the addressed unit.
X X X X X X X X	00010101	Request Average Temp. Data from the addressed unit.(16min. average)
X X X X X X X X	00011000	Request Humidity from addressed unit.
X X X X X X X X	00010110	Request Barometric pressure from addressed unit.
X X X X X X X X	00010111	Request Barometric Pressure Change from the addressed unit.
B B B B B B B B	00011110	Barometric pressure
C C C C C C C C	00011111	Pressure change during last hour
0 H H H H H H H	00011010	Relative humidity
L L L L L L L L	00011011	Ambient Light data from the sensor in the HC/DC fields
T T T T T T T T	00011100	Temperature data from the sensor in the HC/DC fields.
S S S S S S S S	00011101	Status data (bit mapped) from the unit in the HC/DC field

x = don’t care

Barometric pressure Data

The transmitted value is relative to 1000 mBar.

(+/-)B64 B32 B16 B8 B4 B2 B1	Range 0 - 127 in integer values. (+/-) = '1' for negative integers. Units are 0.5 mBar

Example: 10001001 means 1000 – (9x0.5)= 995,5mBar

Pressure Change Data

(+/-)C64 C32 C16 C8 C4 C2 C1	Range -127 - +127 in two's complement. Units are 0.125 mBar/hour

Example: 00001100 means a change of 12 x 0.125 = 1.5 mBar/hour

Humidity Data

0 H64 H32 H16 H8 H4 H2 H1	Range 0 - 100 in integer values. Units are 1% RH

Example: 01000010 means 66 % RH

Status Data

x x x x x x x U/E	Bit 0 set to 1 if USA unit.