CS LAB s.c.
ElectronicLaboratory

simCNC
motion control software

Quickstart guide

Content

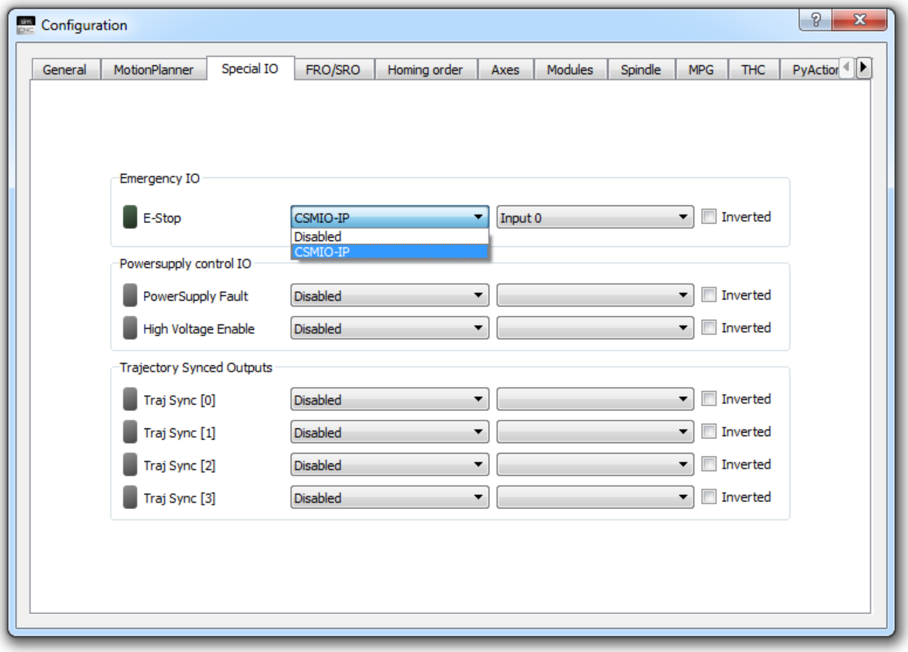
I. E-STOP signal configuration

Select as follows „Configuration > Setting > Special IO"

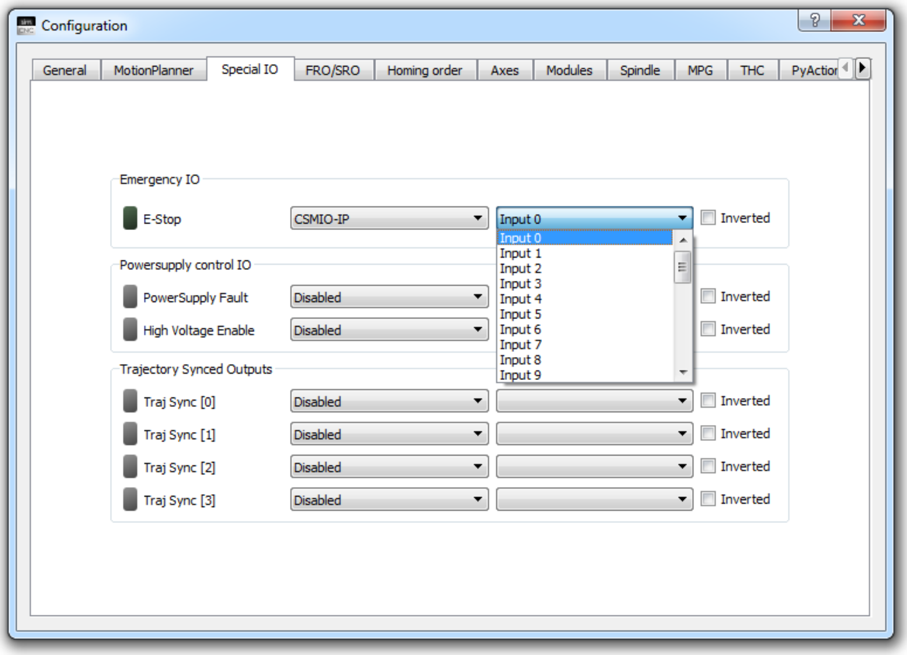
The first thing you should do is to set the E-Stop signal. Using simCNC software isn't possible without this setup.

E-STOP - is an input signal (digital 24V) for an emergency stop.

a) Select from the list a CSMIO/IP controller with the „E-Stop" signal connected.

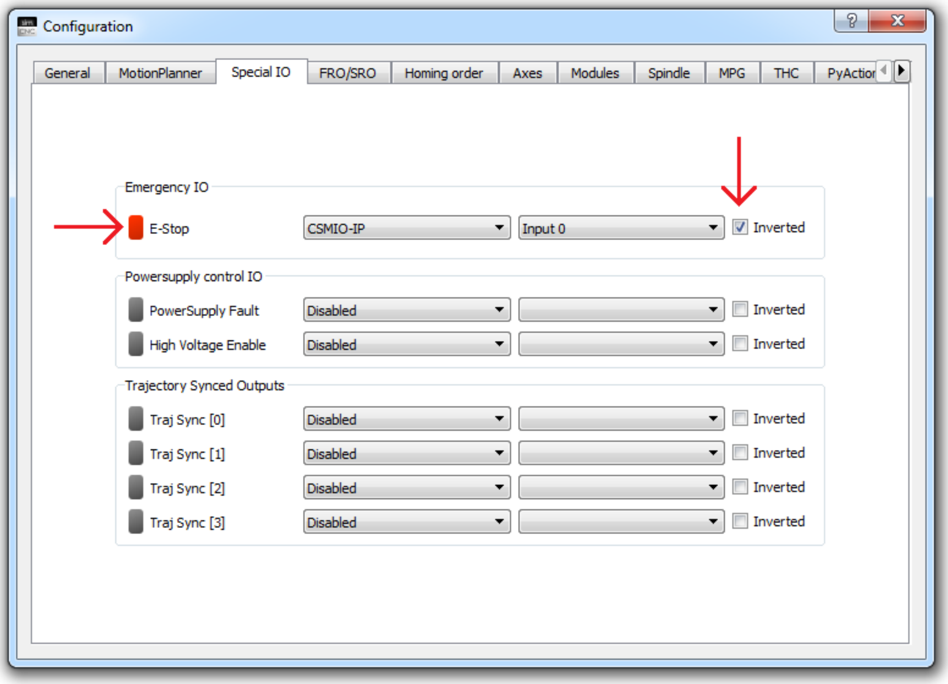


b) Select from the list a digital input number with the „E-Stop" signal connected.



c) If the E-Stop button is NC type - select „Inverted”

INVERTED – is an option for the logic status of digital input and output signals reversal. It means that the digital signal in low status is seen by simCNC as in high status and conversely.



In the picture above you can see that each signal has a light that shows its status. The light presents the status as simCNC sees it, so it includes the „Inverted”.

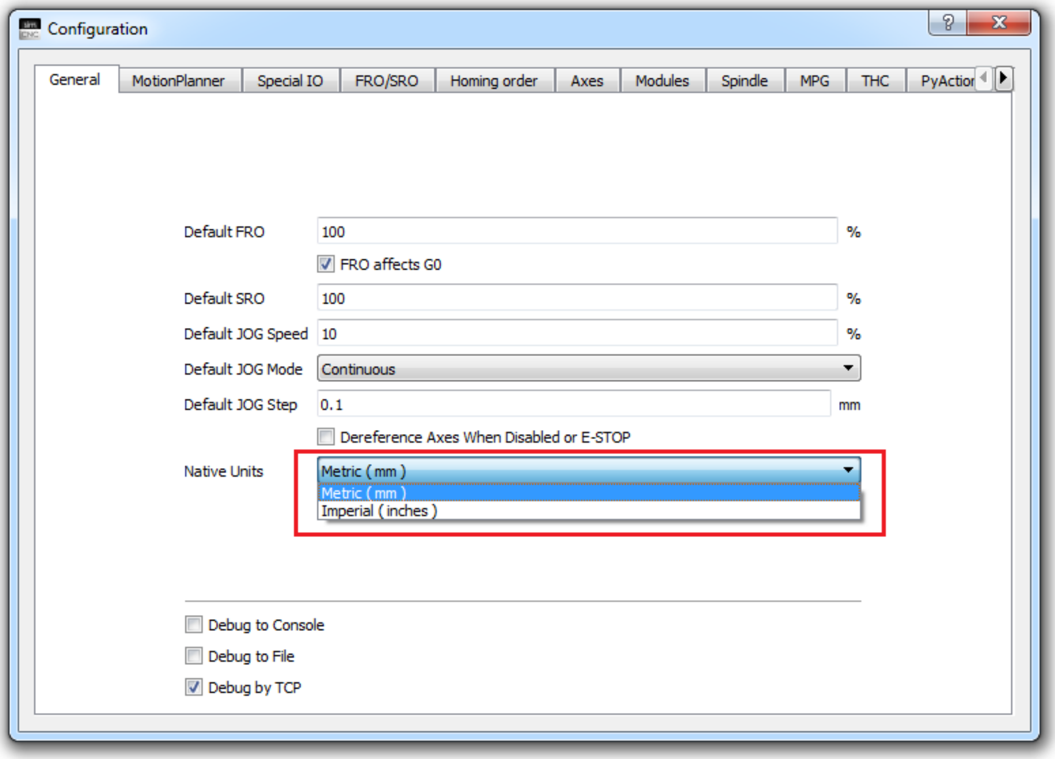
ATTENTION!

Because of safety reasons it's recommended to use NC type „E-stop” button and limit switches. They provide closed circuit which in case of breaking stops a machine. The „E-stop” signal can be connected only to the main controller.

II. Native unit settings

Select as follows „Configuration > Settings > General"

Before further setup, it's worth to verify if simCNC software setup provides the correct unit of length (mm / inches). Go to the window shown below and verify „Native units" settings.

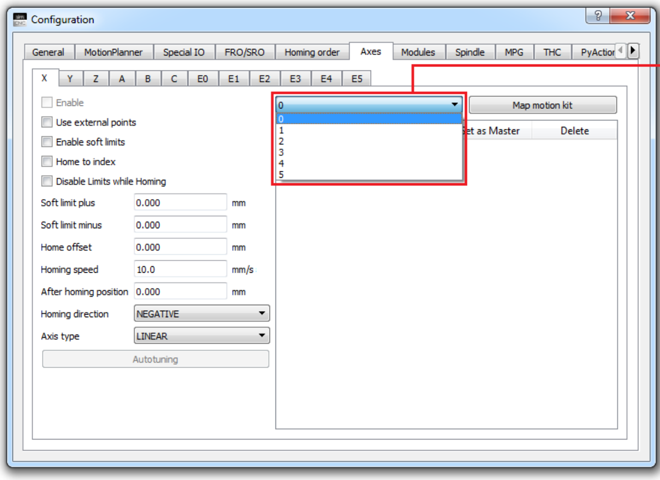


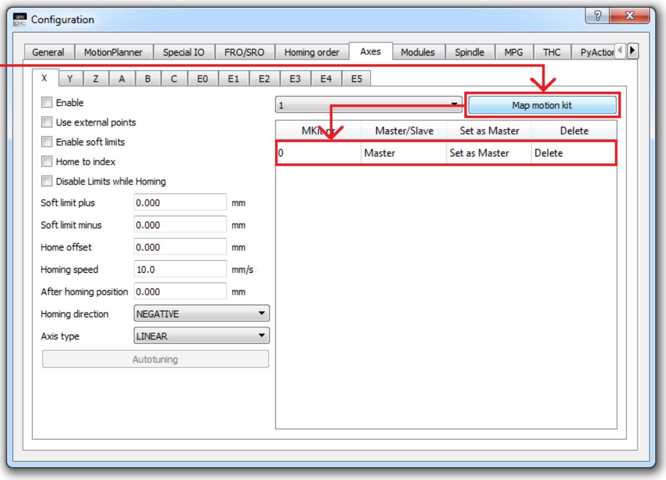
Using incorrect native unit will cause many issues in further setup stages of simCNC software. It's because the native unit affects many other parameters of simCNC software. The first and most noticeable problem may be lack of precision.

III. Configuration of an axis

Select as follows „Configuration > Settings >Axes> X"

a) Assign a proper „MotionKit" to the X-axis. Select the „MotionKit" number from the list and press „Map motion kit".





MOTIONKIT – is a set of settings of a single drive and its signals. „MotionKit" includes settings of:

1) Drive („Steps per unit", „Velocity", „Acceleration" and „Jerk")
2) Drive signals („Drive Enable", „Enable delay", „Drive Reset", „Reset duration", „Drive fault" and „Index")
3) Limit signals (Limit++, Limit-- and Homing)
4) Homing on index („Steps between index", „Forbidden range..." and „Warning range...")

You should remember that the „Motionkit" number in case of CSMIO/IP-M and CSMIO/IP-S controllers also indicates step/dir channel number. In case of a CSMIO/IP-A controller, it indicates a +/-10V analog output channel number and an encoder input channel number.

MotionKit 0

STEP/DIR controlling signals connector

PIN number	Details
1	DIR[0]+
2	STEP[0]+
14	DIR[0]-
15	STEP[0]-

CSMIO/IP-S i CSMIO/IP-M

MotionKit 0

Encoder inputs connector (0 / 1 / 2)

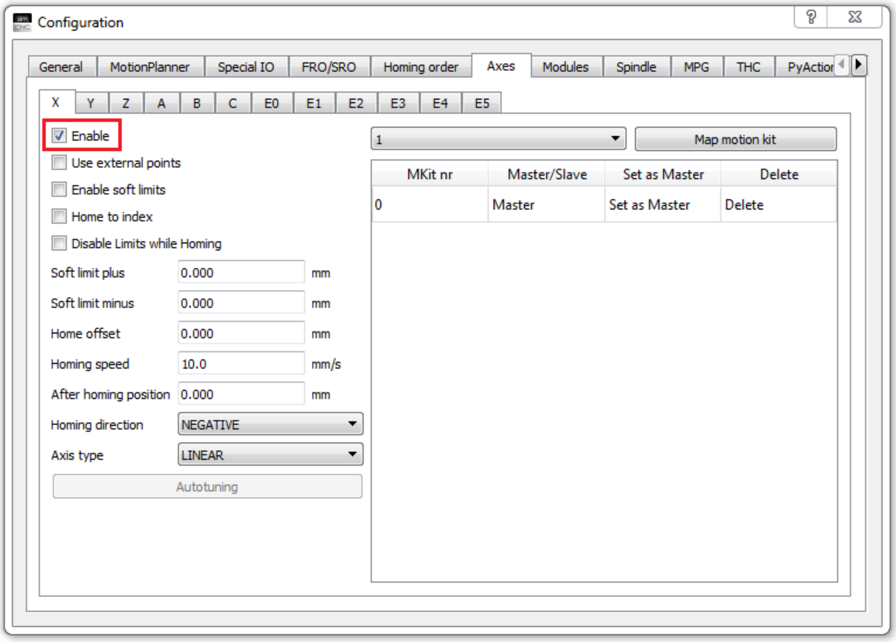
PIN number	Description
1	Enc. Ch0 A+
2	Enc. Ch0 B+
3	Enc. Ch0 I+
14	Enc. Ch0 A-
15	Enc. Ch0 B-
16	Enc. Ch0 I-

Analog inputs/outputs connector

PIN number	Description
1	Analog output Ch0 (+/-10V)
14	GNDCh0

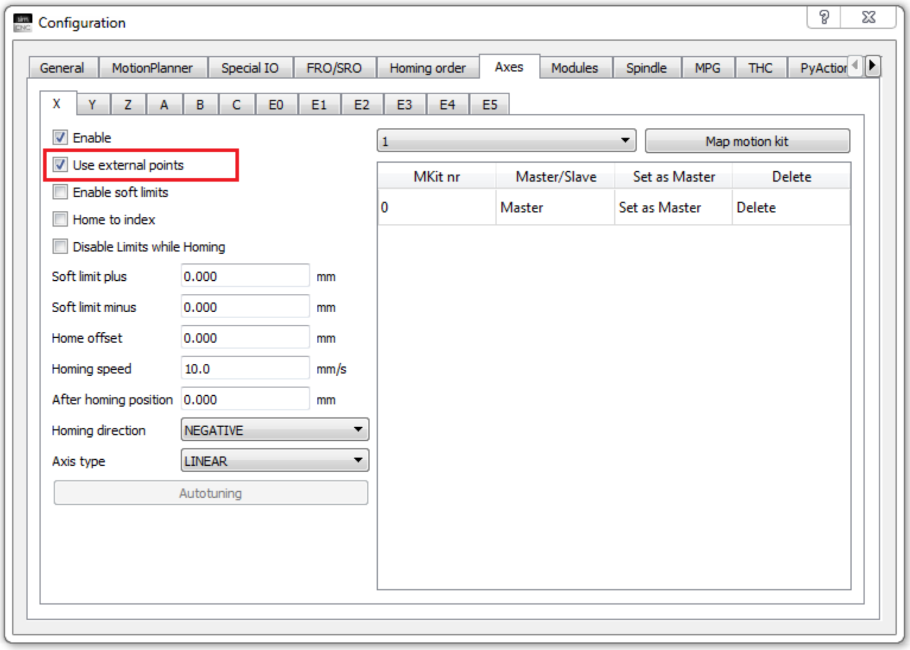
CSMIO/IP-A

b) Select „Enable” option.



