

# 01™ SuperModified – The 01Robolab Software v0.9b / 20160103

## - USER MANUAL -

The 01™ SuperModified combo of miniature PCBs is an all-in one motor control solution. Incorporating a 15-bit magnetic absolute encoder, an 8-bit, 20MHz AVR ATmega328p microcontroller and a 5-Amp MosFet H-bridge at an astonishing outline of 16mm x 16mm x 13.2 mm it is ideal for space constrained applications.

The overall dimensions allow for this motion control system to be installed inside a standard RC servo, transforming the device to a full functionality servo motor. The 01™ SuperModified is a highly cost effective solution, delivering closed loop PID control at 9.765 KHz, with advanced motion profiling capabilities and many other features.

You can use your modified hobby servos as complete Robotics Servos incorporating electro - mechanics (motor + gearbox) as well as hi - end PID control and power electronics. With our 01Robolab software you can operate via an I2C interface and an Arduino a structure with many links (up to 128).

The applications are endless – limited only by the hobbyist's / robotics enthusiast's / researcher's imagination. On this light our products are quite flexible and applied by our customers in multiple applications, mostly in developing custom automata and robotic structures. It is in our company spirit to provide solutions of high customisation and innovation.

The 01Robolab Software is in its beta version, in the close to come versions we will offer inverse kinematics module, repeated posture saving and replay among other future functionalities.

You are very welcome to send your comments and wishlist (and bugs) to our support email: [support@01mechatronics.com](mailto:support@01mechatronics.com).



