

**Discover AUTOMGEN<sup>8</sup> and LEGO NXT brick.**

© 2007 IRAI



## **Introduction**

The aim of this document is to help you get started with using AUTOMGEN with NXT LEGO brick. The examples we suggest can be used to create practical jobs. Our main desire is to present simple examples, which can be used as a starting point for your projects:

## **System requirements**

To use AUTOMGEN with NXT LEGO brick, you need to have:

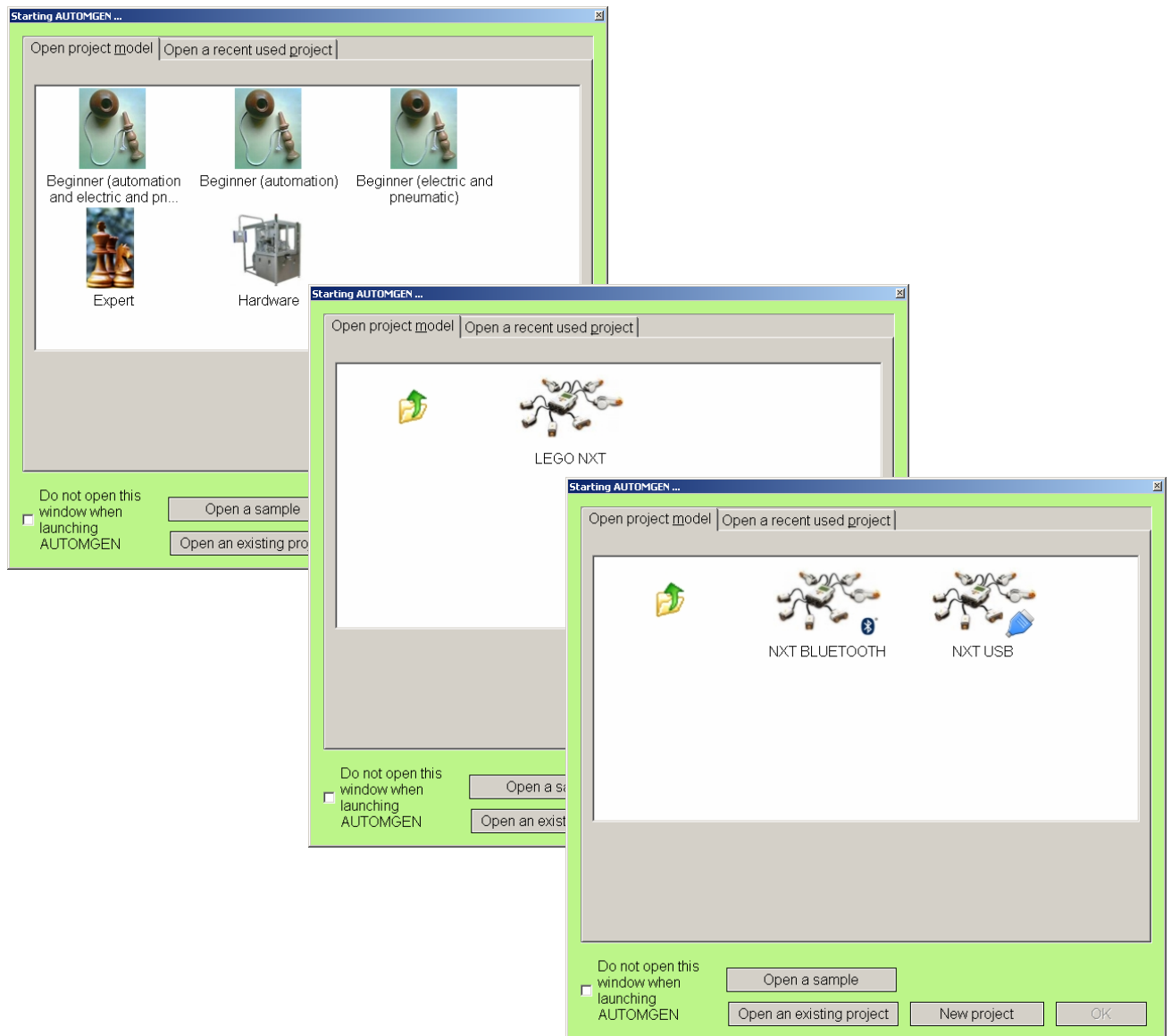
- a NXT LEGO brick ;
- a PC microcomputer equipped with BLUETOOTH connection, or a USB connection. A BLUETOOTH connection is highly recommended to be able to "freely" use the brick, i.e. not connected to a PC;
- AUTOMGEN<sup>8</sup>, update 8.004 or higher,
- the MINDSTORMS NXT driver which can be downloaded here : <http://mindstorms.lego.com/Support/Updates/> (this driver is also installed while LEGO software installation).

