

# VRbot with ARDUINO 2009 (rev. 1.0)

## VRbot Module

The VRbot module provides voice recognition functions for built-in Speaker Independent (SI) commands and up to 32 user-defined commands (Speaker Dependent (SD) trigger or commands, Voice passwords (SV)).

A simple and robust serial protocol can be used to access these functions from the user's microcontroller boards.

### Pinout

- 1 – GND
- 2 – VCC (3.3 to 5VDC)
- 3 – ERX (serial input)
- 4 – ETX (serial output)



**Vocal commands should be given from about 60cm from the microphone but you can try at greater distances by using a louder voice**

## Hardware setup

First of all open the "VRbot" example in the Arduino IDE, compile and download it on the Arduino board, please refer to your board documentation for details on how to do it. In this example we use the Arduino 2009 board (both with ATmega168 or ATmega328), if you have a different board you can modify source code as appropriate for your board.

With the board switched off, connect the VRbot module to the Arduino 2009 board as in the following diagram. Connect the microphone to the white MIC connector.

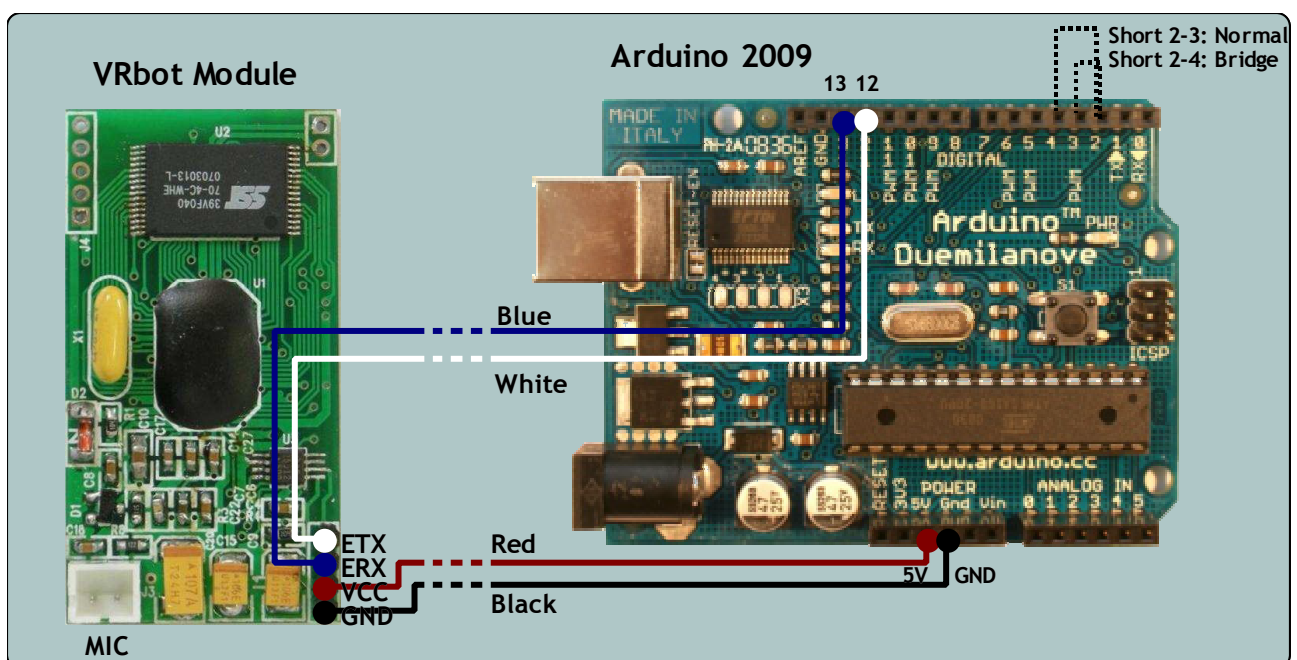


Figure 1

The VRbot example program, that runs on the Arduino board, allows the user to work with the set of SI commands the VRbot provides (see Figure 3) when used in "*normal*" mode or to use the VRbotGUI software to create and test new commands, when used in "*bridge*" mode:

- in order to start in *normal* mode you have to short pin 2 and 3 (see Figure 1) and then turn the board on;
- in order to start in *bridge* mode you have to short pin 2 and 4 (see Figure 1) and then turn the board on.

In "*normal*" mode the program sets the recognition language to English and the timeout to 5 seconds. Then the program waits for the SI trigger word '*Robot*'. If the trigger word is recognised the program sets wordset 1 and waits for the command *MOVE* or the command *TURN*. Please note that the VRbot module recognises also the others SI commands of wordset 1, but for simplicity they are ignored by the Arduino sample program.