By selecting this option, we inform simCNC software that it has at its disposal a physical axis to which it can send motion commands.

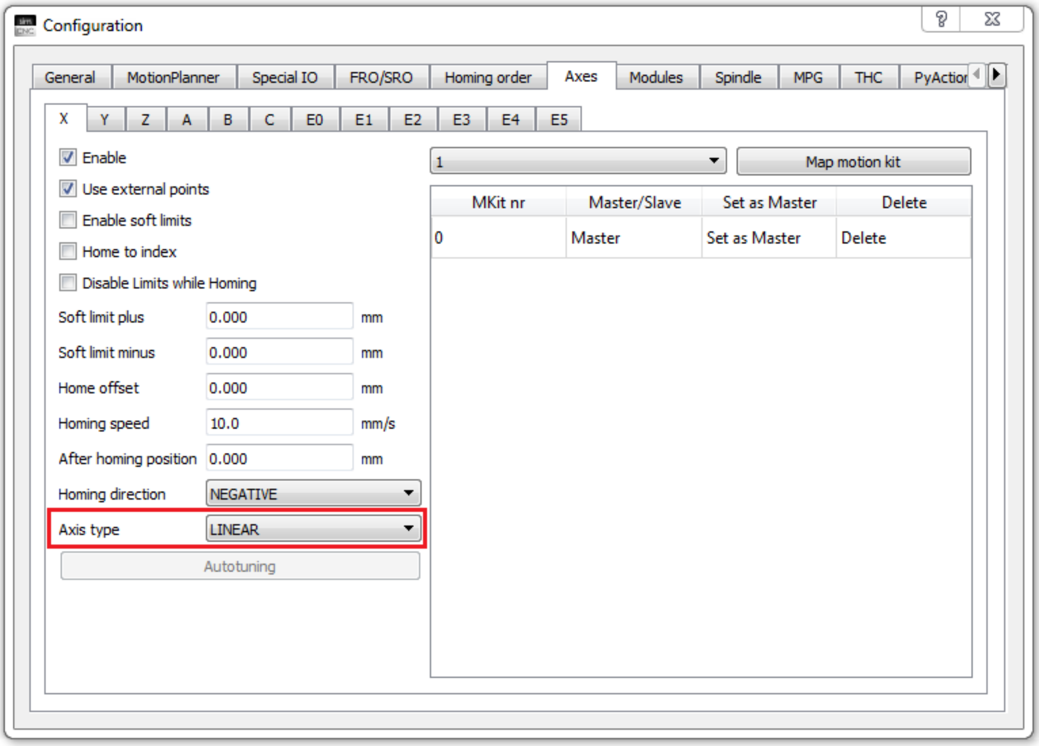
c) Select „Use external points” option.



By selecting this option, the X-axis will be assigned to the motion planner. It means that the X-axis, altogether with other axes assigned to the motion planner, will execute the gcode. The axis can also be used in JOG, MPG and Python macros mode.

If we won't select this option the X-axis can be used outside the motion planner. It means that the X-axis will be able to execute only Python macro commands, independently from other axes. The best example of using axes outside the motion planner is, e.g. part feeders or tool changers in a lathe.

d) Select axis type (linear or rotary)



If you select linear axis type the native units for the axis will be millimeters or inches. You should remember that when setting drive parameters as the parameter's units will be renamed as follows:

- steps/mm (resolution)
- mm/s (velocity)
- mm/s^2 (acceleration)
- mm/s^3 (jerk)

or

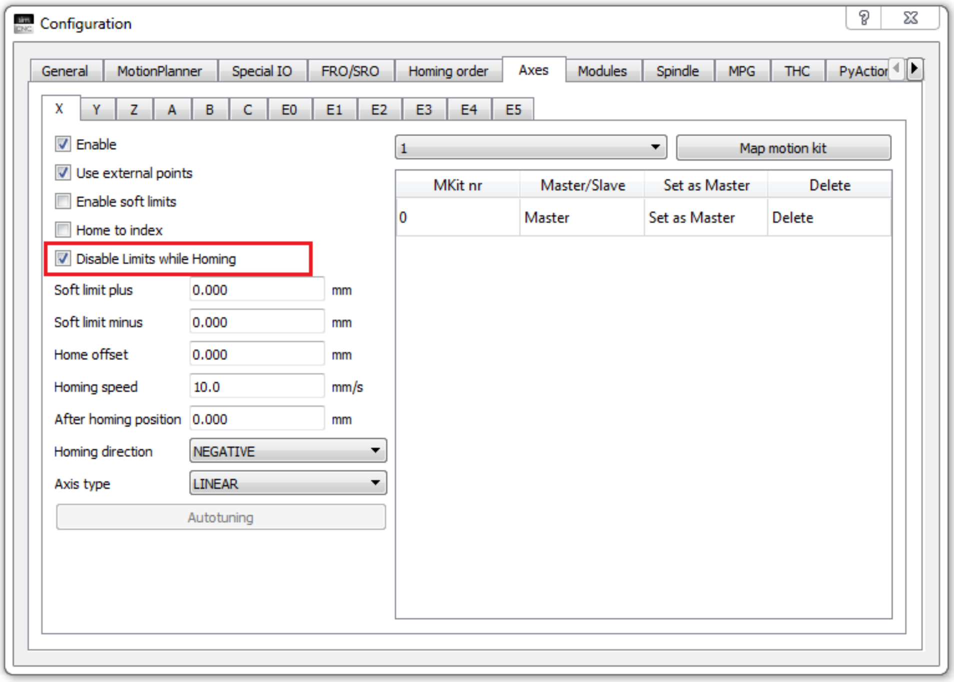
- steps/cal (resolution)
- cal/s (velocity)
- cal/s^2 (acceleration)
- cal/s^3 (jerk)

If you select rotary axis type, the native units for the axis will be degrees. You should remember that when setting drive parameters as the parameter's units will be renamed as follows:

- steps/degree (resolution)
- steps/s (velocity)
- degrees/s^2 (acceleration)
- degrees/s^3 (jerk)

Selecting rotary axis type for an A-axis enables tangential knife option.

e) Select „Disable Limits when Homing" option.



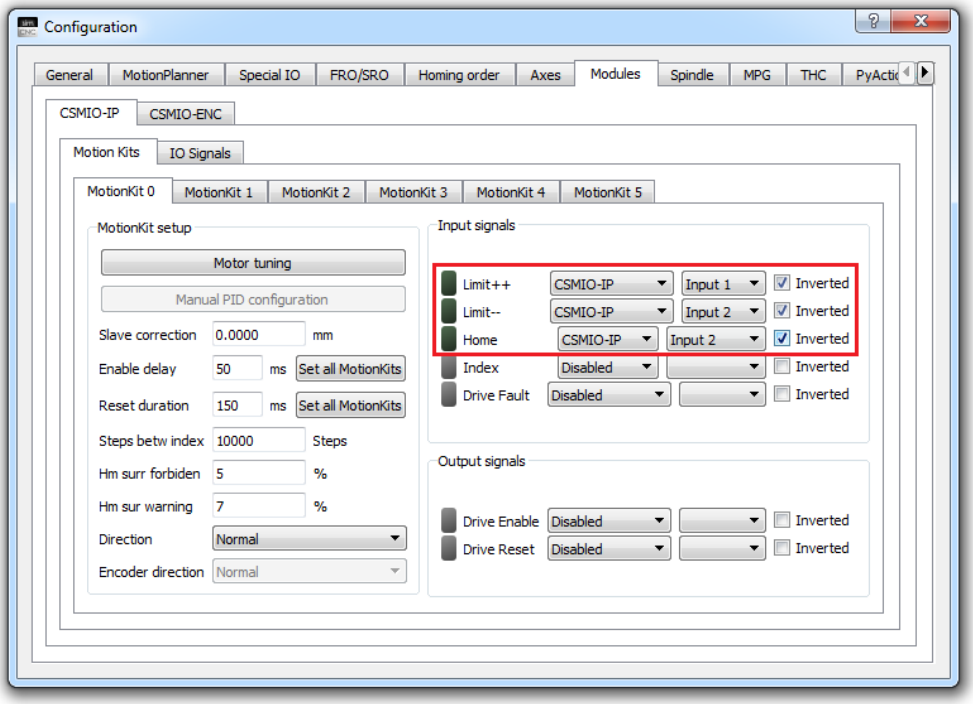
By selecting this option, limit switches will be ignored during axis homing. It enables to use two switches for one axis on both ends of the axis. In this situation, one of the switches is at the same time a limit switch and a homing switch. If the limit switches weren't ignored during homing then hitting a homing switch would activate a limit switch at the same time. This way there would always be the emergency stop of a machine during homing.

If the option isn't selected, the limit switches will be overseen during homing. It enables to use three switches for one axis, two limit switches on both ends of the axis and one homing switch placed between them. The advantage of this solution is that the axis will be stopped by a limit switch in case of a homing switch failure.

IV. MotionKit Configuration

Select as follows „Configuration > Settings > Modules > MotionKit 0"

a) Configuration of „Limit+", „Limit-" and „Homing" switches signal



The configuration is just the same as in case of E-Stop signal, described in the chapter I.

„LIMIT ++" – is an input signal (digital 24V) for an emergency stop. The signal limits axis movement in the positive direction.

„LIMIT --" – is an input signal (digital 24V) for an emergency stop. The signal limits axis movement in the negative direction.

„HOMING" – is an input signal (digital 24V) to determine axis reference point.

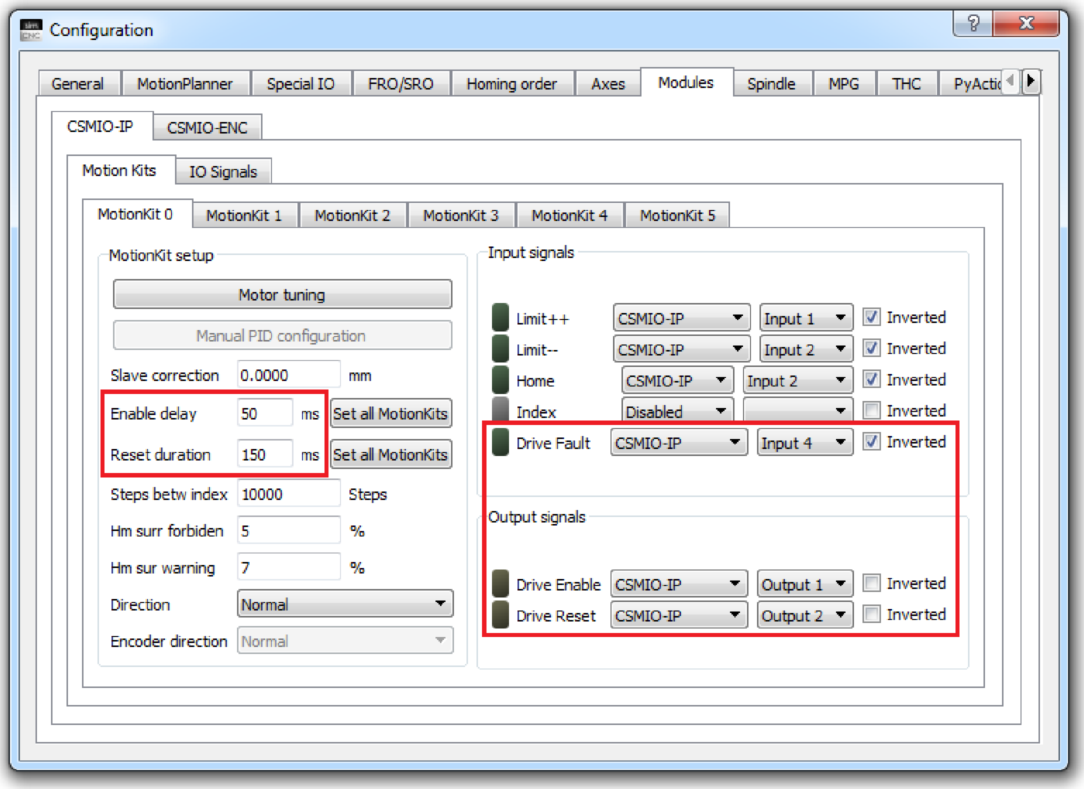
ATTENTION!

Because of safety reasons it's recommended to use NC type switches. They provide closed circuit which in case of breaking stops a machine.

The „Homing" signal can be connected only to a CSMIO/IP motion controller.

During the switches setup pay attention to Chapter III., Section e).

b) Configuration of signals and delays responsible for starting a drive



<u>„DRIVE FAULT”</u> – is an input signal (digital 24V) that activate emergency stop. The „Drive Fault” signal appears if:

– a drive is broken
– a drive is overloaded
– a drive is overheated
– max. following error was exceeded
– etc.

