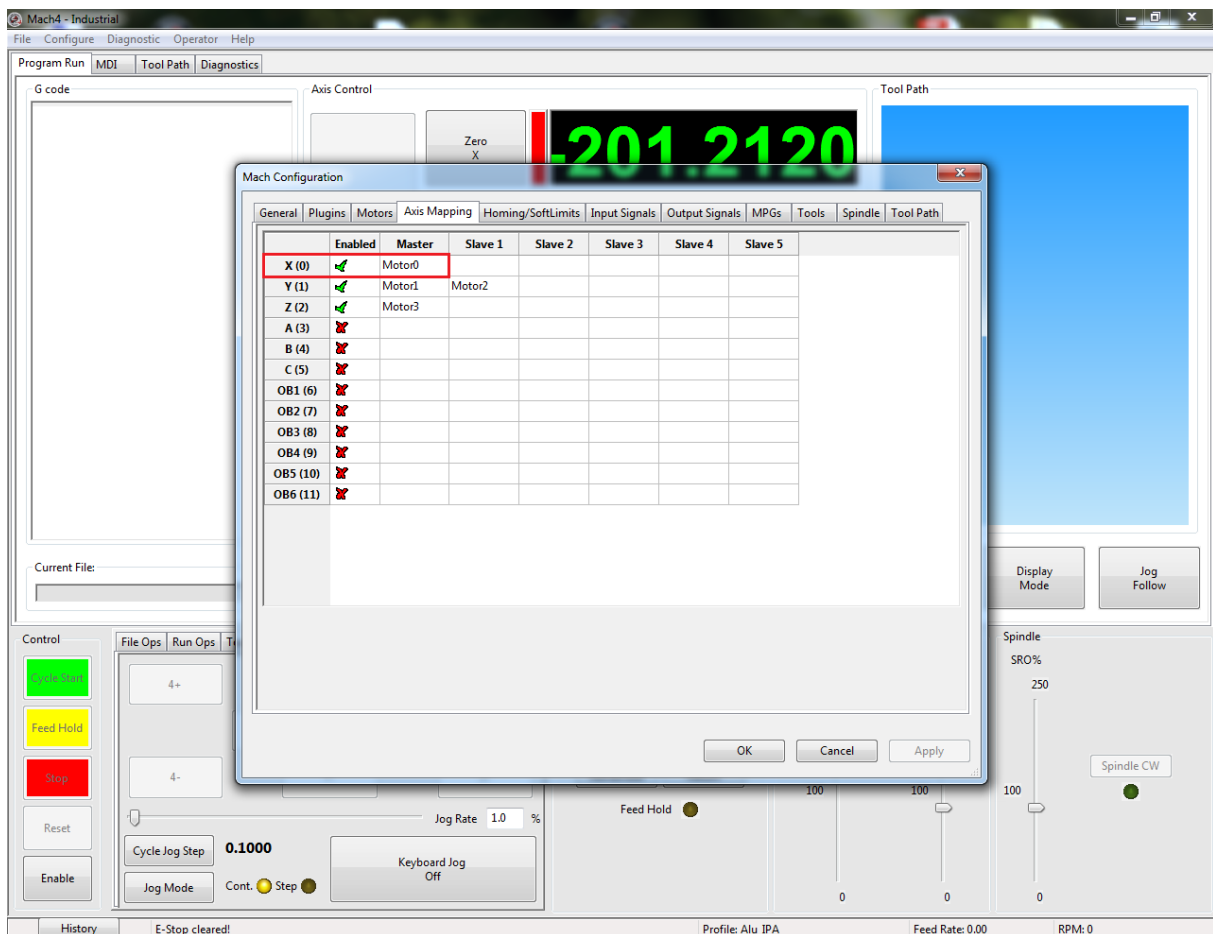


CSMIO/IP-A motion controller and Mach4

Quick start guide – Axis tuning

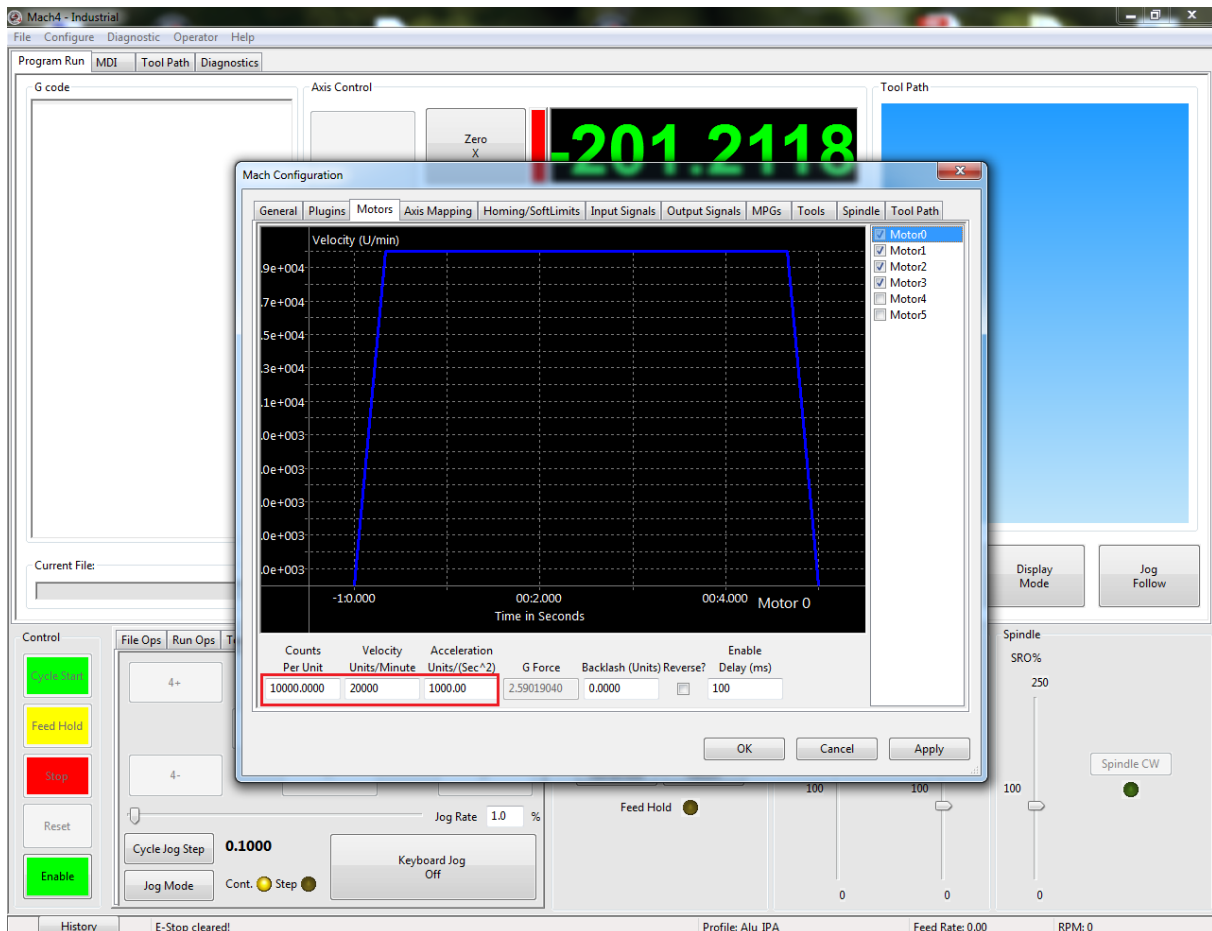
1) We start the configuration with Motor axis assignment.



As you can see in the picture above - the „Motor0” was assign to X axis (the guide is about X axis configuration). It means that the X axis will use an +/-10V analog output no. 0 and an encoder input no. 0. In the current plugin version the „Motor” is permanently assigned to an analog output