The examples use the base robot model proposed in the MINDSTORMS package.



## **Start-up**

When AUTOMGEN is launched, open the "Hardware" category, then "LEGO NXT" then the model "BLUETOOTH NXT connection" or "USB NXT connection".

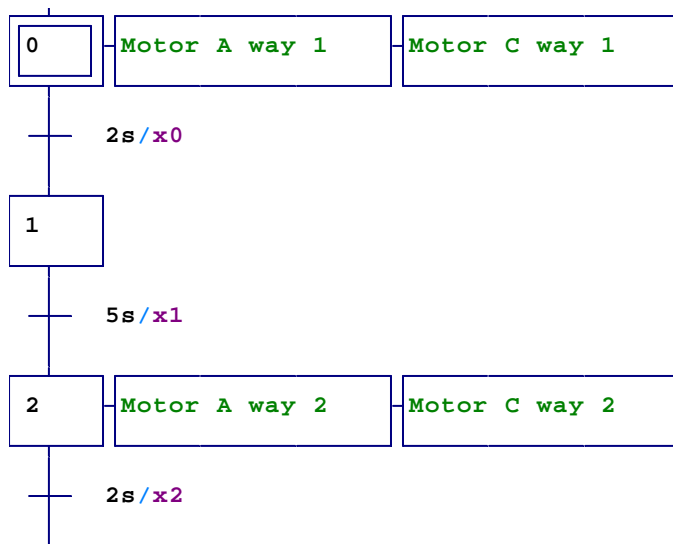


These models contain the setting of the symbols used to access the main brick resources: motors, sensors, etc.

### **Example 1**

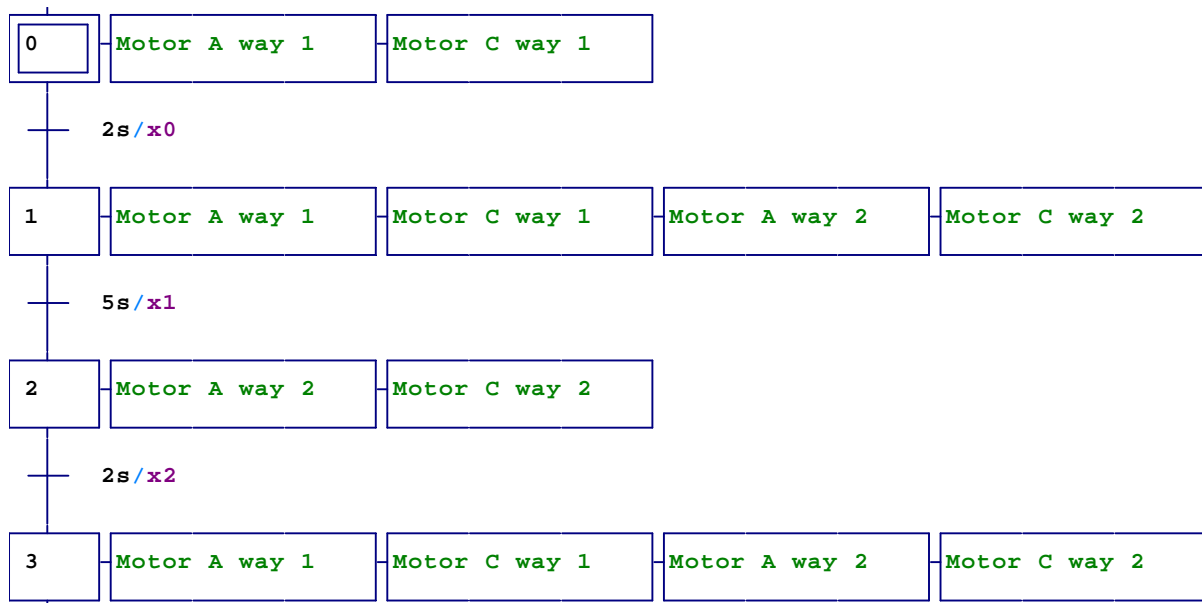
Let's start with a first example, a program making the robot advance for 2 seconds, then stop for 5 seconds and go backwards for 2 seconds. The motor associated with the robot right wheel is wired on output A of the NXT brick, the left motor on outlet C.