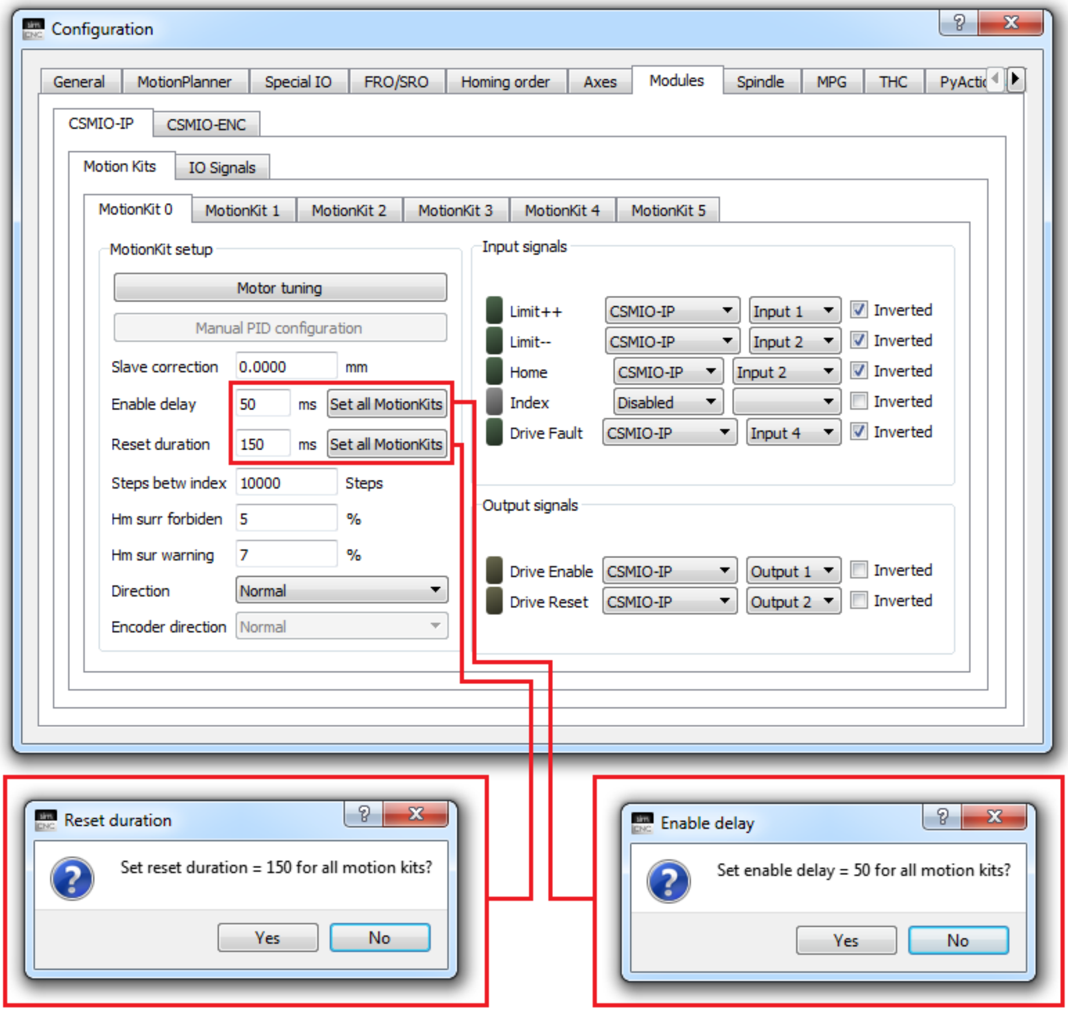
The signal is usually called „Servo Alarm” or „Servo Ready”. If a drive has both the signals you should check in a manual what they mean. It may show up that „Servo Ready” signal will be a better choice as it usually reacts to all unwanted statuses of the drive.
The „Drive Fault” signal, if possible, should be set this way to stop a machine if its wire was broken.

<u>„DRIVE ENABLE”</u> – is an output signal (digital 24V) which task is to activate a drive. The signal is usually called „Enable” and „Servo On”.

<u>„DRIVE RESET”</u> - is an output signal (digital 24V), which task is to reset a drive and delete its alarms. The signal is usually called „Servo Reset” or „Alarm Reset”.

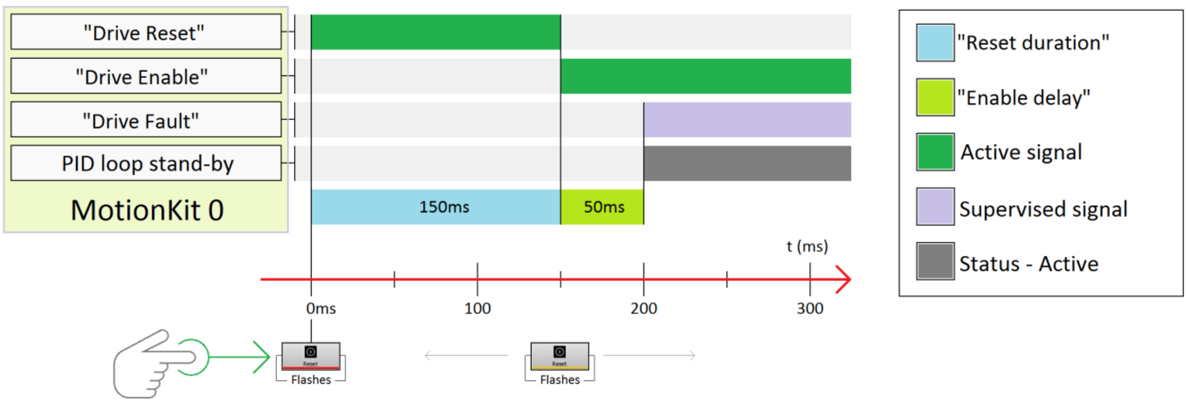
<u>„ENABLE DELAY”</u> – is a parameter that specifies the time in which a drive must be activated after it gets the „Drive Enable” signal.

<u>„RESET DURATION”</u> – is a parameter that specifies the time the „Drive Reset” signal is active. The time must be enough for the drive to reset and delete all alarms.



„SET ALL MOTION KITS” – these buttons are to set the same parameters value for „Enable delay” and „Reset duration” for all „MotionKit”.

In the picture below we can see how the process of drive activation presents. It shows all signals and delays described above.



The process of drive activation starts with „Drive Reset” signal activation. After the time indicated by „Reset duration” parameter, at the same time the „Drive Reset” signal is deactivated and the „Drive Enable” is activated. After the time indicated by „Enable delay” parameter the drive should be already active, so a CSMIO/IP controller activates PID loop and start controlling the „Drive Fault” signal.

ATTENTION!

Too low value of „Enable delay" and „Reset duration" parameters can lead to problems with starting the drive. Too high value of the parameters doesn't cause any issues unnecessarily prolongs the time simCNC software needs to be ready to work.

You should look for the amount of time a drive needs to reset and activate in documentation of the drive. If a manufacturer doesn't provide any values you can try and use default values: „Enable delay" = 50 ms and „Reset duration" = 150ms.

INFORMATION

All CSMIO/IP controllers are equipped with one PID loop for each „MotionKit".

c) Configuration of signals and delays responsible for starting drives of the same series

If drives we have are the same series, it's easier to set signals and delays responsible for starting the drives and also the manual connection of signals is simplified.

Signals settings

We start it by setting „Drive Enable" and „Drive Reset" signals only for one MotionKit, for keeping an order these can be a „MotionKit 0" signal.

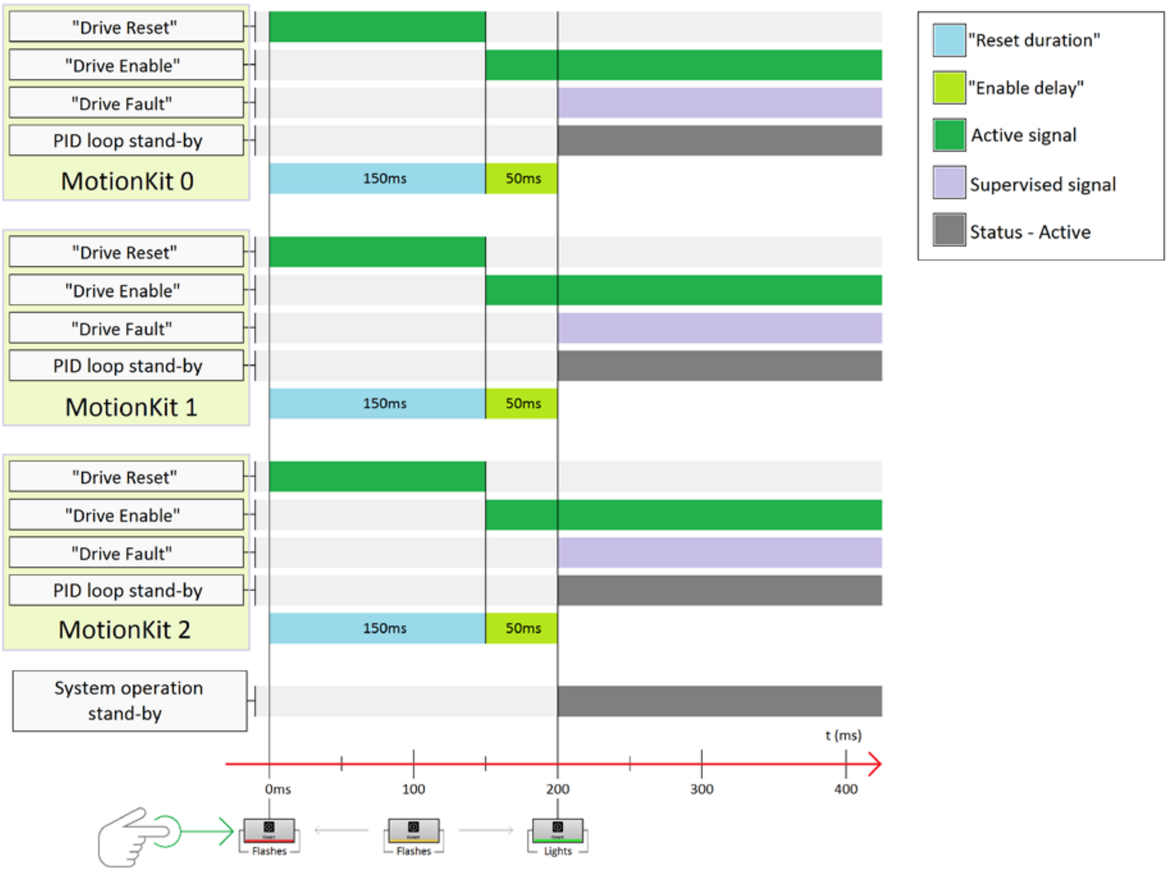
Delay settings

If we use the same series drives values of „Enable delay" and „Reset duration" parameters must be identical for all of them. That is why we set the values of the parameters only in „MotionKit0", and next we press both the „All Motion Kits" buttons. By pressing the buttons, we will copy ale the „Enable delay" and „Reset duration" parameters value to the others „MotionKit".

Signals connection

We connect all the drives to the chosen by us digital outputs of a CSMIO/IP controller which are set as „Drive Enable" and „ Drive Enable" signals in „MotionKit0". Signal branching is possible as all the drives require the same delay value.

In the next picture, we can see the process of starting three drives which require the same value of „Reset duration" and „Enable delay" parameters. You should notice that the control system goes into standby when all the drives are activated.



INFORMATION

The solution presented above saves a large number of digital outputs of a CSMIO/IP controller.

d) Configuration of signals and delays responsible for starting drives of various series

If we use drives of various series, the configuration of signals and delays responsible for the drives' activation and manual connection of signals requires a bit more work and attention.

Signals settings

We start it by setting „Drive Enable” and „Drive Reset” signals for each MotionKit, using separate digital outputs of a CSMIO/IP controller.

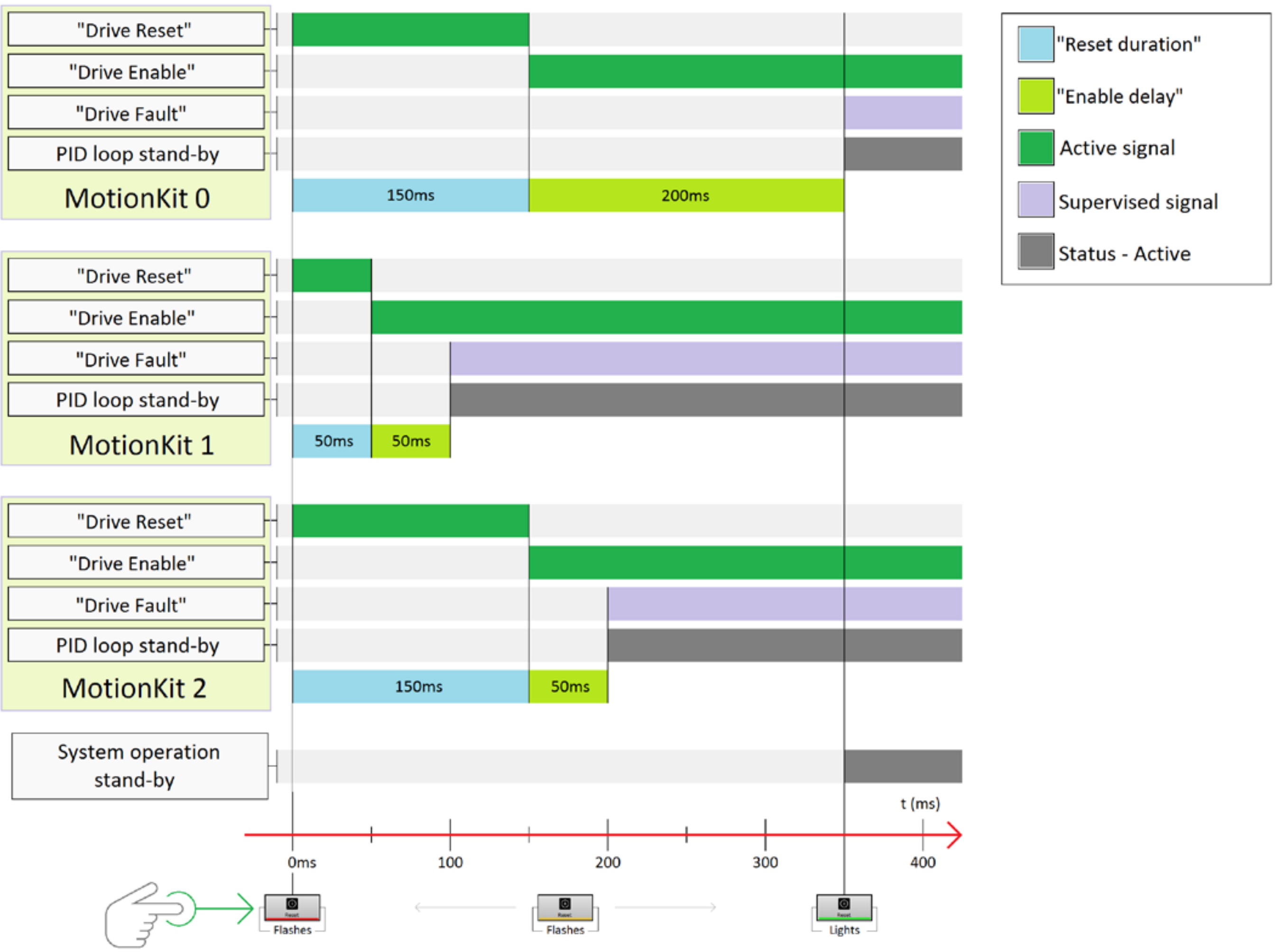
Delays settings

If we use various series drives their value of „Enable delay” and „Reset duration” parameters may differ. That's why in each „MotionKit” we have to set proper values of „Enable delay” and „Reset duration” for every servo drive separately.

Signals connection

We connect the drives to the chosen by us digital outputs of a CSMIO/IP controller which are set as „Drive Enable" and „Drive Reset" signals this way that each of the drives gets its pair of signals.

In the picture below we can see the process of starting three drives which require a different value of „Reset duration" and „Enable delay" parameters. You should notice that the control system goes into standby mode when the drive that requires the highest total value of both the parameters is activated.