and an encoder input. For example „Motor3” uses an +/-10V analog output no. 3 and an encoder input no. 3.

2) Next go to Motors tab and set „Motor0” parameters

In case of a machine was previously working under Mach3 the parameters marked in the picture are well known and we just have to copy them to Mach4.



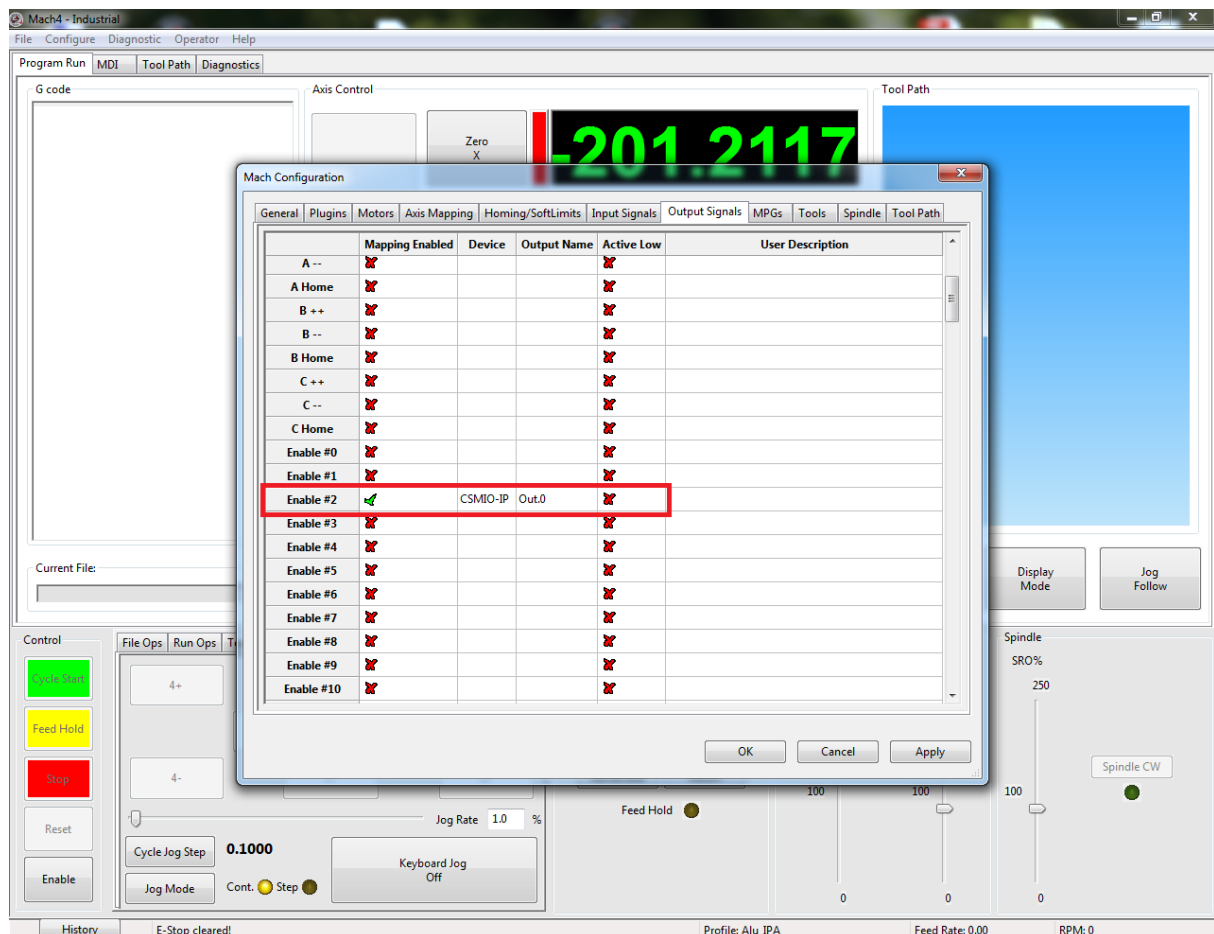
If you run a machine for the first time and you do not know performance then besides the „Counts Per Unit” you can set all the other parameters approximately.