Here is the solution (all of the examples are in the subdirectory "Examples\post-processors\RCX NXT\nxt" of the AUTOMGEN installation directory). The examples have been developed in BLUETOOTH mode, however, if you want to switch to USB mode just change the connection option in the element Configuration/Post-processor/RCX NXT/Communication module by checking "Use Bluetooth"



### Example 2

As we have seen the robot will continue to advance for a few instants after the motors are stopped. Our second example is going to use the possibility of using the motors as brakes. If the two directions of the same motor are driven at the same time, the motor is stopped. So this is our example changed to brake the motor at each stop.

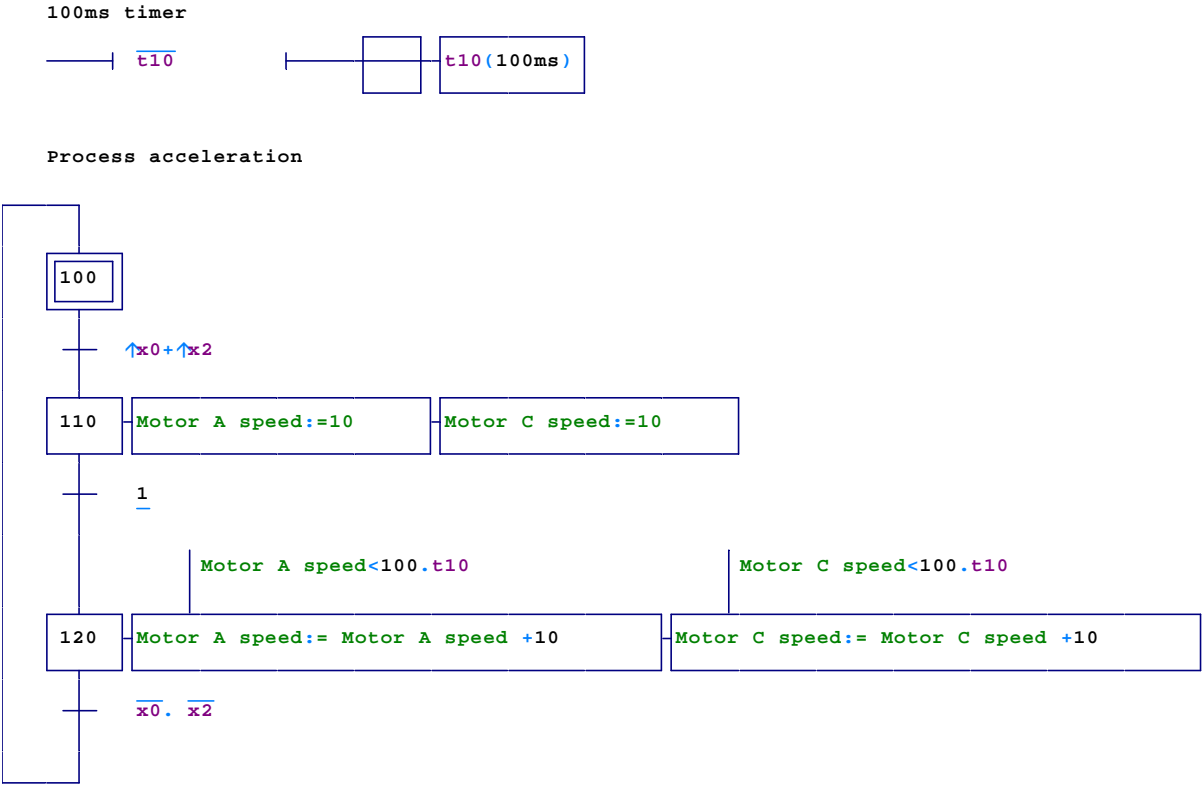


### Example 3

As you have seen in the two previous examples, the motor speed was not changed. The speed can be modulated by changing the values contained in the words (associated to symbols "Motor no. speed"). The contents of these words can vary from 0 (motor stopped) to 100 (maximum speed). A value which is too small will not start the motor (not enough power).

Let's change our example so that the speed will be modulated to reach its maximum speed in around a second.

Here is a solution that implements acceleration management using this:



The first element creates a time base of 100ms with a variable of t10. This time base is used to evolve the speed based on a time base not linked to the cycle times. The only constraint here is that the program cycle time is less than 100 ms. The value 10 initially placed in the words determining the speeds represents a minimum value authorizing motor rotation.

**Example 4**

Now we are going to create a realistic application used in the industrial world: a wire guided robot. For this purpose, we are going to add, a light sensor to our robot. Here is the assembly to create:



Our light sensor will be arbitrarily wired on input 2 of the brick.