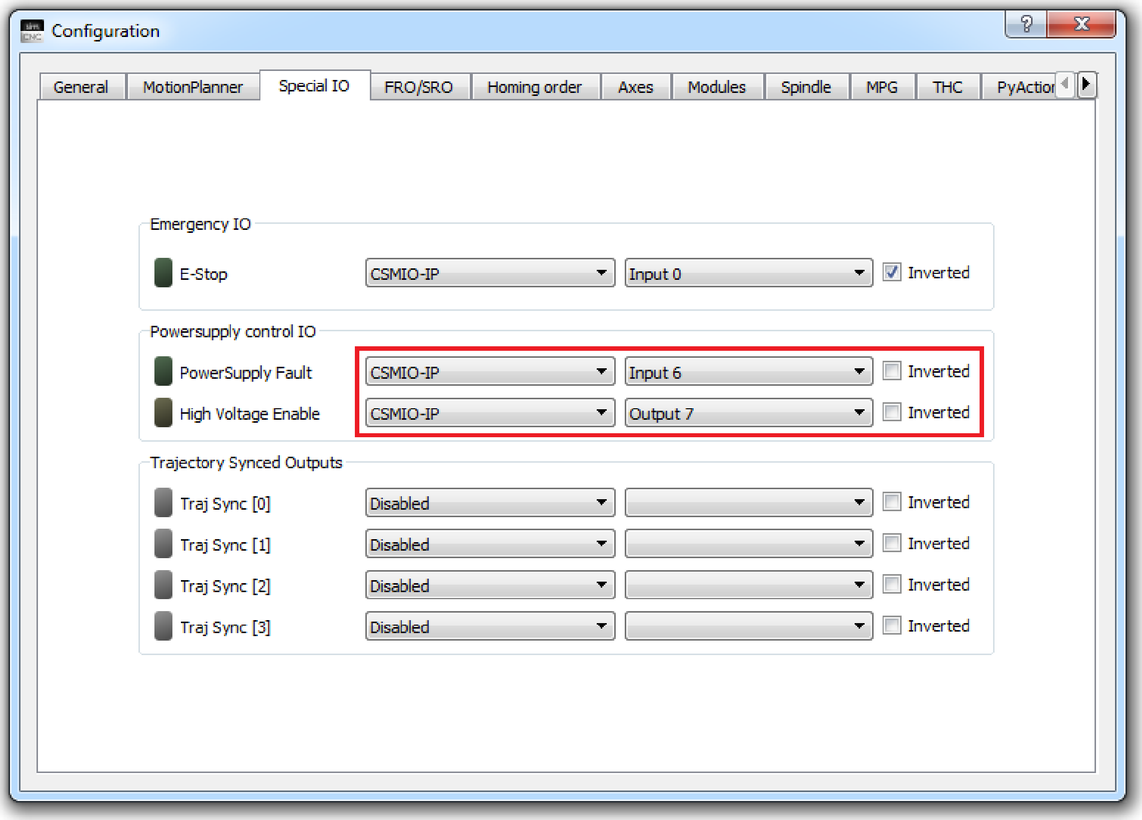
V. Configuration of drive power supply control signals

Select as follows „Configuration > Settings > Special IO"

In documentation of various old and new type drives, we can find information and drawings that present the usage of a central power supply unit equipped with an „HV" relay (a common power supply for all drives) or just the „HV" relay (High Voltage). This solution is also very often used during retrofitting of machines.

The mentioned „HV" relay task is to cut off power output supply of a drive in case of an emergency stop. Cutting off the drive's power output supply improves safety of a user and also in case of a breakdown it sometimes can also reduce damages of the drive.

The „HV" relay has one more important task: it must be enabled a moment before drive gets „Drive Enable" signal. If the „HV" relay is activated ahead of a drive, capacitors of a power supply or a drive will be charged before it becomes active. It's very important as the supplying voltage of power outputs at the moment when a drive goes into active mode requires a proper value and stability. In other case, the drive can report an error of too low voltage value of a power output.



„POWER SUPPLY FAULT" – is an input signal (digital 24V), that activate emergency stop. We can get the signal from a more advanced power supply unit that monitors parameters of work.

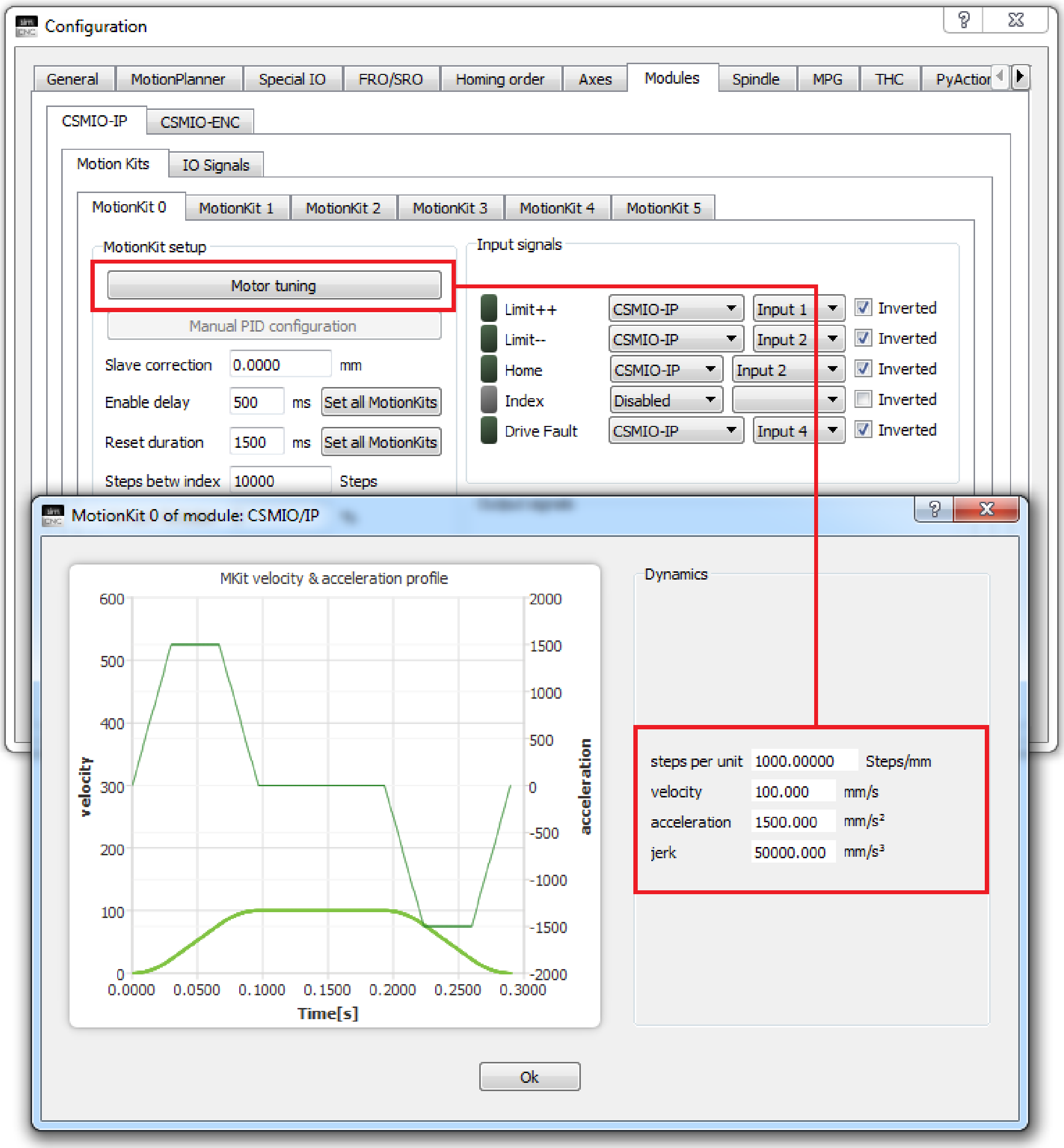
„HIGH VOLTAGE ENABLE" - is an output signal (digital 24V) which is responsible for „HV" relay control. In case of simCNC software, the signal appears 200ms before other signals responsible for drive activation.

In the picture below we can see the process of starting three drives of various series including signals for drive power supply control.

The chart starts with activation of „High Voltage Enable” signal and supervising „Power Supply Fault” signal at the same time. After 200ms the process of activation of all drives starts (described in the previous chapter). Notice that the system goes into standby mode when the drive that requires the highest total value of „Enable delay” and „Reset duration” parameters is activated.

VI. Configuration of drive parameters - MotionKit settings cont.

Select as follows „Configuration > Settings > Modules > MotionKit 0" > „Motor tuning"



The parameters in the above window directly affect the dynamics and speed of an axis.

a) STEPS PER UNIT – the parameter defines steps number required to move an axis by a unit (mm, inch or degree).

<u>How to set the parameter value?</u> Value of the parameter must be carefully calculated basing on:

- resolution of a drive – steps number per one revolution of a motor shaft,
- gear ratio, if used
- a ball screw pitch or a pitch diameter of a rack and pinion.

b) VELOCITY – is a distance traveled by an axis in time. The parameter defines what distance (e.g., in mm) per one second the axis traveled. It is expressed in units per second (mm/s, inch/s, and degree/s).

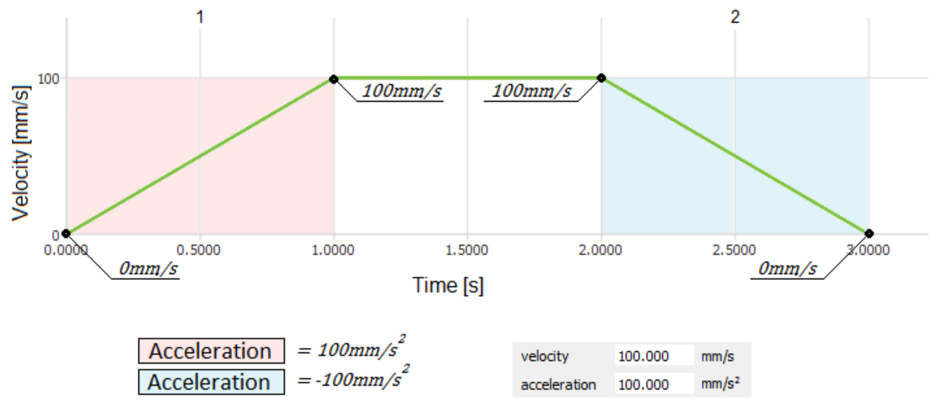
How to set the parameter value? The target value must be carefully calculated basing on:

- nominal, rotational speed of a drive,
- gear ratio, if used
- a ball screw pitch or a pitch diameter of a rack and pinion.

c) ACCELERATION – is the rate of axis velocity change. The parameter defines how much (e.g., mm per one second) the axis speeds up or slows down in one second of time. It is expressed in units per second^2 (mm/s^2, inch/s^2, degree/s^2). Acceleration is calculated by the following formula:

$$Acceleration = \frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Time}}$$

To show what the acceleration exactly is let's see the chart of velocity of an axis accelerated to 100mm/s and then braked. The acceleration during speeding up and braking is exactly 100mm/s^2 (an absolute value).



The first part of the chart - the axis speeds up from 0mm/s to 100mm/s in one second. It means that the axis acceleration is 100mm/s^2.

$$\frac{100mm/s - 0mm/s}{1s} = 100mm/s^2$$

The second part of the chart - the axis reduces its speed from 100mm/s to 0mm/s in one second. It means that the axis acceleration is -100mm/s^2.

$$\frac{0mm/s - 100mm/s}{1s} = -100mm/s^2$$

As we can see, in the light red area of the chart the axis acceleration is 100mm/s^2 and in the light blue area it's - 100mm/s^2.

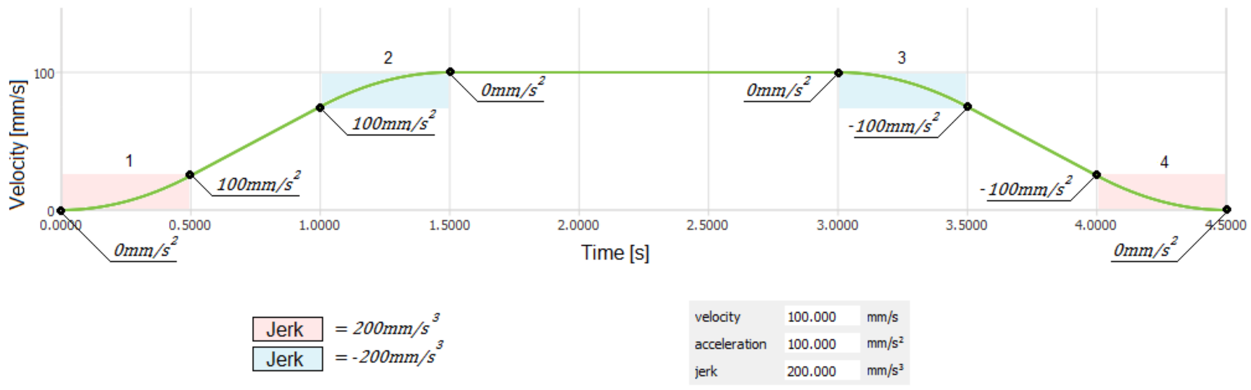
How to set the parameter value? The target value must be carefully calculated basing on:

- following error of a drive,
- temporary load of the drive,
- power of the drive,
- rigidity of a machine,
- strength of a drive train system (gears, driving screws or racks).

d) JERK – is the rate of axis acceleration change. The parameter defines how many units per one second^2 (e.g., mm/s^2) the axis increases or decreases its acceleration in one second. It is expressed in units per second^3 (mm/s^3, inch/s^3, degree/s^2). Jerk is calculated by the following formula:

$$Jerk = \frac{\text{Final Acceleration} - \text{Initial Acceleration}}{\text{Time}}$$

To show what the jerk exactly is let's see the chart of velocity of an axis accelerated to 100mm/s and the braked. The acceleration during speeding up and braking is exactly 100mm/s^2 (an absolute value), and the jerk is 200mm/s^3 (an absolute value).



The first part of the chart – the axis acceleration was increased from 0mm/s^2 to 100mm/s^2 in 0,5 seconds. It means that the axis jerk is 200mm/s^3.

$$\frac{100mm/s2 - 0mm/s2}{0,5s} = 200mm/s^3$$

The second part of the chart – the axis acceleration was decreased from 100mm/s^2 to 0mm/s^2 in 0,5 seconds. It means that the axis jerk is - 200mm/s^3

$$\frac{0mm/s2 - 100mm/s2}{0,5s} = -200mm/s^3$$

The third part of the chart – the axis acceleration was decreased from 0mm/s^2 to -100mm/s^2 in 0,5 seconds. It means that the axis jerk is -200mm/s^3.

$$\frac{-100mm/s2 - 0mm/s2}{0,5s} = -200mm/s^3$$

The fourth part of the chart – the axis acceleration was increased from -100mm/s^2 to 0mm/s^2 in 0,5 seconds. It means that the axis jerk is 200mm/s^3.

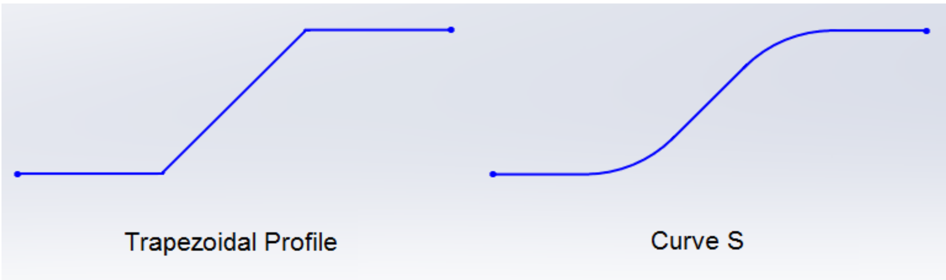
$$\frac{0mm/s2 - (-100mm/s2)}{0{,}5s} = 200mm/s^3$$

As we can see, in the light red area of the chart the axis jerk is 200mm/s^3 and in the light blue area it's -200mm/s^3.