- „Counts Per Unit” value of the parameter must be calculated accurately as precision of a machine and PID regulator operation depend on it.
- „Velocity Units/Minute” you can set the value approximately however it's recommended to calculate the value accurately to not force a motor.
- „Acceleration Units/(Sec^2)” value of the parameter should be adjusted experimentally. We recommend to start at low values (about 100 – 200) and increase the value step by step watching servo drives operation parameters.

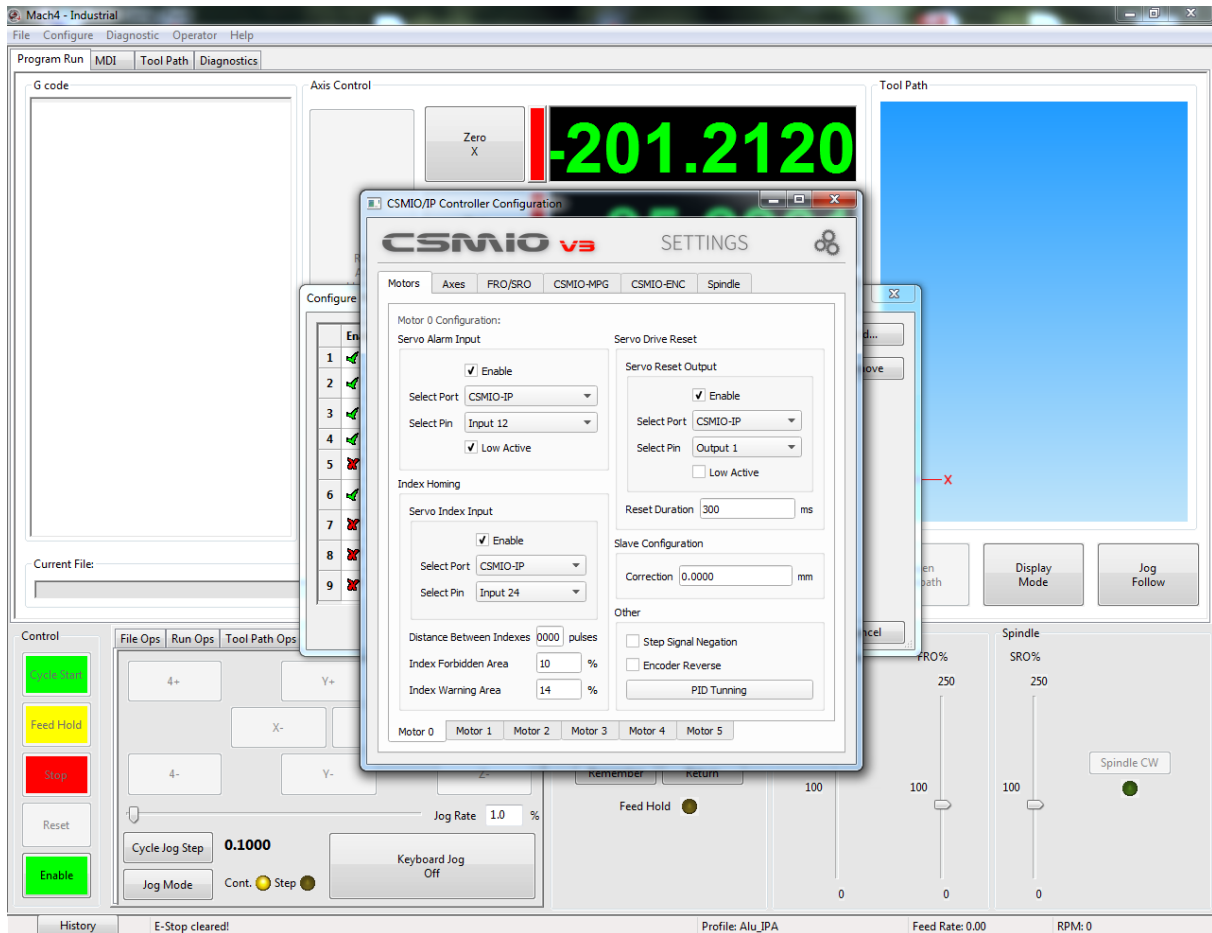
After every change of „Counts Per Unit” and „Acceleration Units/(Sec^2)” parameters value you should tune an axis again.