If command *MOVE* is recognised the program sets wordset 2 and waits for the command *FORWARD* or the command *BACKWARD*. Others commands recognised by VRbot in wordset 2 are ignored by the program.

If command *TURN* is recognised the program sets wordset 2 and waits for the command *LEFT* or the command *RIGHT*. Others commands recognised by VRbot in wordset 2 are ignored by the program.

In case of error or when the commands are recognised properly the program jump back to the recognition of the trigger word. Outputs and messages of the program are sent over the serial port for debugging: follow the instructions shown on the terminal in order to pronounce the commands at the right moment.

## VRbotGUI Software

The VRbotGUI software can be used to easily connect the PC to the VRbot module, without the need of additional adapter boards, but simply by using the microcontroller host board with the provided program in "*bridge*" mode.

To start using the VRbot GUI software, connect your PC to the Arduino board and turn it on while shorting pin 2 and 4 in order to start the firmware in "Bridge mode".

Select the serial port to use (the same as in *Arduino IDE*) from the toolbar or the "File" menu, then go with the "Connect" command.



**Any software using the same COM port must be closed before selecting "Connect" in VRbot GUI**

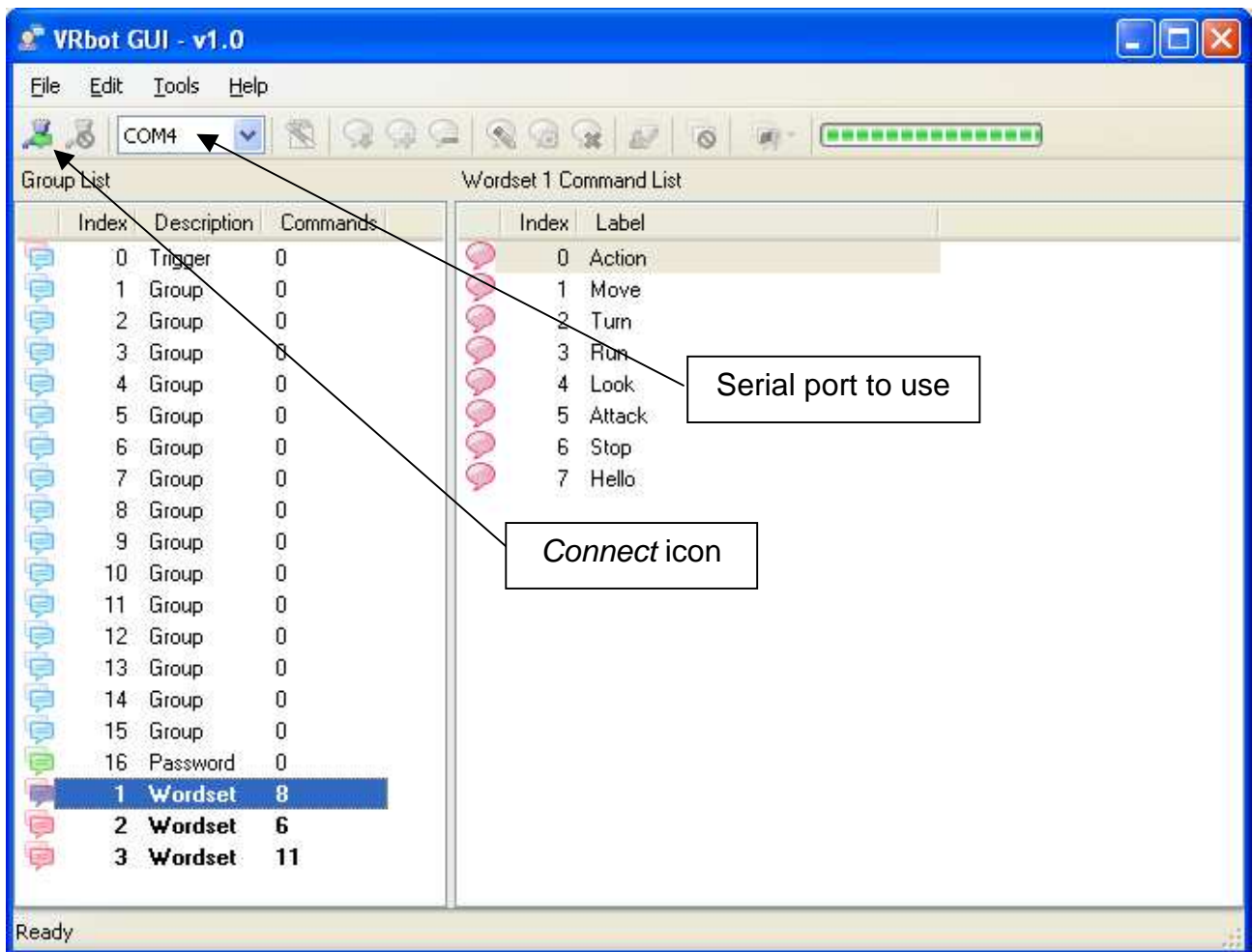