How to set the parameter value? The target value must be carefully calculated basing on:

- following error of a drive,
- temporary load of the drive,
- power of the drive,
- rigidity of a machine,
- strength of a drive train system (gears, driving screws or racks).

If at this stage not everything is clear below we are trying to explain the "Jerk" idea more straightforwardly and what it affects.



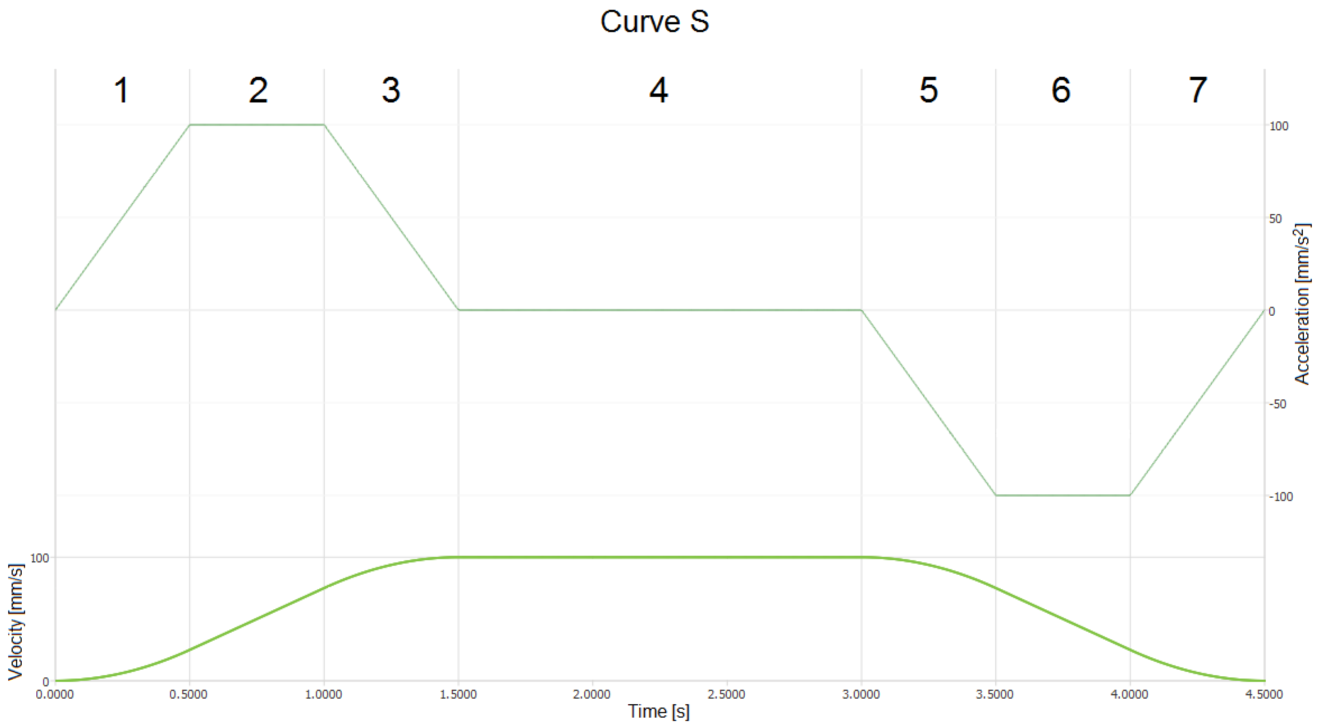
As you know, the simCNC software is equipped with the S-curve profile, it means that the axis velocity chart doesn't look like a trapeze, but it is S-letter shaped and is as rounded as the letter.

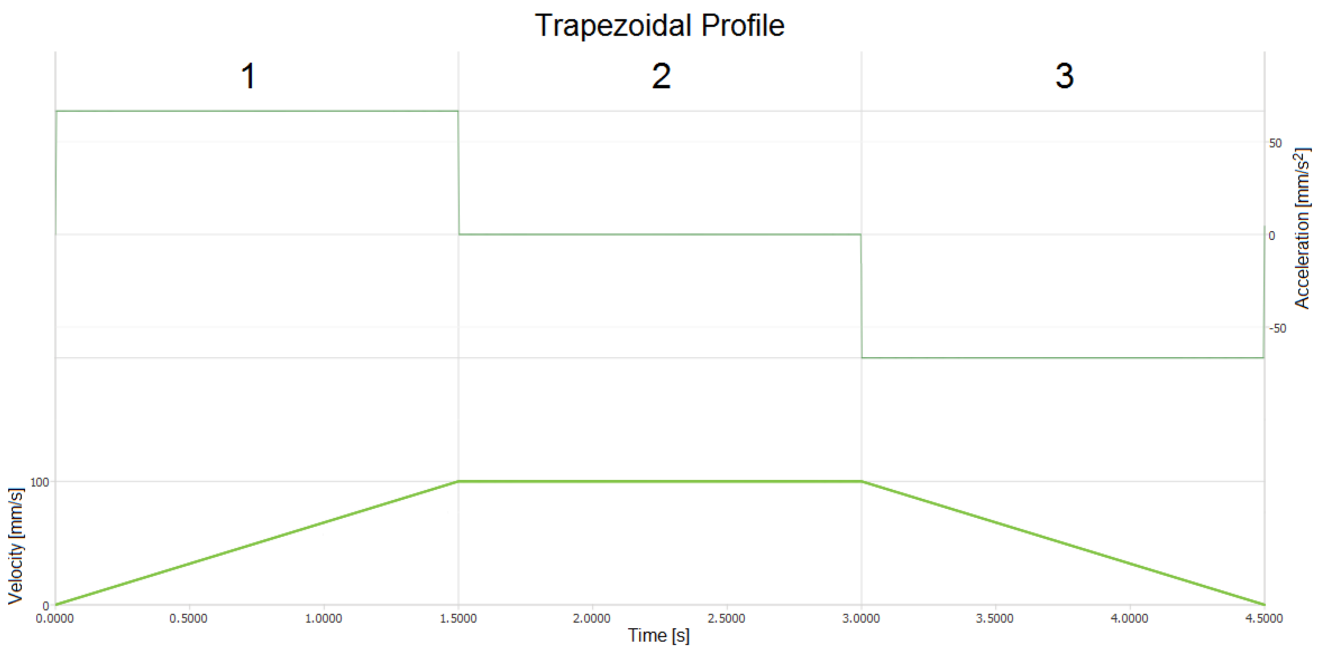
The S-curve profile provides high acceleration without noticeable knocking in an axis drive train system (ball screws noise), what next transfers to:
- better dynamics of a machine,
- smaller following error of a drive (better precision of a machine),
- lower load for a drive,
- longer lifetime for drive system parts,
- shortest time of gcode execution,
- reducing vibrations of a machine.

The high acceleration without noises is only possible if the acceleration is increased and decreased smoothly. The smooth acceleration changes create the characteristic roundings of the velocity chart which is then similar to the S-letter. The bigger the roundings are, the softer a machine works but a bit more sluggishly. The smaller roundings, the harder and much faster and more briskly is the machine. Therefore, the roundings should be neither too big nor too small. Moreover, every machine has its properties (speed, weight, power, construction rigidity) and the velocity chart roundings size can't always be the same.
It would be perfect if we could decide how big the roundings are to use the full potential of a machine.

The simCNC software provides this very feature of the axis velocity chart roundings size manipulation, and the parameter responsible for this is the "Jerk".

To understand even better what benefits the adjustable "Jerk" feature brings you can see below the pictures of velocity and acceleration for S-curve profile and trapezoidal profile. The charts don't require any comments so the description will be reduced only to description of the divided areas. The conclusions are obvious.





<u>S-curve velocity profile chart is divided into seven areas:</u>

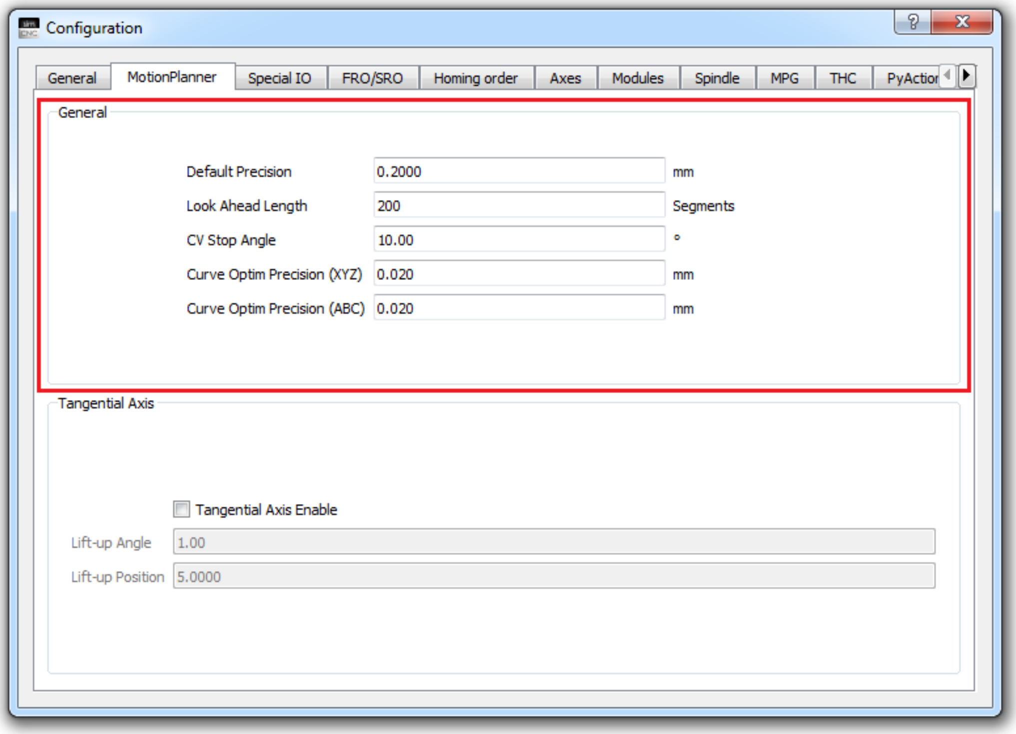
1. Smooth acceleration.
2. Uniform acceleration.
3. Smooth deceleration.
4. Constant speed.
5. Smooth deceleration.
6. Constant acceleration.
7. Smooth acceleration.

<u>Trapezoidal velocity profile chart is divided only into three areas:</u>

1. Constant acceleration.
2. Constant speed.
3. Constant acceleration.

VII. Motion planer

Select as follows „Configuration > Settings > Motion Planer > General"



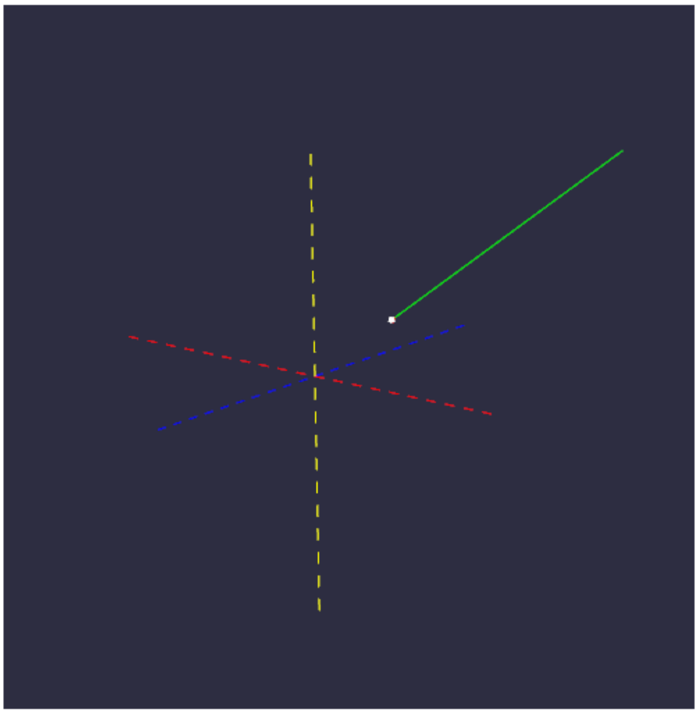
The parameters shown in the picture above affect precision, smoothness and treatment speed. Before we describe the parameters, you can read below about a few issues directly related to the parameters.

ATTENTION!

Units of parameters presented in this chapter depend on a native unit (point 2).

SEGMENT – it is the smallest part of a tool path, this can be a section or an arc.

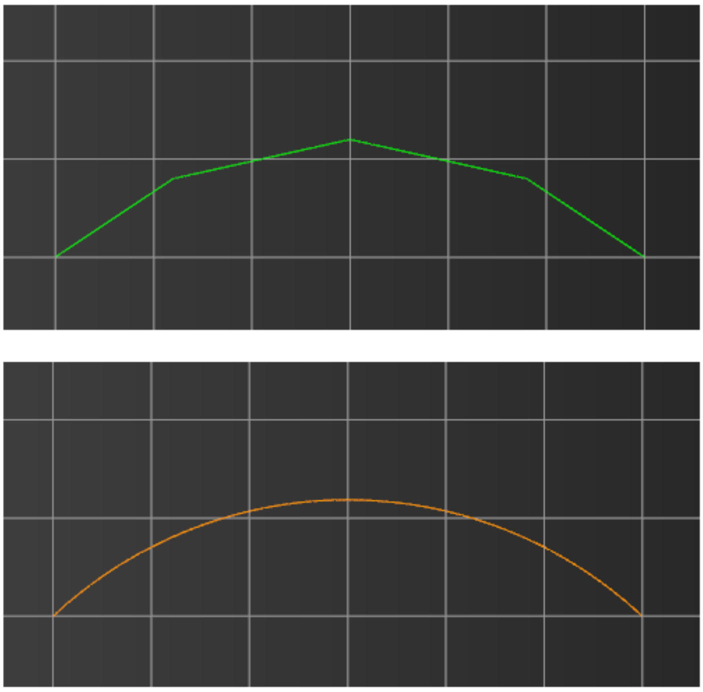
```
G21
G0X10Y10Z10
G1X40Y40Z40F500
M30
```



OPTIMIZATION - it merges as many section-type segments as possible into one bigger arc-shaped segment.

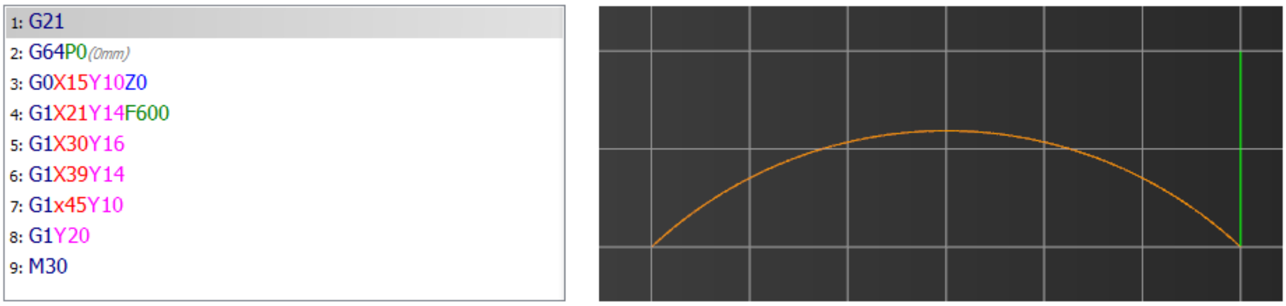
The segments are merged as long as the distance between a new segment and one of the old segments won't exceed the "Optimization".