3) In „Output Signals” tab set „Enable” signal

In Mach4 you can set delay for Enable signal - you should remember about it in case of servo drives that need very long time to activate.



4) Go to plugin configuration on „Moto0” tab and set the following signals and functions.



- „Servo Alarm Input” is standard signal activated by a servo or stepper drive at the moment of an error or a failure.
- „Servo Drive Reset” is standard signal for servo drive reset. As Mach4 has separate „Enable” signal for each Motor, plugin has separate „Servo Reset” signal for each Motor.
- „Reset Duration” is „Servo Reset” signal duration parameter.

Warning!

After Mach4 activation you first get „Servo Reset” signal which lasts for the time defined by „Reset Duration” parameter and then „Enable” signal is activated.

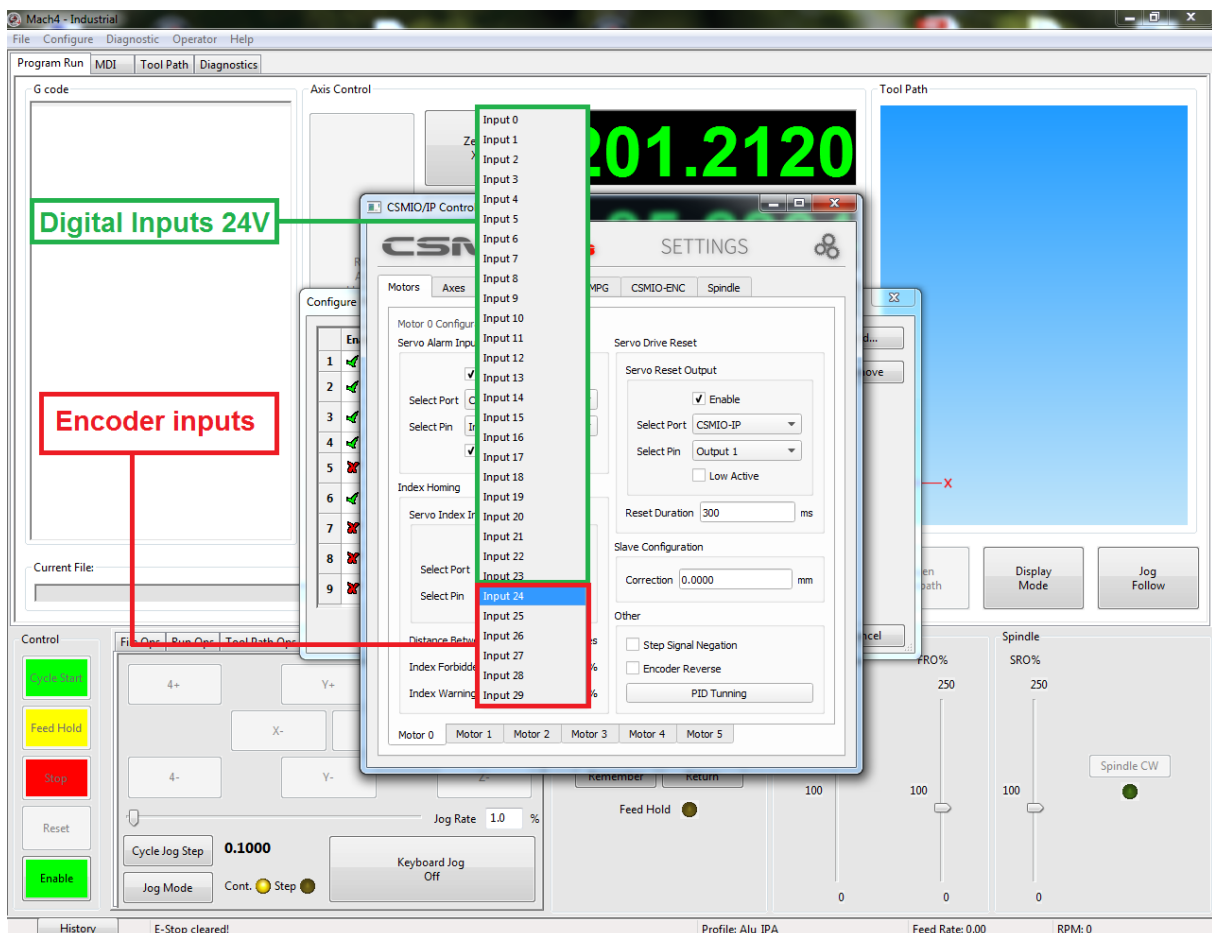
You can use „Reset Duration” parameter without using „Servo Reset” signal. In this situation „Reset Duration” parameter is the delay that delays „Enable” activation.