### 01™ SuperModified

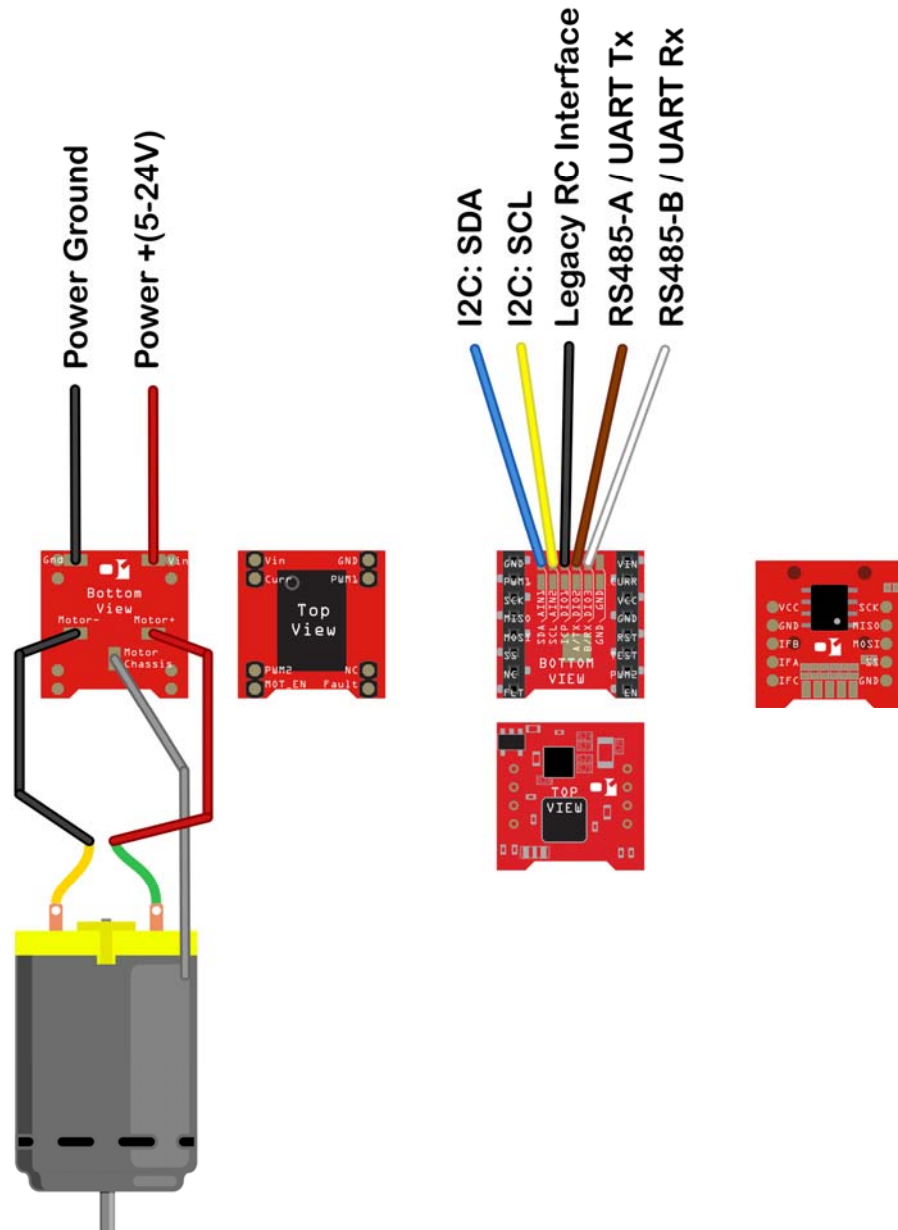
Miniature  
Controller for  
DC Motors

*"The robotic  
rebirth of the  
hobby servo"*

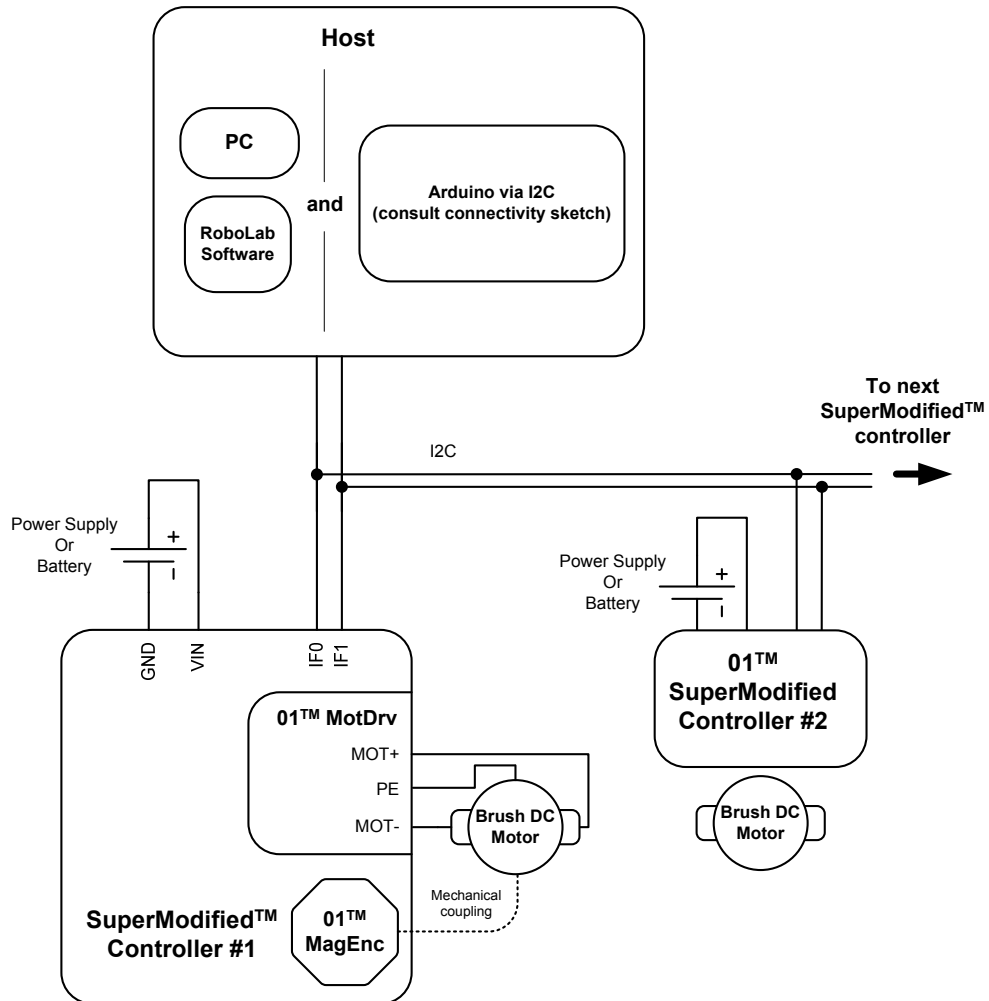
01Robolab  
Software with  
Arduino

## 1. Pre-installed cables

The Super-modified controller comes with several wires soldered. By default the power RS485 cable, I2C and legacy RC servo interface cables are soldered. These are represented in the schematic below. Please note that the pre-soldered cables always have the illustrated colors.



The overall connectivity of the Supermodified motors / servos is depicted in the following figure:



## 2. Prerequisites

- **Windows XP or later.**
- **Arduino installation.** It can be downloaded at: <http://arduino.cc/en/main/software>
- **01™ SupermodifiedArduino library files.** They can be downloaded at: <http://www.01mechatronics.com/sites/default/files/docs/ZerooneSupermodified.zip>
- **01Robolab executable file.**
- **1Robolab Arduino code.**

### 3. Arduino connection

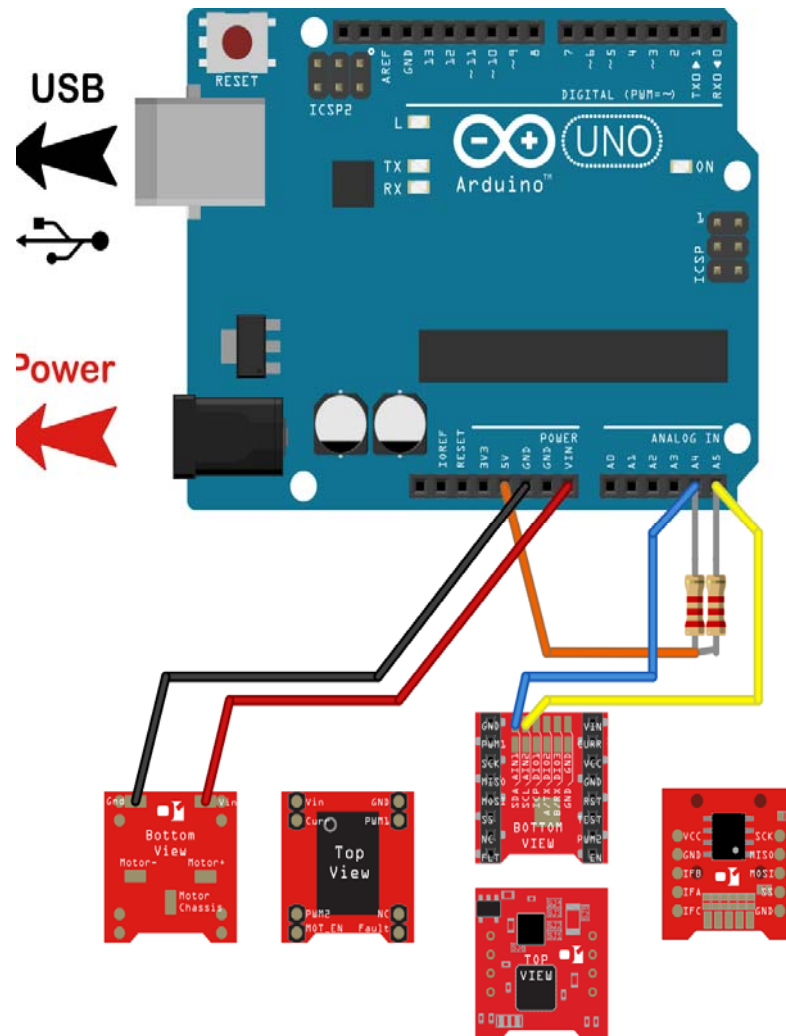
After downloading the archive with the Supermodified Arduino library simply unzip it inside your Arduino libraries folder. This is usually C:/Program Files/Arduino/libraries.