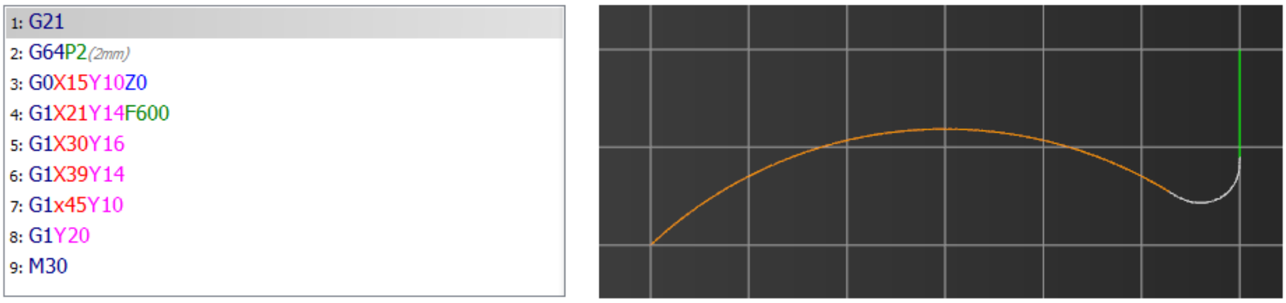
```
G21
G0X15Y10Z0
G1X21Y14F600
G1X30Y16
G1X39Y14
G1x45Y10
M30
```



PRECISION – it merges two segments into one polynomial segment by rounding the section of segments connection. You can connect each type of a segment, either a section with a section, a section with an arc, an arc with an arc. Rounding of segments is most visible on sharp corners of a workpiece.

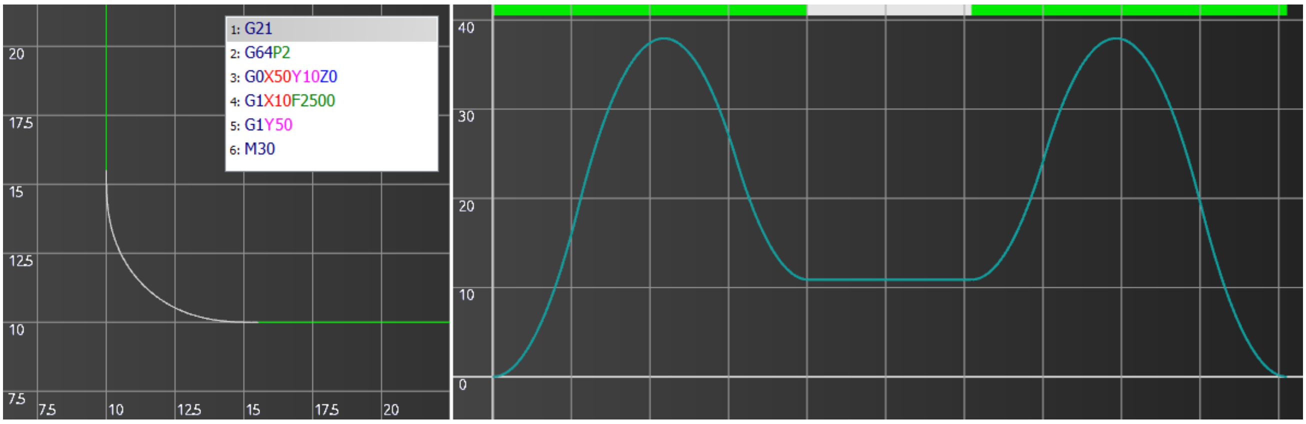
The „Precision" value and machining set-point velocity decide how much the place of connection will be rounded. As we can see in the picture below the „Precision" value can be set by „G64 P2" command where the „P2" is „Precision" value. If „Precision" value is set to 0, the simCNC software goes into the *exact stop*.



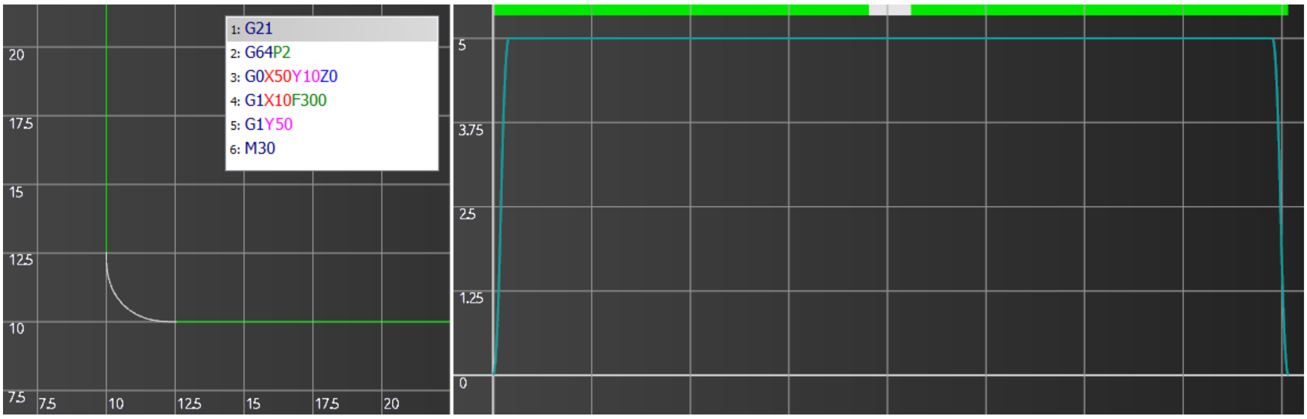


The PRECISION is governed by two rules:

RULE #1) If the machining set-point velocity is so high that it is not possible to keep the „Precision" set-point value then the speed will be reduced enough to keep the „Precision" set-point value.



RULE #2) If the machining set-point velocity is low enough to get the lower value of the „Precision" then the set-point value is then the „Precision" value will be decreased, and the machining set-point velocity will be kept. This way we get Constant Velocity.



Notice that the color and length of the tool-path (a picture on the left), and the color and length of the marking line (on the right) match.

***

At this stage, we can go to the parameters description.

a) DEFAULT PRECISION - the parameter determines „Precision" value (read more in PRECISION definition section above), it will be used if simCNC won't find G64 Px command in gcode.

How to set the parameter value? The value depends only on machine operator's expectations regarding precise corners processing.

- At rough machining that leaves excess material of a workpiece, you can set the value high. It will positively affect the average speed and smoothness of machining.
- If it is finish machining, then the value shouldn't exceed a value of acceptable rounding of workpiece corners.
- If the parameter is set to 0, a machine goes into *exact stop* what will negatively affect machining smoothness and speed.

b) LOOK AHEAD LENGTH - the parameter determines how many gcode lines the simCNC software analyzes in advance.

How to set the parameter value? An optimal value of the parameter, which is the most effective and doesn't overload a computer too much, is 200 lines.

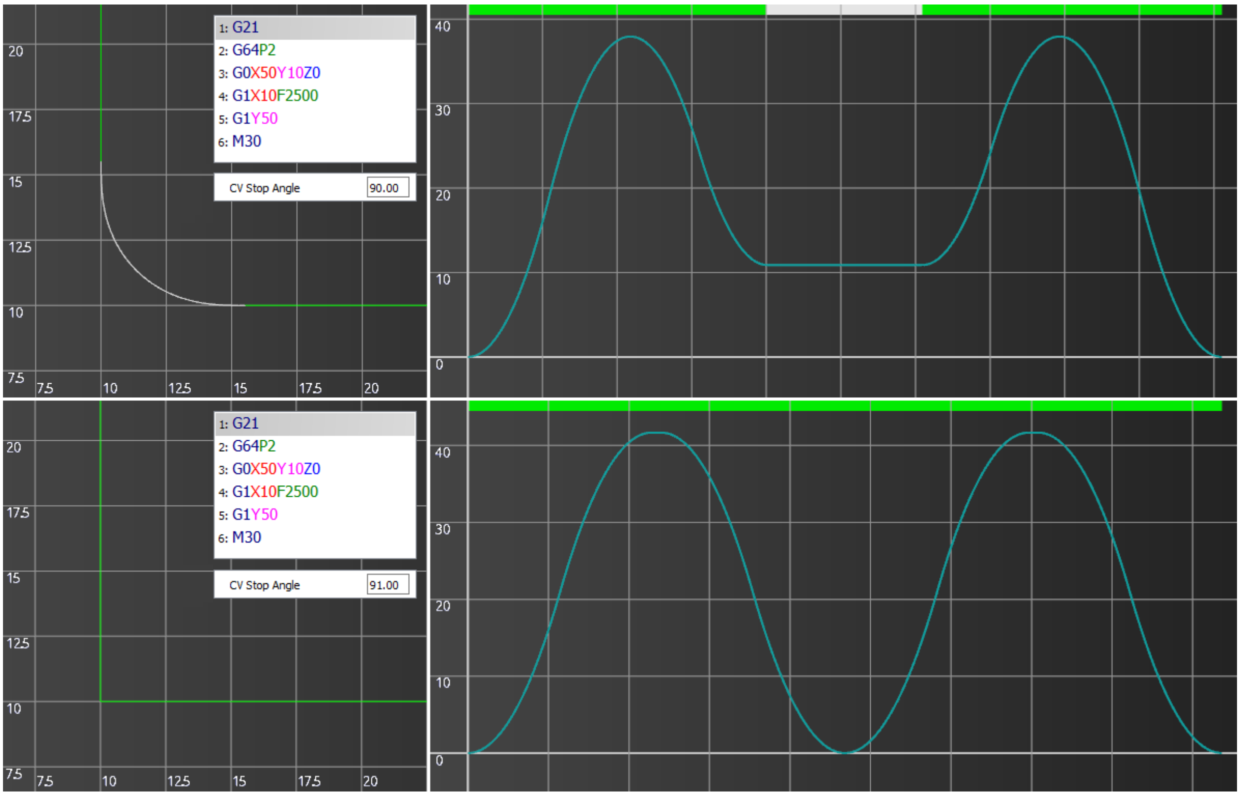
- In case if the executed gcode consists of many small parts, increasing a value of the parameter may slightly increase machining speed.
- Unfounded increase of the parameter value may not bring any benefits and can cause computer overload.

c) CV STOP ANGLE – the parameter determines a value of an angle formed by two segments, below which an exact stop will be executed. It means that the places of segments connection will not be rounded. The minimal value of the parameter is 10˚ (degrees).

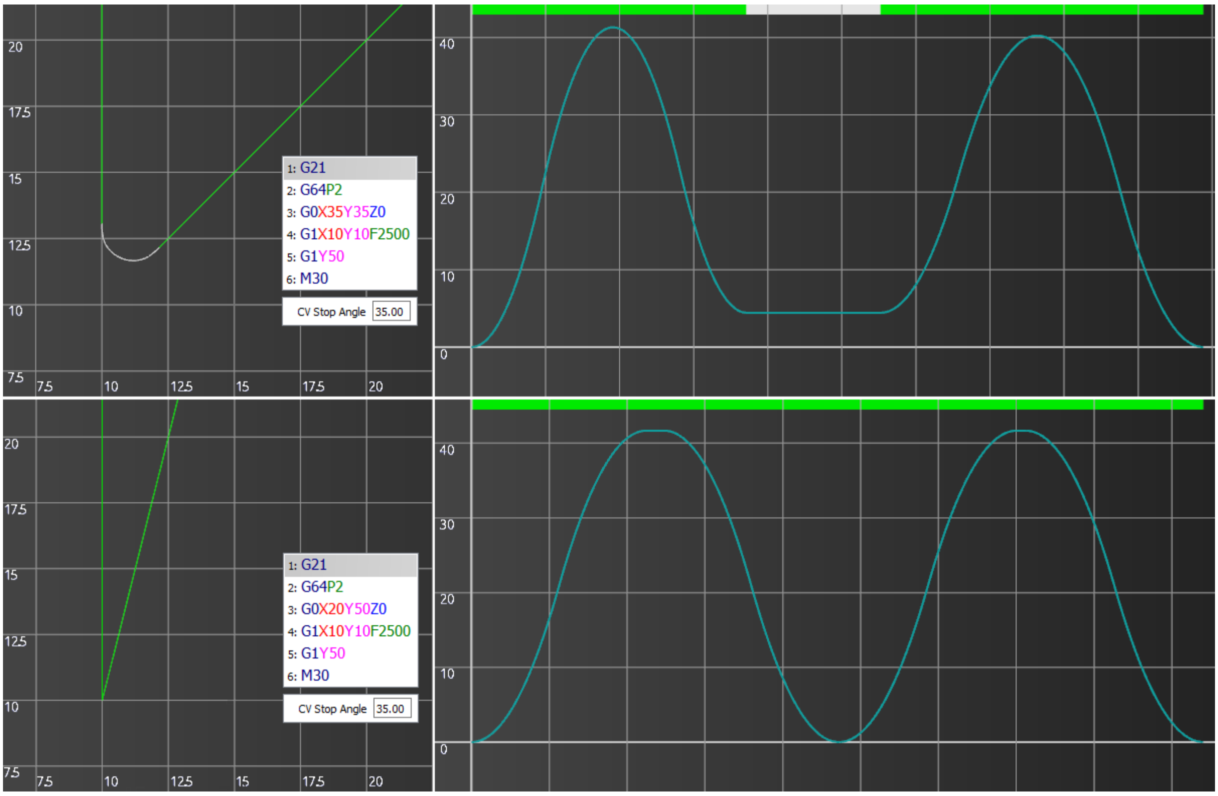
To show you how the „CV Stop Angle” parameter works we present these two examples:

The first example shows two situations were, in both of them we used the same tool path that forms an ideal 90˚ angle. The situations differ by a „CV Stop Angle” parameter value. In the first situation, we used 90˚ and in the second situation 91˚.

As you can notice, in the second situation the machining completely stopped (exact stop) because the angle created by the path is smaller than „CV Stop Angle” parameter value.



The second example also shows two situations, were in both of them we used the same „CV Stop Angle" value, which is 35˚. The situations differ by angles value created by tool paths. In the first situation, the tool path angle is 45˚and in the second situation it's 15˚. As you can see, in the second situation the machining completely stopped (exact stop) because the angle created by the paths is smaller than „CV Stop Angle" parameter value.



Notice that the color and length of the tool-path (a picture on the left), and the color and length of the marking line (on the right) match.

How to set the parameter value? The value depends only on machine operator's expectations regarding precise corners processing.

- In most situations, the parameter can be 10˚.
- Only if you need to have sharp edges with a value below the set angle, you should change the parameter value.

d) CURVE OPTIM PRECISION (XYZ) - the parameter determines „Optimization" value (read more in OPTIMIZATION definition chapter above) for X, Y and Z axes.

<u>How to set the parameter value?</u> The parameter is responsible for segments number reduction, the same a PC is less loaded, and a gcode consisting of thousands of segments per millimeter is done smoothly. Even low values of the parameter provide such an effect.

- An optimal value of the parameter shouldn't exceed 0.02mm.
- In case of not that precise machines, e.g. plasma cutters or woodworking machines, you can increase the value to 0.1mm.
- Using values higher than 0.1mm won't bring any benefits, but only reduces the accuracy of the machining.

e) CURVE OPTIM PRECISION (ABC) – the parameter determines „Optimization" value (read more in OPTIMIZATION definition chapter above) for A, B and C axes.

<u>How to set the parameter value?</u> Setting the value is the same as in case of „Curve Optim Precision (XYZ)".

ATTENTION!