Figure 2



**VRbot GUI must be disconnected before using the Arduino IDE to download new programs to the board**

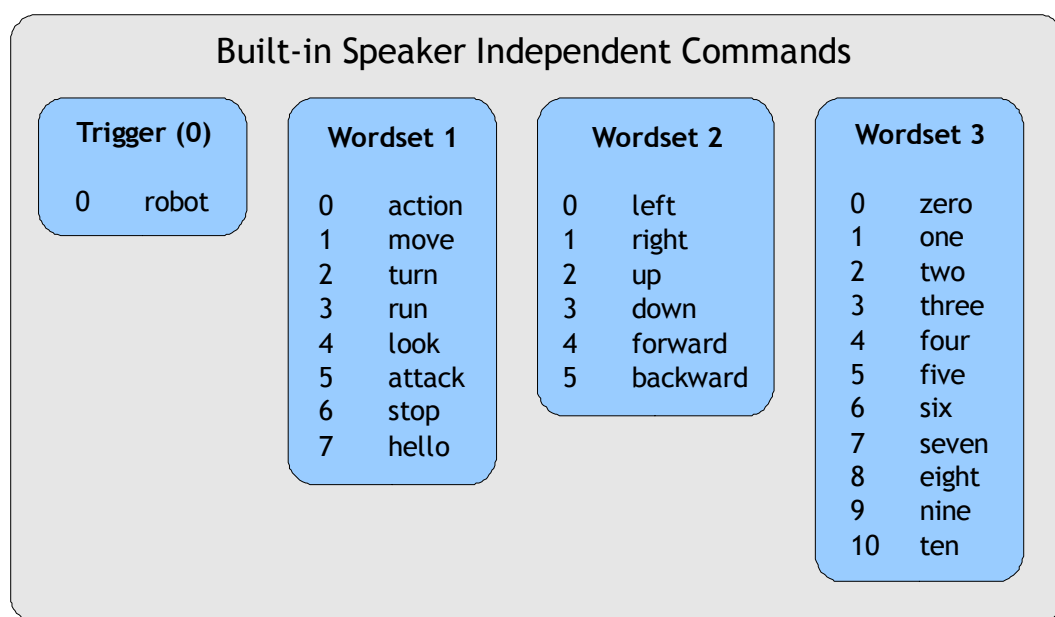


Figure 3

Furthermore, the program in "bridge" mode also enables programming of the SD commands into VRbot by using the PC interface.

There are four kinds of commands in the GUI (see Figure 2 and Figure 4):

- ☐ Trigger - is a special group where you have the built-in SI trigger word "Robot" and you may add one user-defined SD trigger word. Trigger words are used to start the recognition process
- ☐ Group - where you may add user-defined SD commands
- ☐ Password - a special group for "vocal passwords" (up to five), using Speaker Verification (SV) technology
- ☐ Wordset - built-in set of SI commands (for instance in Figure 2 above, Wordset 1 is selected)

The user can define groups of SD commands or passwords and then edit the code in Arduino IDE to handle them.

The recognition function of VRbot works on a single group at a time, so that users need to group together all the commands that they want to be able to use at the same time.

When VRbotGUI connects to the module, it reads back all the user-defined commands and groups, which are stored into the VRbot module non-volatile memory.