#### 3.1. I2C

The current version of 01Robot\_controller supports only the I2C connection configuration.

The connections needed for I2C operation are illustrated below. Although the Arduino Wire library activates the MCU internal pull up resistors, it is recommended to connect two external ones of approx. 2KOhm each.

**Important Note:** The Arduino **must** have the external power supply connected. Almost any motor can draw more than 500mA of current which is usually the USB maximum current.



#### 4. Arduino software

Open your Arduino IDE. Then go File>Open and find the 01Robot\_Controller Arduino code that you downloaded from our website. Lastly, upload it to your Arduino device.

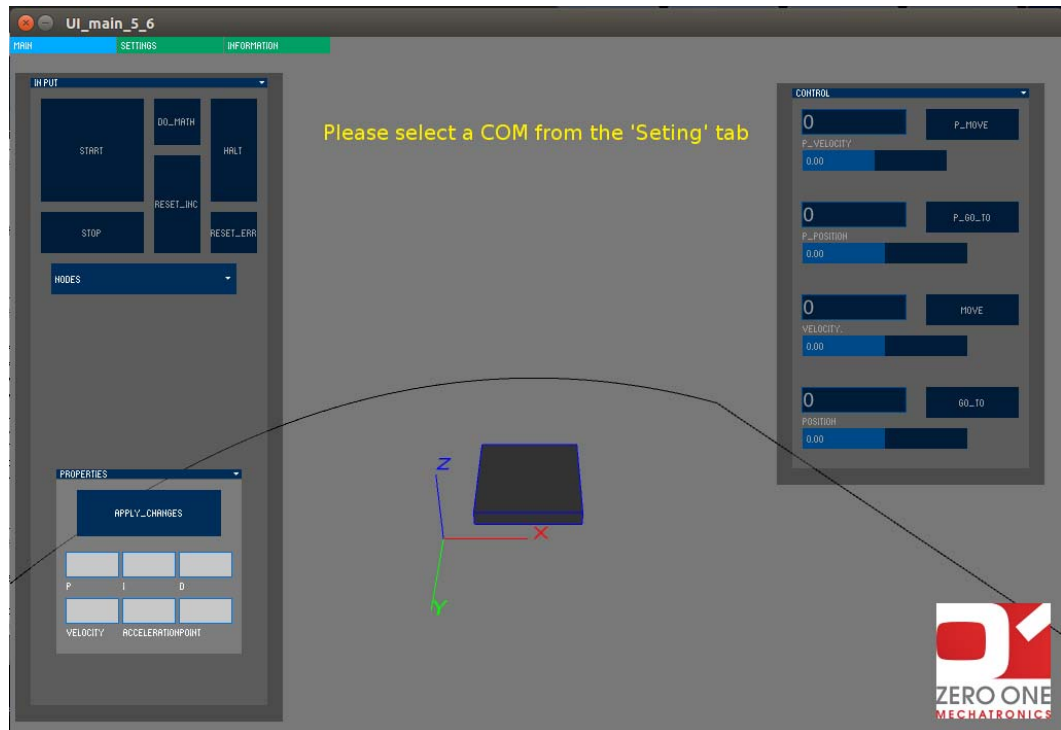
#### 5. 01Robot\_Controller

We are going to show a few examples of how to use 01Robot\_Controller's main functionalities. Specifically:

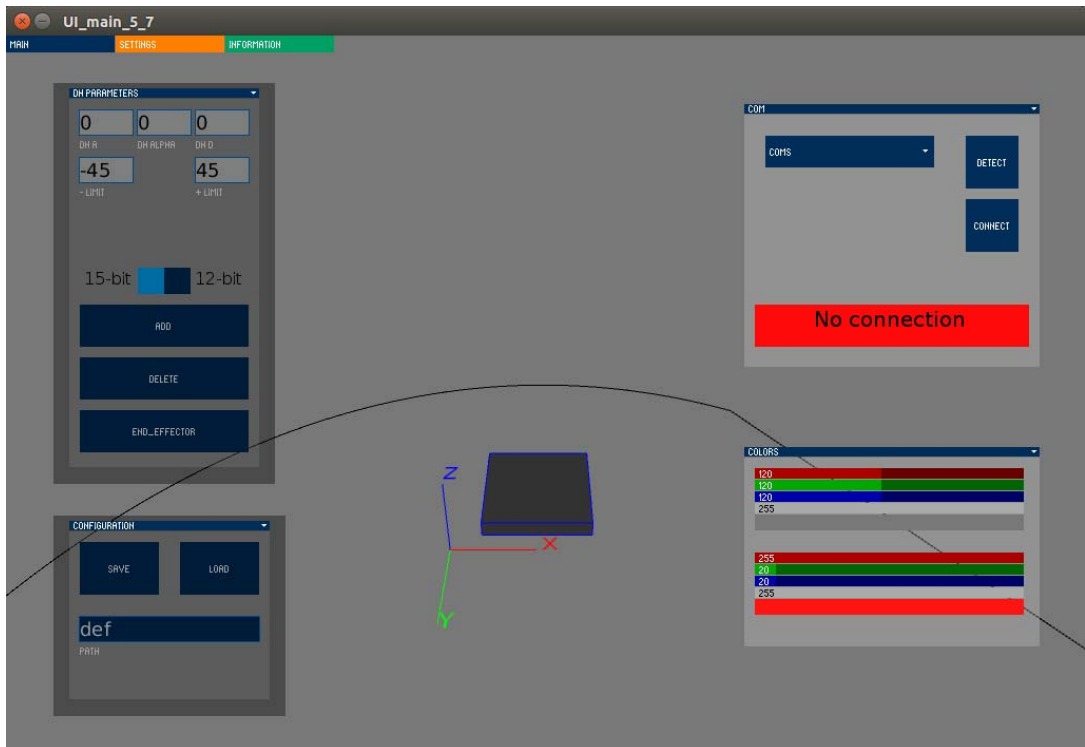
- Connect to the Arduino
- Design the open-chain robot
- Control your robot

##### 5.1. Connect to Arduino

When opening the application you will be presented with the following screen:

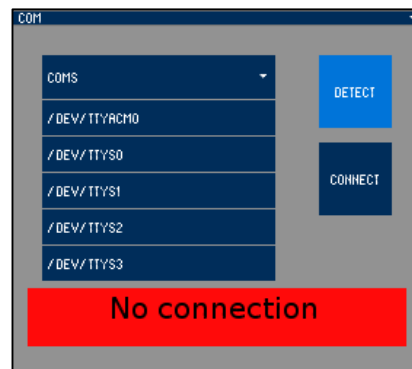


This is the “Main” tab. You can indicate in which tab you are from the up-left corner tab menu. Go to the “Setting” tab. You will see the following screen:

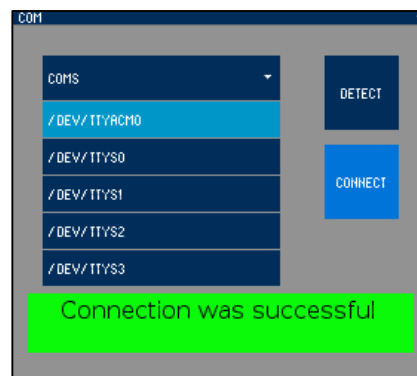


On the right you will see the “COM” options.