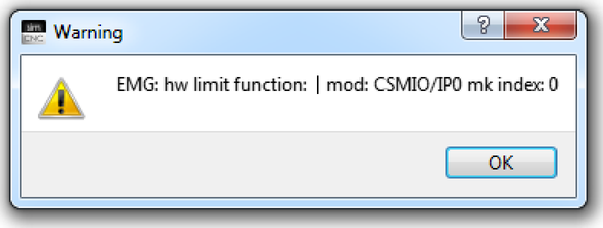
All the presented charts have very low „Acceleration" and „Jerk" values to highlight „Precision" and „Optimization" algorithm. If a machine is set properly the real charts may differ.

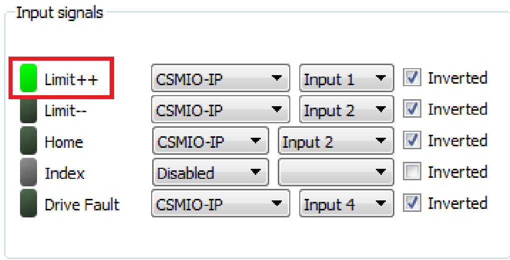
The charts were made using diagnostic tool designed by CS-Lab's software developers for simCNC software. The utility is also available for simCNC users. You can run the tool in „Diagnostics" tab by pressing „Path Simulation/Test" button. Switch the velocity chart and the tool-path chart screens by pressing Ctrl + Shift + d.

VIII. The first axis moves

Before we go any further, you have to check „Limit++” and „Limit--” switches working.

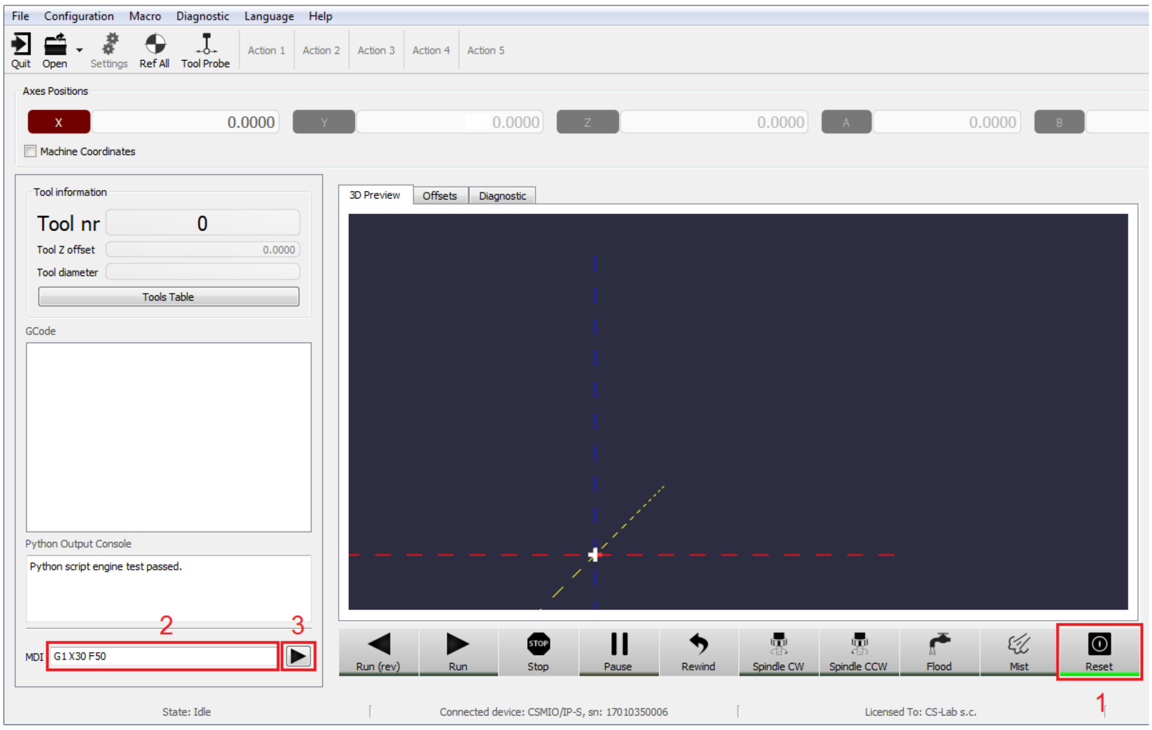
For that press „Enable” on the main screen and activate the switches one by one by pressing them or if you use inductive switches by putting a steel object to them. If the switches work properly, you will see a relevant message on the simCNC screen. You can watch the switches in „Config > Settings > Modules > MotionKit 0 > Input signals”.





If the switches work properly and you see no „Drive Fault” message, it means that you can try and move an X-axis.

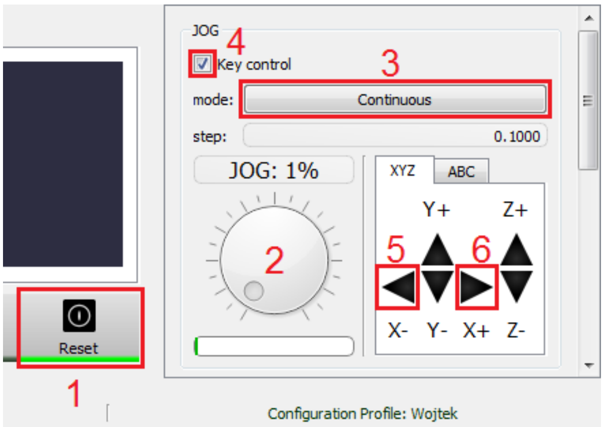
a) Moving an axis with MDI line command - to move an axis using the MDI line follow the steps:
   1. Press „Enable” on the main simCNC screen.
   2. Enter „G1 X100 F50” command into the MDI line or „G1 X4 F2” command if the native unit is an inch.
   3. Press the button at the end of the MDI line; your command will be executed.



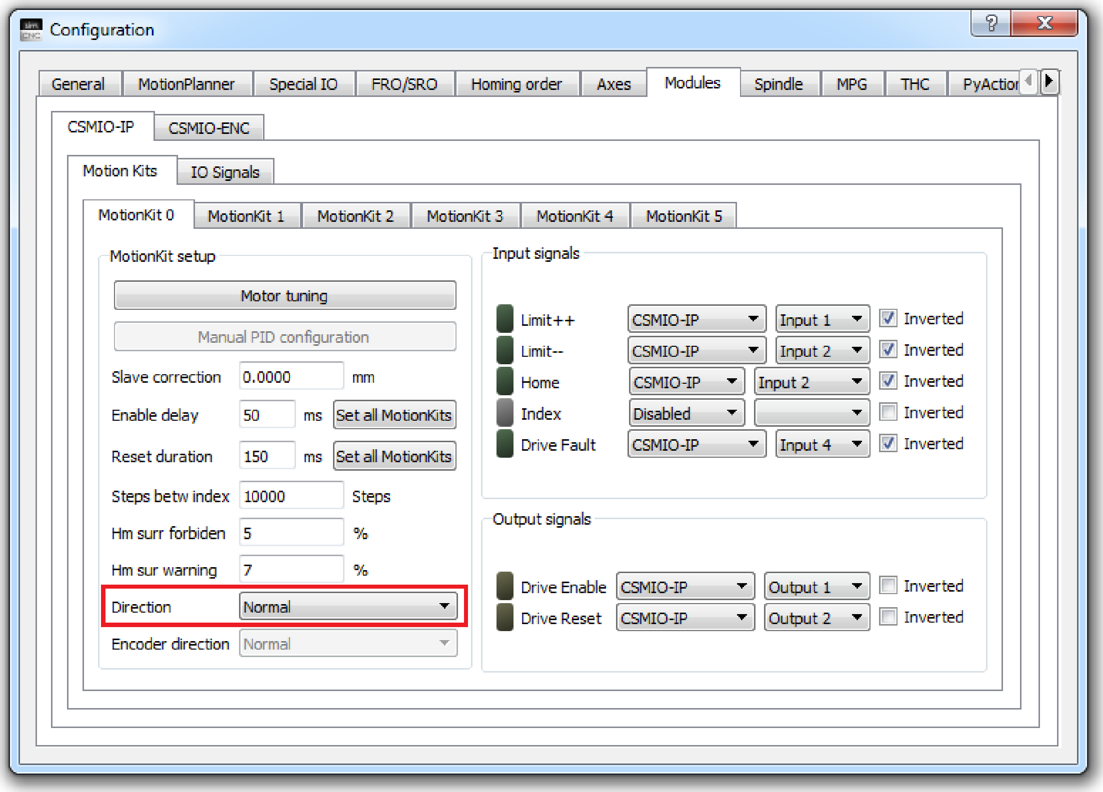
At this moment the X-axis should travel 100mm at 50mm/min if it did you can move the axis in the opposite direction in the same way.

b) Moving an axis with JOG mode - to move an axis in JOG mode follow the steps:

1. Press „Enable” on the main simCNC screen.
2. Reduce JOG speed to 1% (1% of the axis speed which was set in parameters of a drive).
3. Press the button to work in JOG „Continuous” mode.
4. Activate the JOG control by checking the „Key control” option box or press Alt + J.
5. Move the axis in both directions pressing the buttons briefly.



In case if the axis direction is reversed go to „Config > Settings > Modules > MotionKit 0” and find the „Direction” option and change it from „Normal" to „Reverse”.

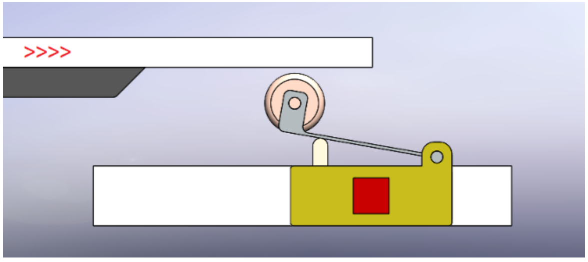


IX. Homing

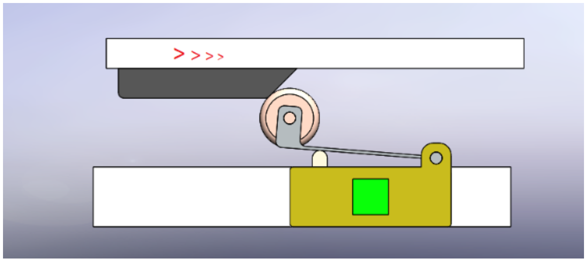
AXIS HOMING – an operation of finding an axis reference point, to define a value of coordinates of a machine. As a result, you can continue work of a machine not losing position after switching it off. For axis homing, we use mechanical and inductive switches. To improve homing accuracy, you can additionally use „Index" signal coming, e.g. from an encoder.

a) The homing process using a switch (CSMIO/IP-M, CSMIO/IP-S, and CSMIO/IP-A controllers).

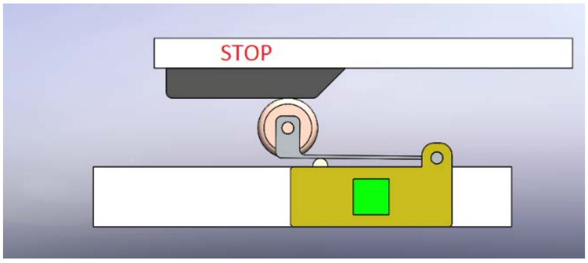
Homing activation.
After homing process activation, an axis moves in the switch direction.



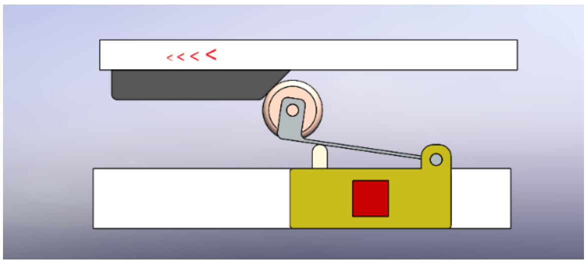
Switch activation.
At the moment of the switch activation, the axis begins to brake.



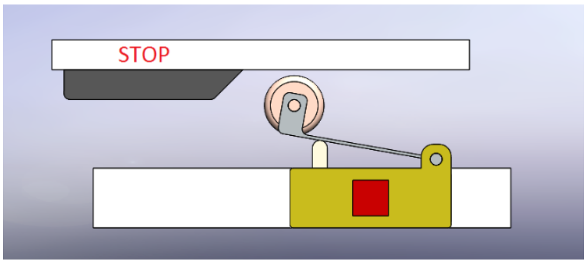
Direction change.
The axis stops and changes direction.



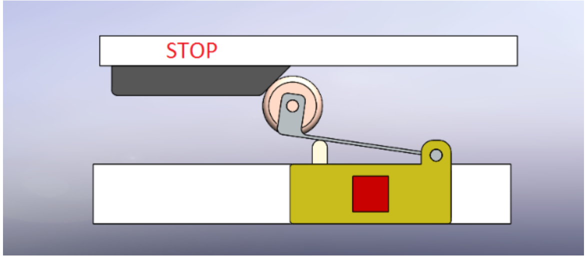
Switch deactivation.
At the moment of axis deactivation a motion controller stores the position and the axis begins to brake.



Direction change.
The axis stops and changes direction.



Return to the stored position.
The axis travels back to the stored position and stops in it.



The end of the homing process.
The motion controller ends the homing process and determines the current axis position in the switch deactivation point as the axis reference point.

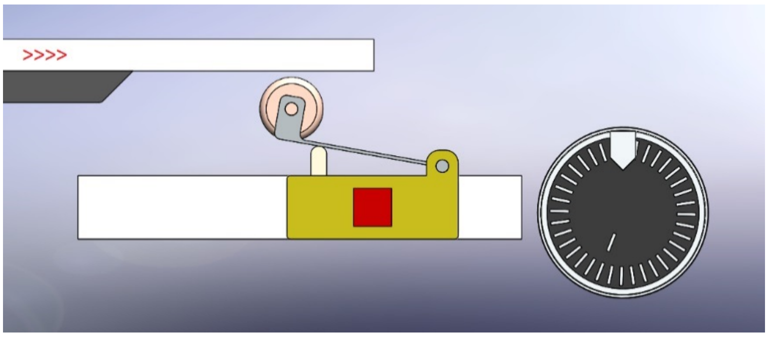
You can see the entire axis homing process on the CS-Lab website: www.cs-lab.eu

ATTENTION!

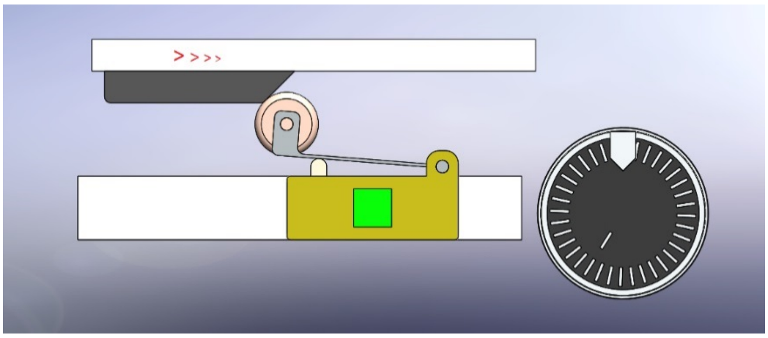
Please note that a reference point is placed exactly in a switch deactivation point. It's possible because a CSMIO/IP controller remembers the switch deactivation position and an axis goes back to this position. With this solution, regardless of homing speed, acceleration and jerk values, the reference point is always in the same position of an axis.

b) The homing process using a switch and Index signal (CSMIO/IP-S and CSMIO/IP-A controllers).