- „Index Homing” - this signal is generated by an encoder or a linear scale which in connection with a common mechanical or inductive switch signal provides very accurate axis homing (you can skip configuration of this signal and do it later).

The current plugin version provides index signal reading through standard 24V digital inputs (inputs 0 to 23) and also through encoder inputs (24 to 29).

Selecting input number 24 means that there will be used index signal from an encoder input no. 0.

Selecting input number 29 means that there will be used index signal from an encoder input no. 5.





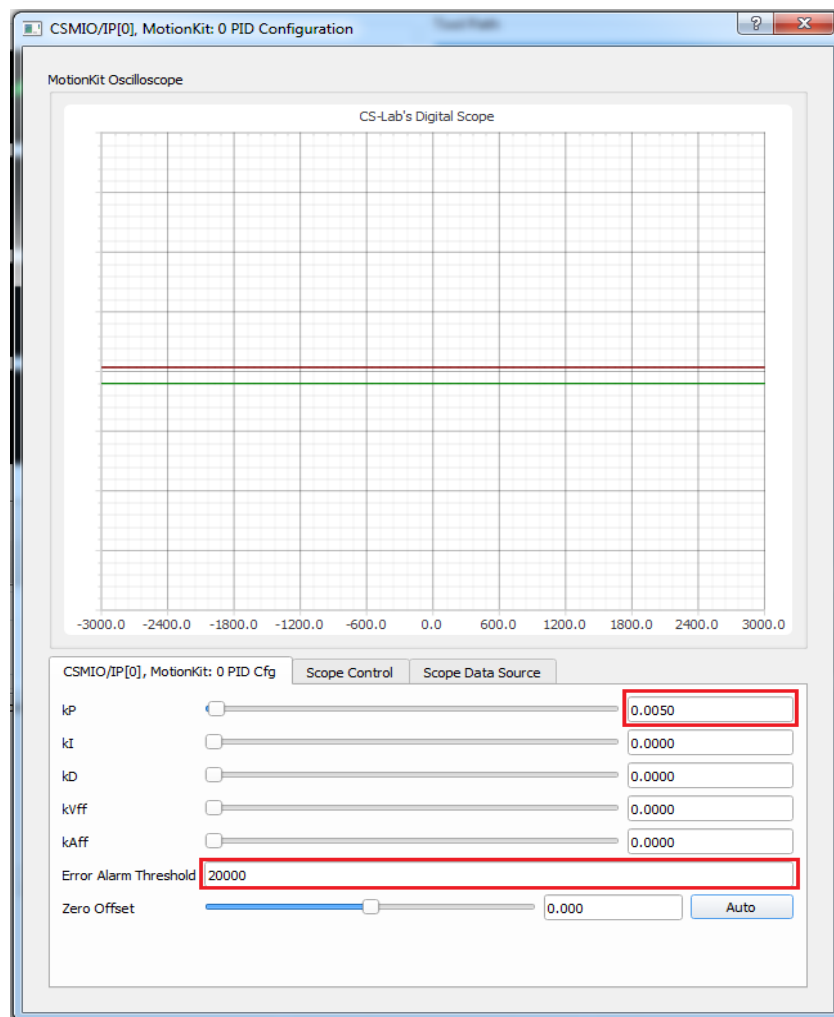
To make homing on index signal safe you should also set another three parameters that watch over the homing process.

- „Distance Between Indexes” encoder pulses number per one rev. or distance expressed in pulses between index signal in case of a linear scale. Setting this parameter you should remember to include all four edges of the signal.
- „Index Forbidden” is minimal distance kept between index signal and switch signal. The distance is expressed in percentages of „Distance Between Indexes” parameter. If the distance between index signal and switch signal is shorter a machine will be stopped emergency.
- „Index Warning Area” is minimal distance that must be kept between index signal and switch signal. The distance is expressed in percentages of „Distance Between Indexes” parameter. If the distance between index signal and switch signal is shorter you will get warning message about to short distance.

5) Initial PID loop configuration

Initial PID loop configuration will help you to assess whether encoder direction is correct. To go to PID loop manual configuration window press „PID Tuning” in the window you were using previously. In the window you get set only two parameters:

- „Error Alarm Threshold” - a parameter of maximal following error that can be done by an axis during its work. The parameter should be (initially) from $\frac{1}{4}$ to $\frac{1}{2}$ of encoder pulses number including all four edges. It's not recommended to use higher values as there is a risk of collision in case of incorrect encoder counting direction.
- „KP” parameter is PID loop proportional control term gain. We set the parameter to low value to avoid strong axis jerking in case of incorrect encoder direction. We used 0.005 value. For very heavy axes you can use a bit higher value.