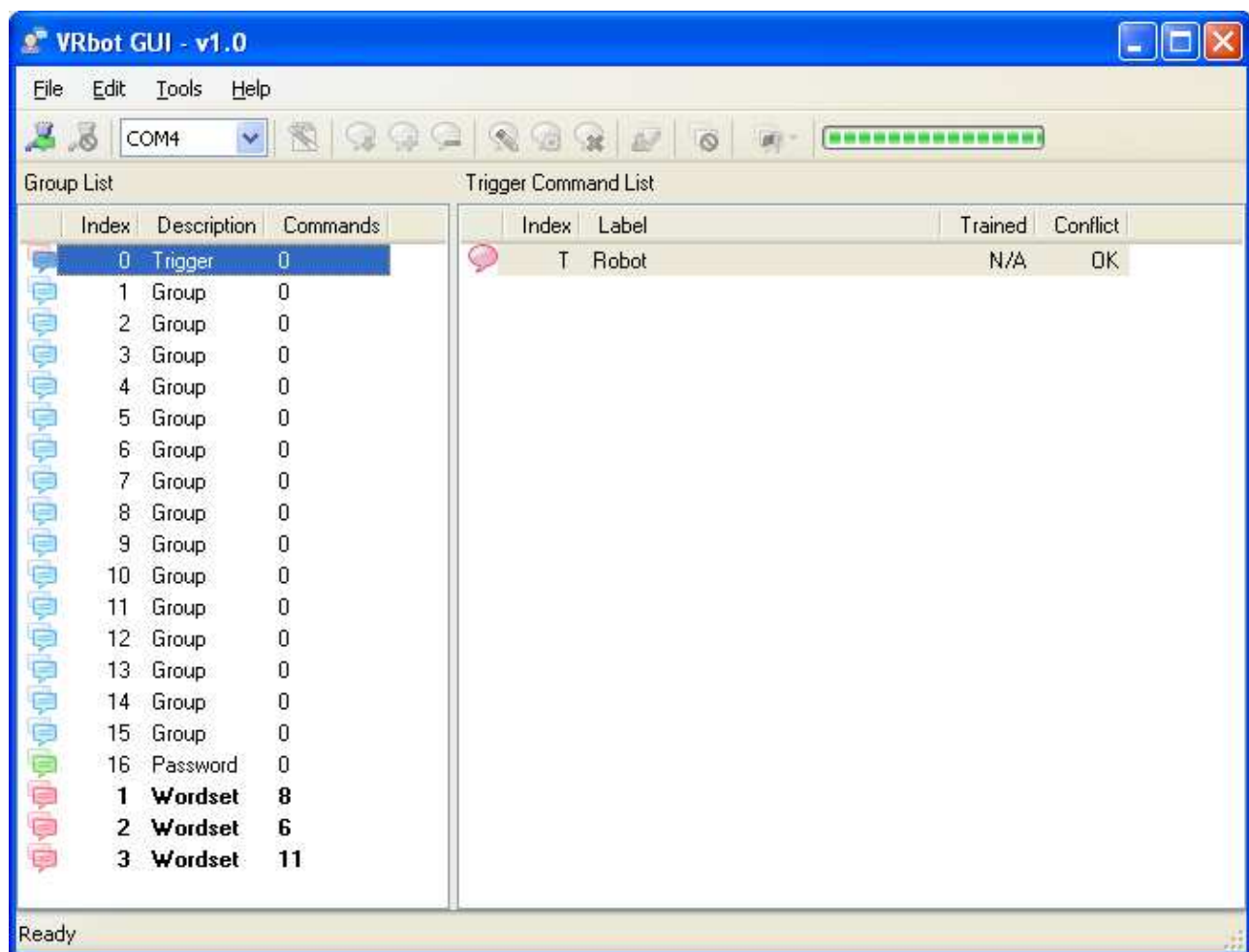


Figure 4

The user can add a new command by first selecting the group in which the command needs to be created and then using the toolbar icons or the "Edit" menu.

A command should be given a label and then it should be trained twice with the user's voice: the user will be guided throughout this process (see Figure 5) when the "train command" icon is clicked or the "train command" is selected from the Edit menu.

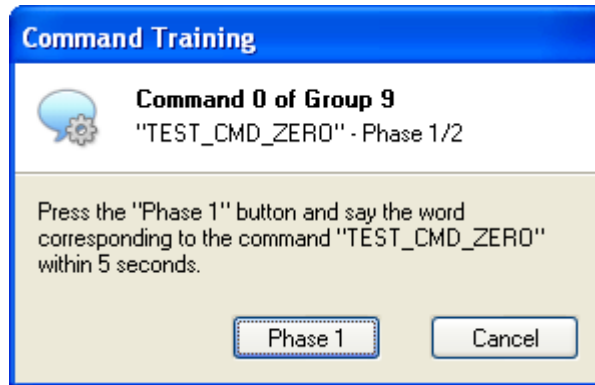
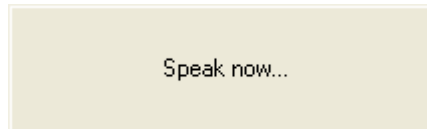


Figure 5

**After clicking on Phase 1 or Phase 2 buttons, remember to start speaking only when you see this little window:**



If any error happens, command training will be canceled. Errors may happen when the user voice is not heard correctly or when the second word heard is too different from the first. The software will also alert if a command is too similar to another one by specifying the index of the "conflicting command" in the "conflict" column.