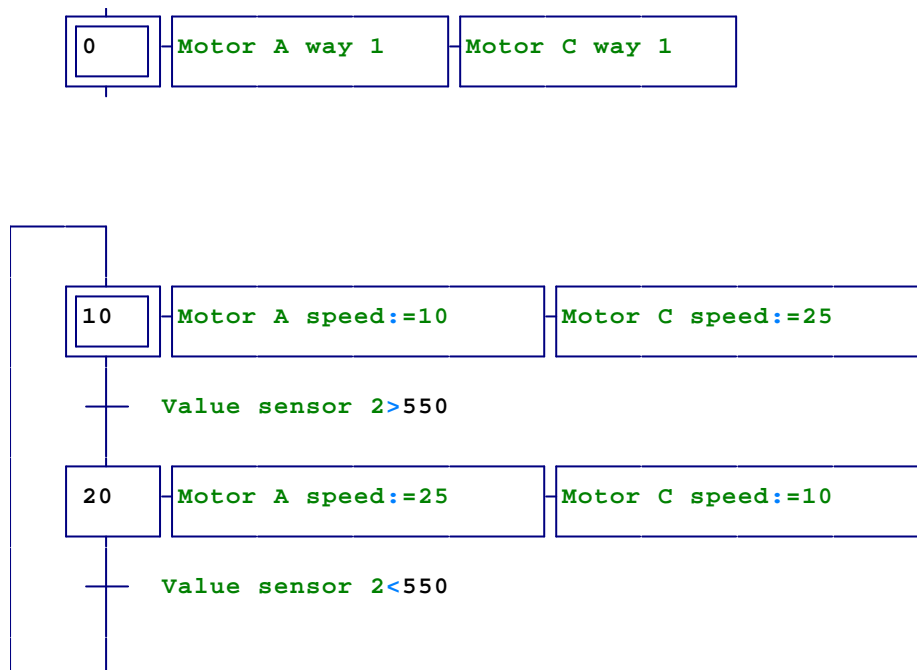


We need to specify the sensor type and its reading mode in the post-processor configuration:

Configuration/Post-processors/RCX NXT/System/Hardware setup/ Sensor type 2  
 Select: LIGHT ACTIVE

Elements	Values	Comments
Hardware setup		
Target model	NXT	
sensor 1 model	0	none
sensor 1 mode	0	RAW
sensor 2 model	5	LIGHT ACTIVE
sensor 2 mode	0	RAW
sensor 3 model	0	none
sensor 3 mode	0	RAW
sensor 4 model	0	none
sensor 4 mode	0	RAW
Software setup		

Here is a possible minimalist solution for tracking the line:



The principle of the proposed program is simple: the motors are always enabled (step 0), then their speed is modulated. The robot runs in one direction (to run, it is sufficient to run one of the 2 motors faster than the other), until reaching a luminous intensity level, then this limit is obtained, the turns to the other side and so on.

The value 550 is the only one (light sensor detection) between black and white. This value needs to be adjusted based on the lighting conditions,

You can use the "belt" in the MINDSTORMS package to test the program.

## Example 5

This last example illustrates the use of an ultrasound sensor. We'll create a simple program which will make the robot advance and then make it come back when an obstacle is present.

First of all the ultrasound sensor needs to be assembled on the robot:



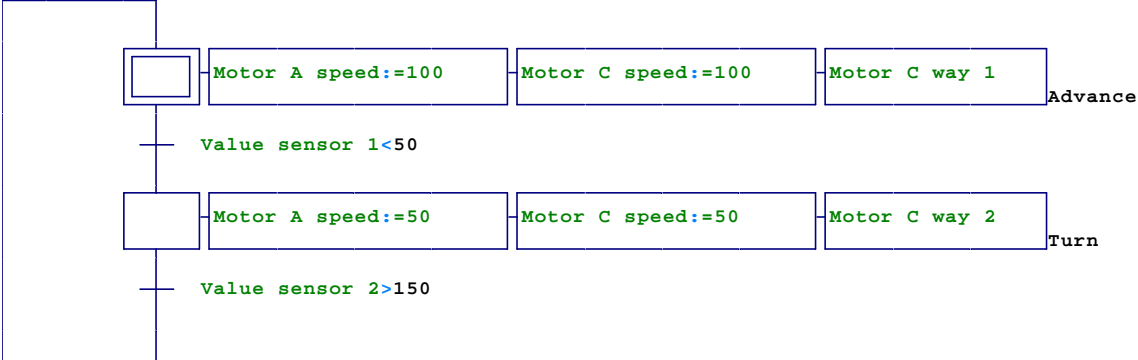
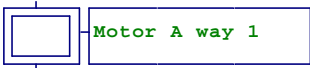
We wire the sensor on input 1 (this is completely arbitrary).