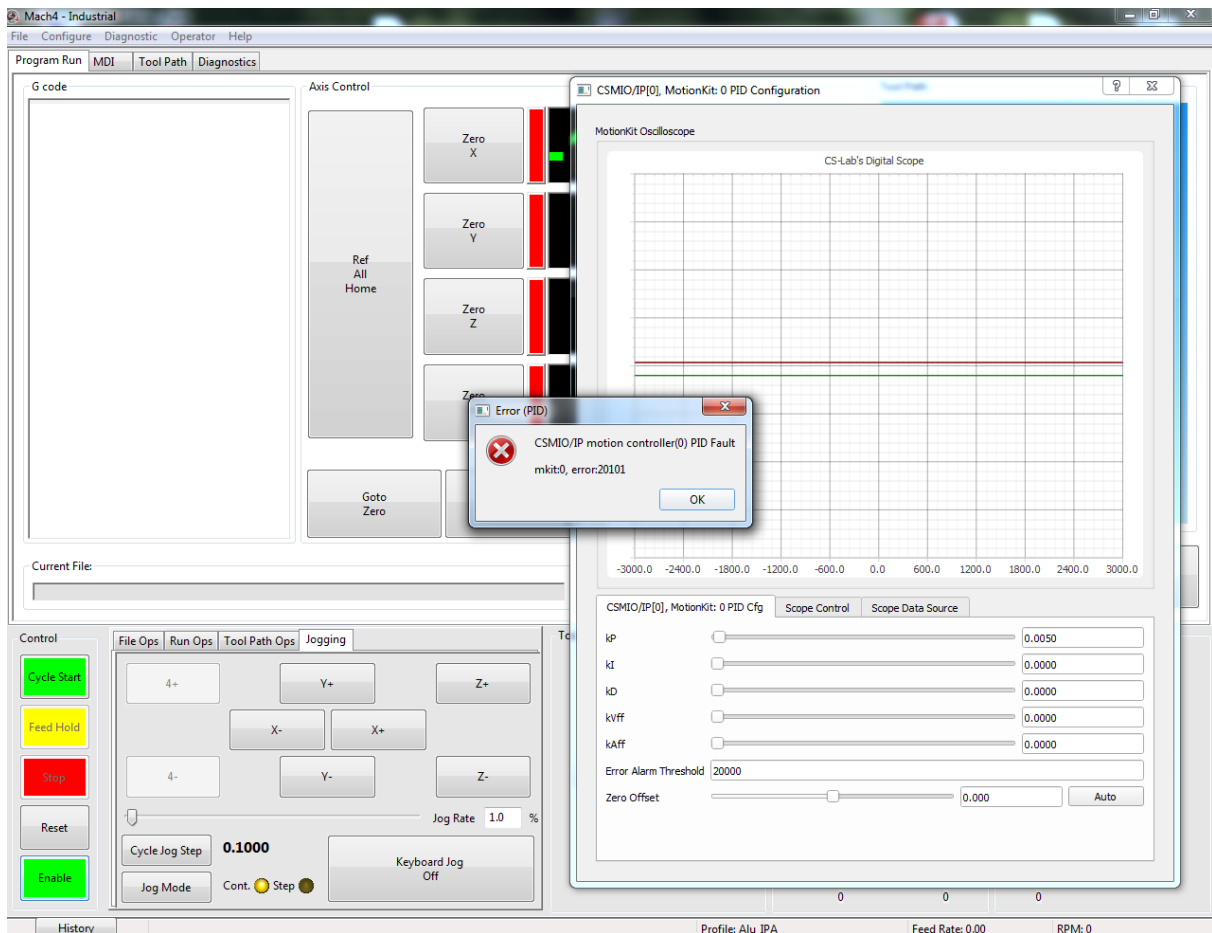
6) The first servo drive run

WARNING!

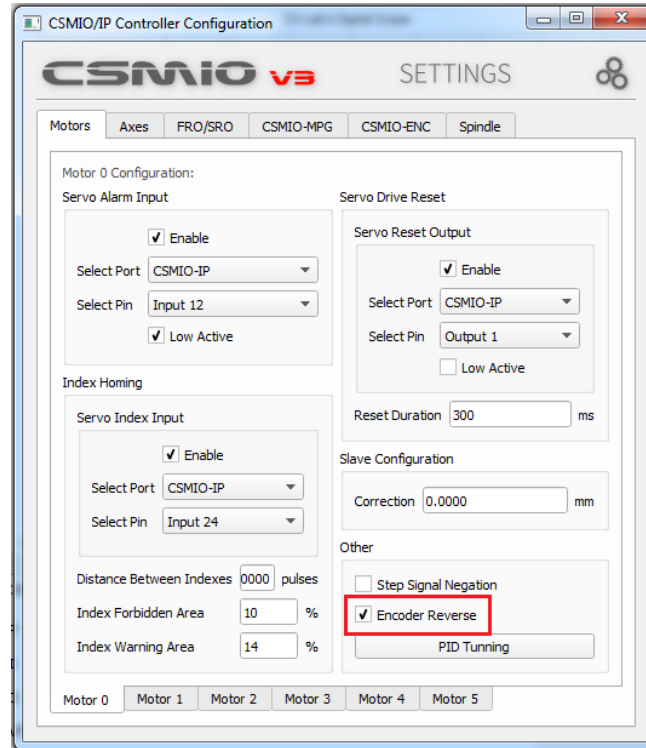
Before taking further steps described in this point you should set your servo drives first. PID current and velocity loop in servo drives must be tuned.