First click on Connection. This will present all serial devices connected to your computer.



Then select your Arduino COM and click connect. If the message below the buttons says “Connection was successful” and the red color becomes green, the connection between the computer and the Arduino has been successfully installed.



## 6. Design your robot

You can input your robot's design by using the Denavit–Hartenberg parameters. You will see under the “Settings” tab, on the left, a DH PARAMETERS region. Here you have 5 fields to fill in.

- DH A → The a parameters relative to the previous frame (in cm)
- DH ALPHA → The alpha parameters relative to the previous frame (in degrees)
- DH D → The D parameter relative to the current frame (in cm)
- -LIM → the lower limit of the joint (in degrees)
- +LIM → the higher limit of the joint (in degrees)
- The toggle button allows the user to select between that 15-bit and 12-bit version of MAGENC.

**Note:** Since we have only rotational joints,  $\theta$  is by default our variable.

After you have added your parameters, click on ADD. You will see in the middle of the screen a 3D joint representation.

By clicking DELETE the last joint is always automatically deleted.

The END\_EFFECTOR just adds the frame of the end effector relative to the last joint frame. The location of the end effector is determined by the DH A and DH D parameters.

***The “Lim +” and “Lim -” determine the higher and lower limit of the mechanical designee from its home position. The limits are specified in degrees. Once the joint reaches its limit, a “hold” command is send to the specific motor. In this case, press the “STOP” button, move the robot to its home position and press “RESET\_INC”.***

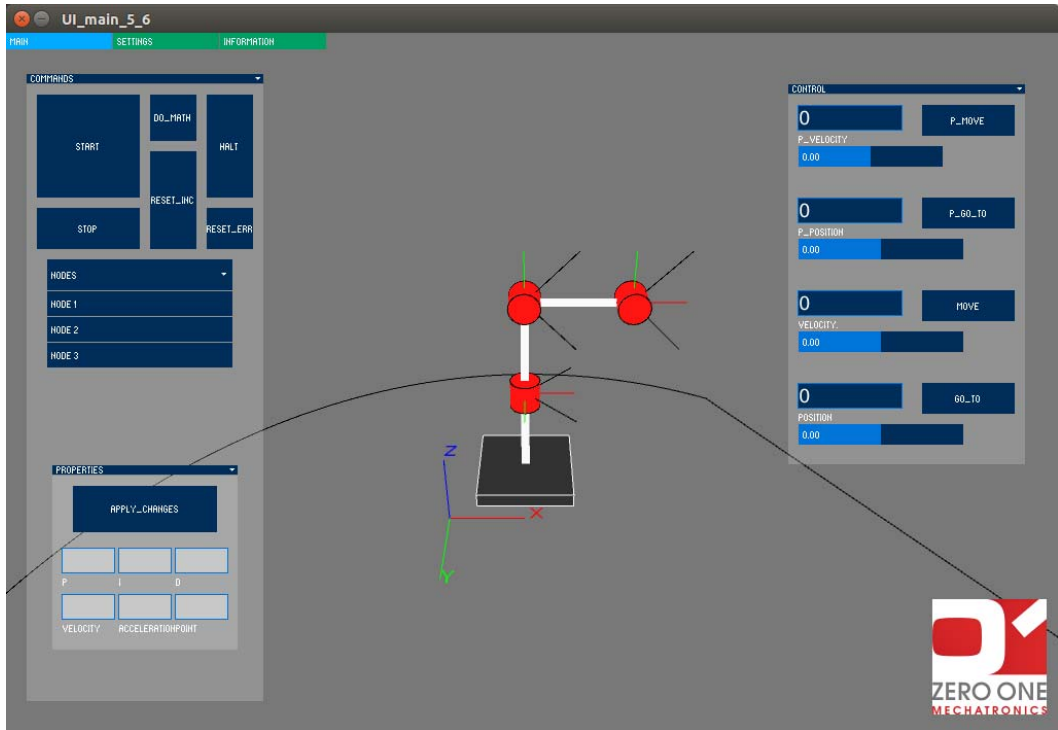
### 6.1. Saving and Loading robot configuration

It is possible to save and load your robot. After you have added all your joints, go to the “configuration” area. There specify a name for your file in the “path” textbox and then press “Save”. A folder named “saves” will be created in the same location as your .exe file (if this is your first save). In that folder, your file is saved as a .XML file.