For instance, in the following Figure 6 the command "TEST\_CMD\_ONE" sounds too similar to "TEST\_CMD\_ZERO" (i.e. they have a too similar pronunciation).



**TEST CMD ZERO and TEST CMD ONE are just examples of labels, you should use label names that reflects the real command that you are going to train**

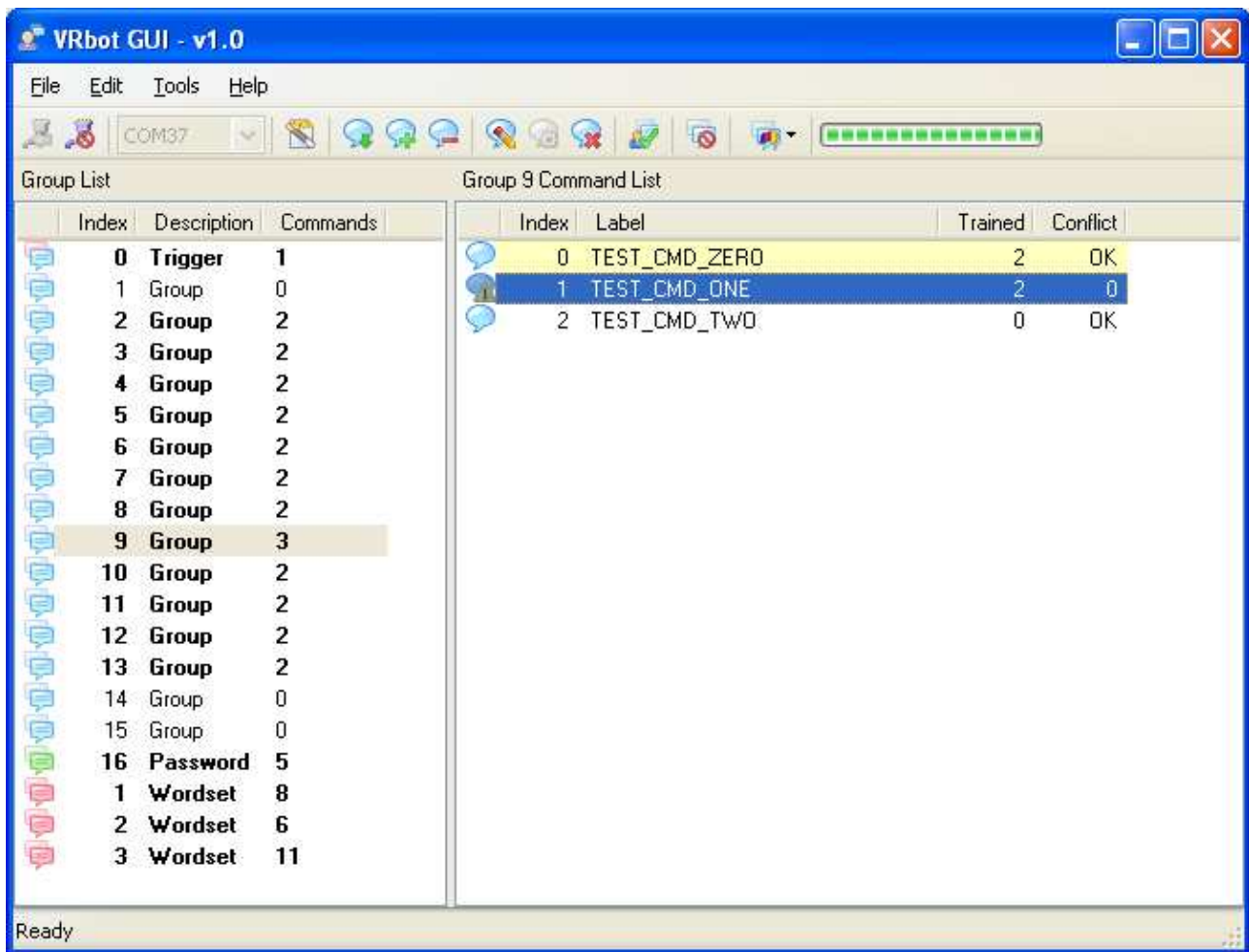


Figure 6

The current status is displayed in the VRbotGUI list view where groups that already contain commands are highlighted in bold.

The selected group of commands can also be tested, by using the icon on the toolbar or the “Tools” menu, to make sure the trained commands can be recognized successfully.



**If you want to re-train a command you have to erase the previous training first**

Once you have created and trained all your desired commands, starting from the provided example program and the documented VRbot communication protocol, you can create your custom voice recognition application.



**"Vocal passwords"(group 16) are much more sensitive to environment noise and distance from the microphone: be sure to train and give the password in similar conditions**