As we got here without problems we can now press Enable button on Mach4 main screen to activate our servo drive.

If after a fraction of a second we hear axis hitting and you get „PID Fault” on Mach4 screen then certainly the encoder direction set incorrectly.

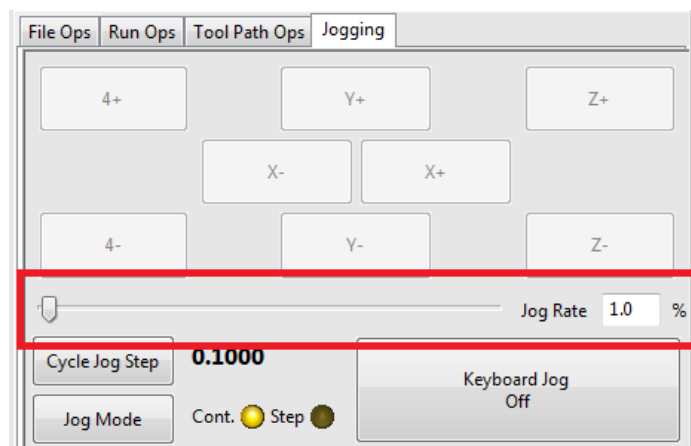


To change the direction, go back to the window we used previously (below) and select or deselect „Encoder Reverse” function.



After that start Mach4 again, if the initial settings of the parameters from point 5 are accurate and servo drives are connected and set properly then they should from now on they should keep their position.

To verify if a servo drive keeps position and can move an axis you can use „Jog” function. You have to remember that the servo drive is set initially and can't do any aggressive or fast moves so you should use only 1% of „Jog” speed.