Then we configure the sensor in the parameter settings of the AUTOMGEN post-processor:

Elements	Values	Comments
Hardware setup		
Target model	NXT	
sensor 1 model	10	LOWSPEED
sensor 1 mode	0	RAW
sensor 2 model	0	none
sensor 2 mode	0	RAW
sensor 3 model	0	none
sensor 3 mode	0	RAW
sensor 4 model	0	none
sensor 4 mode	0	RAW
Software setup		
Code builder options (warning, modify with care)		
Variable statement		



Here is one possible solution:



## Appendix

### Correspondences between AUTOMGEN variables and LEGO NXT brick inputs and outputs

AUTOMGEN variables	NXT I/O	Comments
%i0 to %i3	Sensor 1 to sensor 4	To use if sensor type is TOUCH
%Q0 and %Q1	Motor A	Each output drive a motor in a way. If none of the output is activated, then the motor is floating, if both are activated, the motor is braked
%Q2 and %Q3	Motor B	Same for motor B
%Q4 et %Q5	Motor C	Same for motor C
%Q6 to %Q8	Reset position for motor A, B and C	Reset the motor position (see below)
%MW200 to %MW202	Speed for motor A, B and C	Between 0 (stopped) and 100 (maximum speed). For each of the 3 motors
%MW203 to %MW206	Sensor 1 to sensor 4	Numerical values for sensors 1 to 4. These values depend of the sensors types and modes defined in the post-processor configuration (system / hardware setup item)
%MW207 to %MW209	Position for motors A, B and C	16 bits signed value : motor position
%MD200 to %MW202	Position for motors A, B and C	Same but 32 bits values
%MW210 and %MW211	Sound	%MW210 is frequency, %MW211 is the duration in ms.

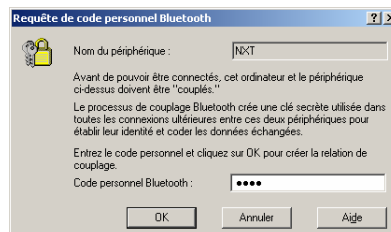
## BLUETOOTH connection

Here is Bluetooth connection process:

On the NXT brick:

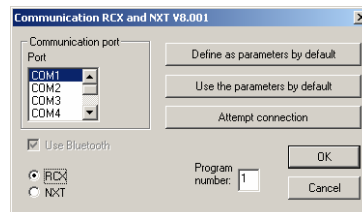
Beginning of the process

- Select BlueTooth,
- Select Search,
- Wait for the display of partners list,
- Select partner which is corresponding to the PC,
- Select place 1 by example,
- Message "Connecting" is displayed,
- If "Line Busy" is displayed, try to connect from AUTOMGEN,
  - o If the connection is established, everything is ok, nothing more to do.
  - o If the connection is aborted :
    - return to "Bluetooth" menu on the brick,
    - select "My contact",
    - select partner which is corresponding to the PC,
    - select "Delete",
    - restart to the beginning of the process.
- Passkey follow by a code is displayed, you can let "1234" and validate,
- Windows shows a connection request :



Confirm this by giving "1234" as code.

You can now connect AUTOMGEN to the brick, check the "Bluetooth" option in the communication module options:



## Using WINDOWS VISTA

Actually, the NXT driver provided by LEGO works only in Administrator mode. An upgrade of this driver should solve this problem in the new months. For using AUTOMGEN and NXT brick on VISTA now, you have to launch AUTOMGEN in administrator mode: right click on the AUTOMGEN shortcut and select "Execute as administrator".

For the Bluetooth connection, verify that the check box "Allow Bluetooth peripherals to search this computer" is checked:

- Right click on the Bluetooth icon on the bottom, at the right of the tasks bar,
- Select « sélectionnez "Open Bluetooth parameters",
- select "Options" tabulation,
- check " Allow Bluetooth peripherals to search this computer",
- then connect the brick with the process described into the "Bluetooth connection" appendix in this document,
- right click on the Bluetooth icon on the bottom, at the right of the tasks bar,
- select "Display Bluetooth peripherals",
- select "NXT",
- click on "Properties",
- open "Services" tabulation,
- check "serial port" check box or check boxes,
- click twice on "Ok".

The connection shall now work with AUTOMGEN.