If you wish to load a file, simply type the files name in the “path” textbox and press “Load”. After you have loaded a file, you can freely add or delete joints.

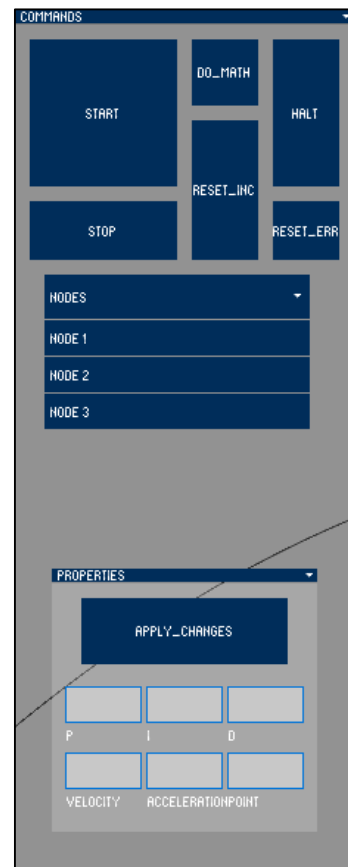
## 7. Control the robot

Under the current version, the application can only control individual joints. Go to the Main tab now.



On the left side the main command panel can be seen:

- **START** → Starts all motors. (command: *broadcastStart*)
- **STOP** → Stops all motors. (command: *broadcastStop*)
- **RESET\_INC** → Resets Incremental position of all motors. (command: *resetIncrementalPosition*)
- **HALT** → Will “halt” all motors (command: *halt*)
- **RESET\_ERR** → Resets errors for all motors (command: *resetErrors*)
- To see the properties, change the properties or send control commands to an individual joint, select it from the list under the “NODES”.





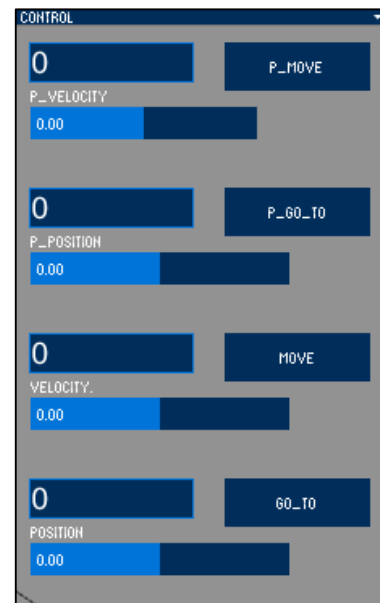
**PROPERTIES** → After selecting a joint from the “NODES” list, the following properties can be seen:

- P gain, I gain and D gain
- ProfileConstantVelocity
- ProfileAcceleration
- VelocitySetpoint

By changing the value of one of the aforementioned properties and clicking the APPLY\_CHANGES button, the new properties will be sent to the Supermodified controller.

On the right side the control panel can be seen:

- **P\_MOVE** → sends a *“profiledMoveWithVelocity”* command.
- **P\_POSITION** → sends a *“profiledMoveToRelativePosition”* command
- **VELOCITY.** → sends a *“MoveWithVelocity”* command.
- **POSITION** → sends a *“MoveToRelativePosition”* command



**Important Note:** To determine the value that will be sent, first put the desired value in the text box (next to the button). Afterwards, the slider underneath that can be used as a “fine adjustment” for the value. By pressing the button, the value on the slider is sent automatically (not the one in the text box).

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