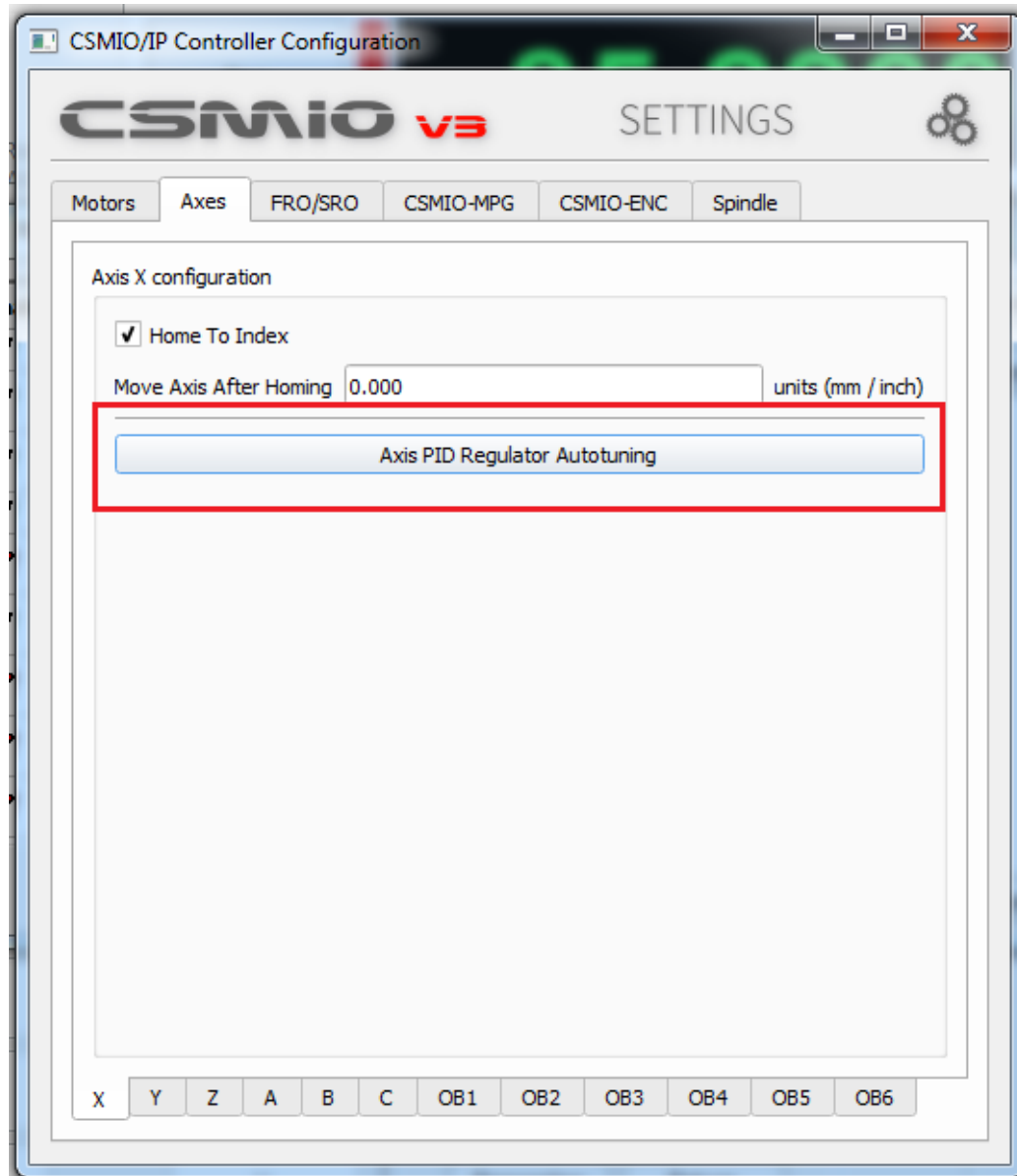




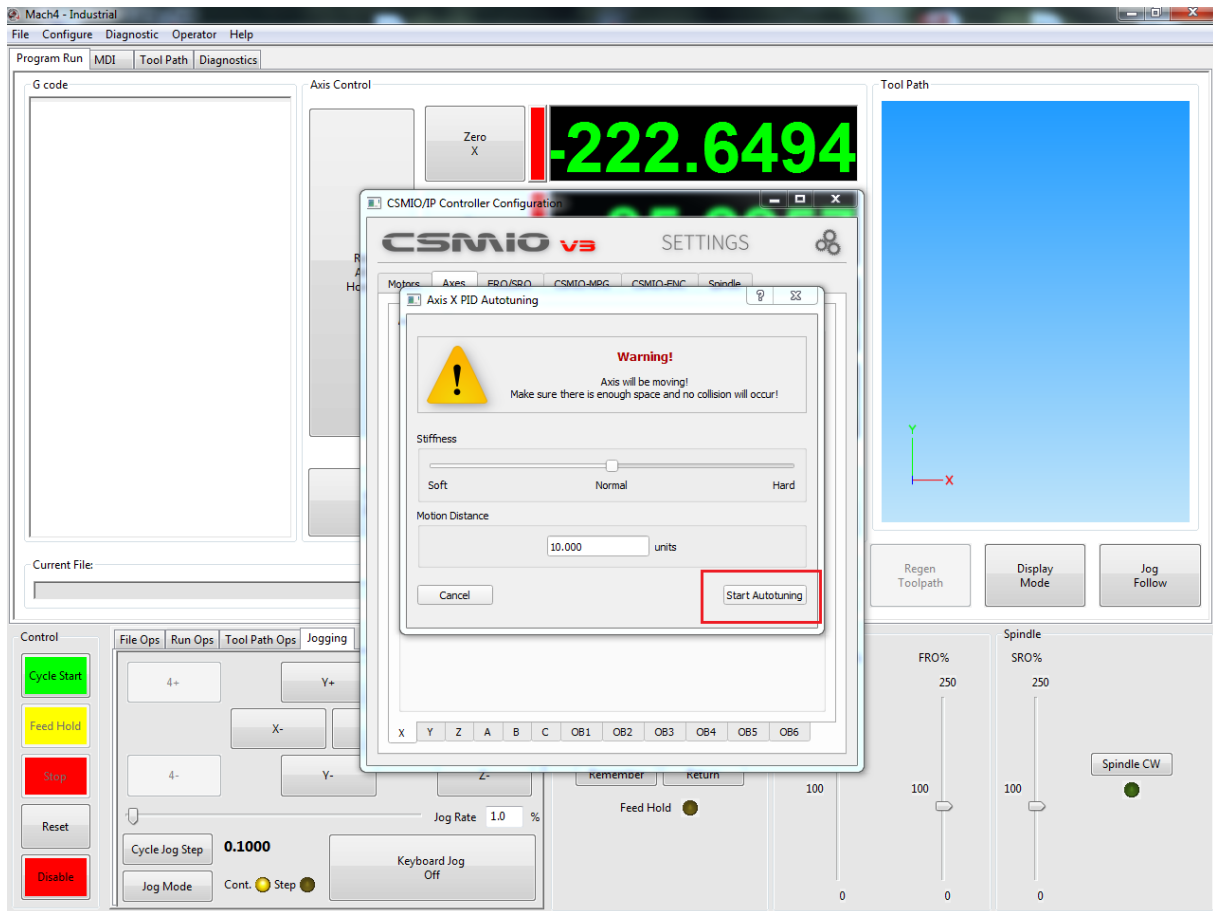
7) „Auto Tunning”

If the point 6 is done and you axis moved in „Jog” mode then you are ready to run „AutoTuning” function.

To run the function, go to „Axes” tab and press „Axis PID Regulator Autotuning”.



After pressing „Axis PID Regulator Autotuning” you will see your destination window where you run Auto tuning function. Before you start „Autotuning” function you should activate Mach4 by pressing Enable on the main screen. After that „Start Autotuning” button will be backlit.





After you press „Start Autotuning“ you will see a window that shows process of finding all values needed for accurate PID loop working.