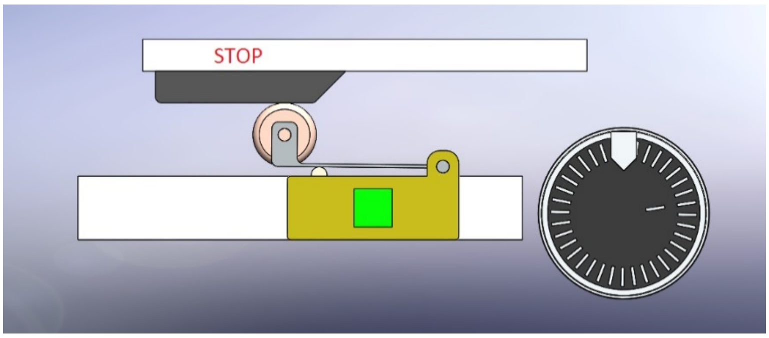
Homing activation.
After homing process activation an axis moves in the switch direction.



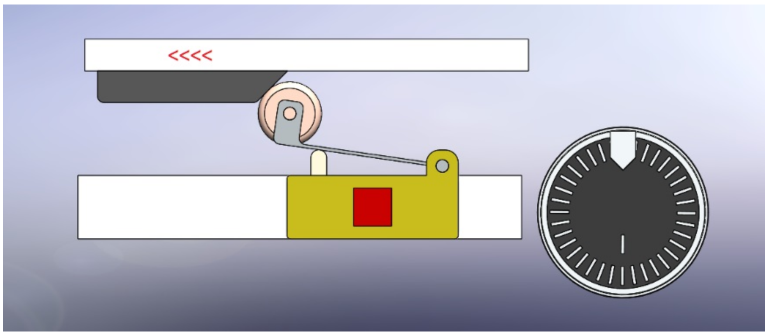
Switch activation.
At the moment of the switch activation the axis begins to brake.



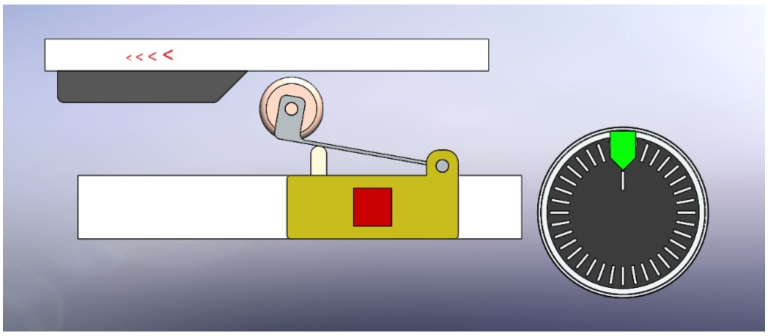
Direction change.
The axis stops and starts to move in the opposite direction.



Switch deactivation.
From the moment of axis deactivation a motion controller is looking for the „Index" signal.

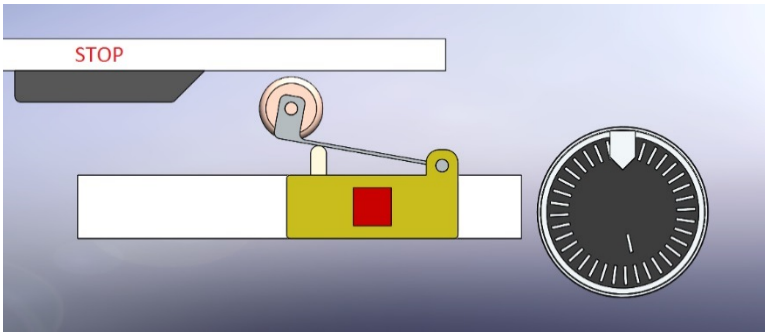


„Index" signal detection.
When the „Index" signal is found the motion controller stores its position and the axis begins to brake.



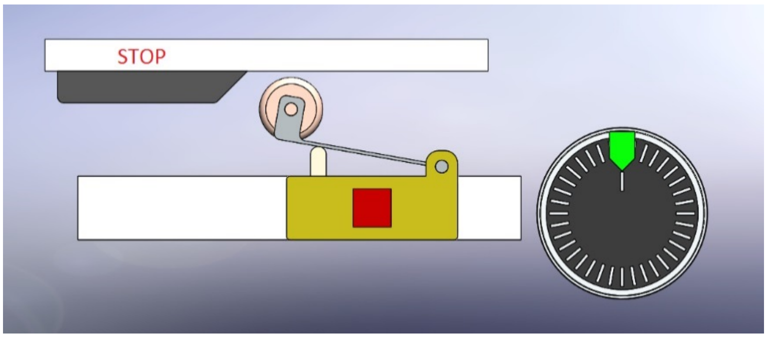
<u>Direction change.</u>

The axis stops and changes direction.



<u>Return to the stored position.</u>

The axis travels back to the stored position and stops in it.



<u>The end of the homing process.</u>

The motion controller ends the homing process and determines the current axis position in the „Index" signal detection point as the axis reference point.

You can see the entire axis homing process on the CS-Lab website: www.cs-lab.eu

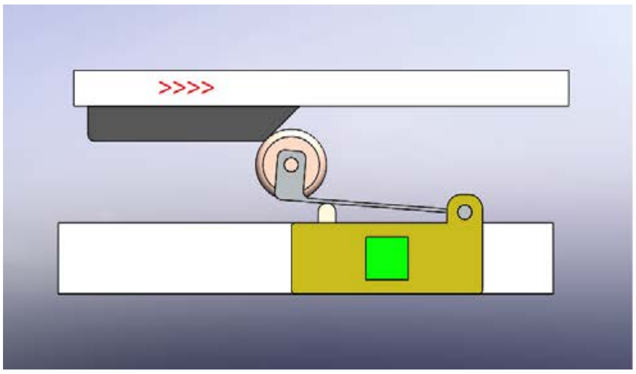
ATTENTION!

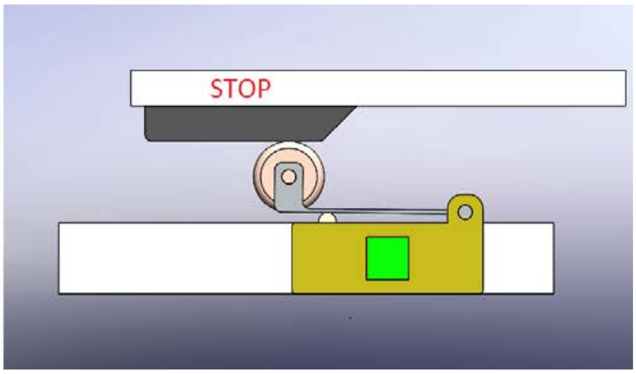
Please note that, just like in the solution of homing using a switch, an axis comes back to the previously stored position however, this time it's a position of „Index" signal detection.
A CSMIO/IP controller remembers the position of the first detected signal after switch deactivation. It means that all the other „Index" signals from the moment of the the switch deactivation were ignored.

9.1. Homing security

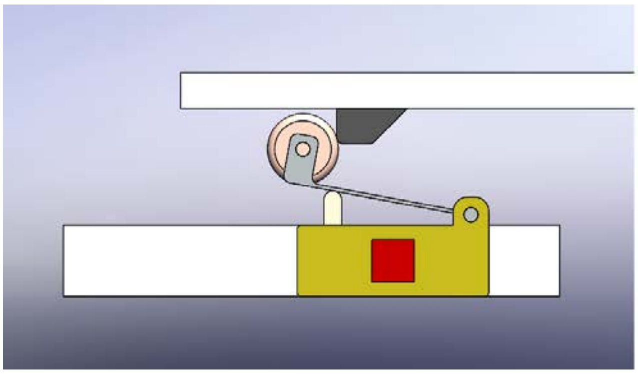
a) „Safety feature no. 1" (CSMIO/IP-M, CSMIO/IP-S, CSMIO/IP-A controllers)
The protection is to watch over a switch operation. After the switch activation (the picture on the left below) and stopping an axis the motion controller verifies if the switch is still active.

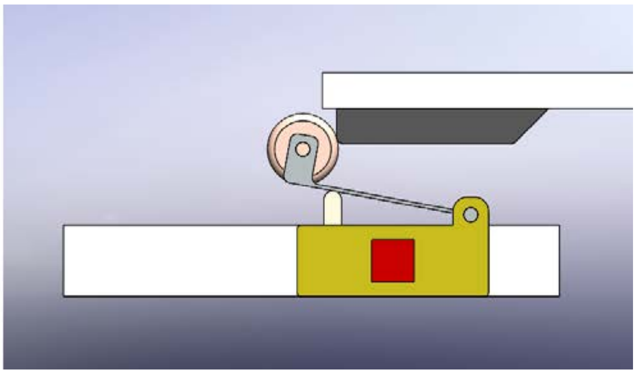
If a switch is still active (the picture on the right) a motion controller continues homing.





If the switch isn't active (the pictures below) the CSMIO/IP controller stops homing.





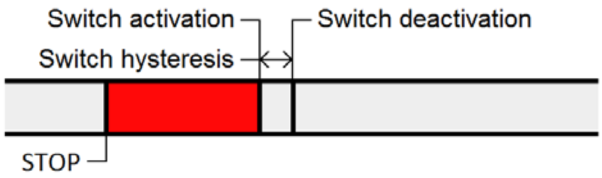
As the homing process is stopped simCNC software displays error message with information to which axis it refers. In this situation we should check if the switch and its related parts are well functioning and fastened.

INFORMATION

If homing process stopped while we were running a machine for the first time we should check:
- if the prism (in grey in the above pictures) isn't too short (the left picture above)?
- if homing isn't too fast at too low acceleration and jerk values (the right picture above)?

In both the situations the axis stops out of the prism where the switch isn't active anymore.

The red area in the drawing here shows where is the „Safety feature no. 1" functioning. It starts watching over the switch signal from the moment of activation until the axis stops.

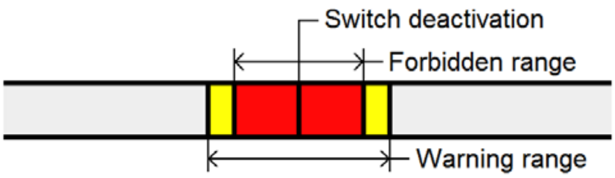


The safety feature applies for homing using a switch and for homing on index.

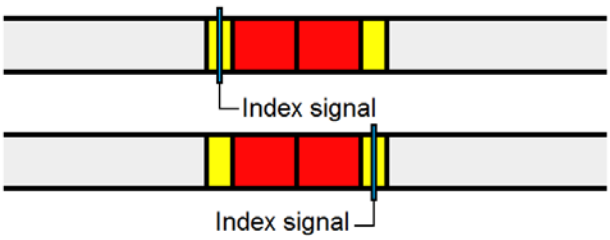
b) „Safety feature no. 2" (CSMIO/IP-S, CSMIO/IP-A controllers)
The protection is to watch if an index signal is not too close to switch deactivation point.

If there is too short distance between an index signal and a switch deactivation point and if the switch is not accurate enough then a motion controller may detect an incorrect move of the index signal. This way the reference point will be set in a wrong place. For an example, an „Index" signal appearing right before a switch deactivation point in fact may appear out of it because of switch inaccuracy. In this situation machine coordinates value changes and they are moved by the same distance as the distance between the two following „Index" signals. To avoid it we have „Warning range" and „Forbidden range".

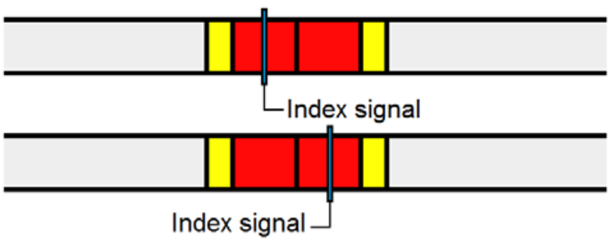
In the drawing on the right, the „Forbidden range" is shown in red and the „Warning range" in yellow. These ranges are placed this way so the switch deactivation point is always places in their middle. If it turns out, after finding the index signal, that at the moment of switch deactivation the signal was in „Warning range" or in „Forbidden range", the simCNC software will react to it.



<u>WARNING RANGE</u> – if the „Index" is in this range you will get a warning message but homing will be continued. In this situation you should verify if the switch and its related parts are well functioning and fastened. You should also check a mechanical gear, flexible coupling fastening, servo motor, encoder or linear scales fastening. The „Warning range" size is determined by „Hm warning range" parameter value.



<u>FORBIDDEN RANGE</u> – if the „Index" is in this range you will get a warning message and homing will be stopped. In this situation you should check the same options like in case of „Warning range". The „Forbidden range" size is determined by „Hm forbidden range" parameter value.

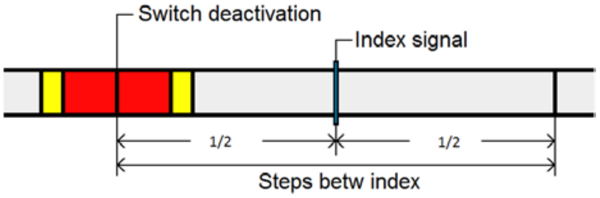


INFORMATION

If homing process stopped while we were running a machine for the first time then we should first move the switch by a few millimeters. If possible we should also disconnect a drive train system, turn the disconnected parts tens of degrees to each other and connect the again. For example, we take off a toothed belt from cogwheels, we turn one of the wheel a few tens of degrees and we install the belt again.

INFORMATION

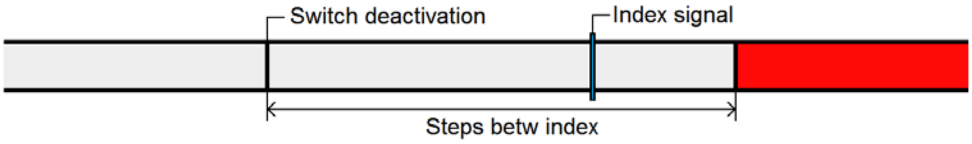
The perfect distance between an index signal and a switch deactivation point is exactly ½ of „Steps between index" parameter value (the parameter was described in chapter IX, 9.2.c).



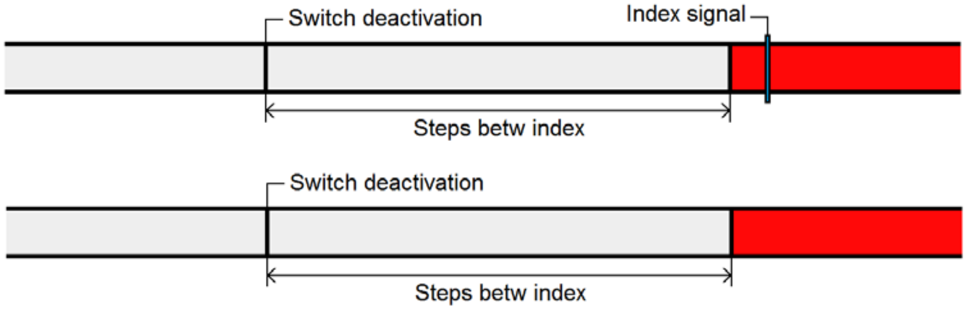
The safety feature applies for homing using a switch and for homing on index.

c) „Safety feature no. 3" (CSMIO/IP-S, CSMIO/IP-A controllers)
The protection watches if a distance between a switch deactivation point and a point of index signal detection isn't too long.

If, after switch deactivation, the index signal is detected closer than „Steps between index" parameter value homing will be continued.



If, after switch deactivation, the index signal is detected at the same distance as „Steps between index" parameter value, homing will be stopped and error message will be displayed.



Homing may be stopped in two situations. First, if an index signal is out of allowed range, secondly if an index signal was corrupted and didn't appear at all.

If homing is stopped you should check if your encoder or a liner scale is mechanically and electrically efficient.

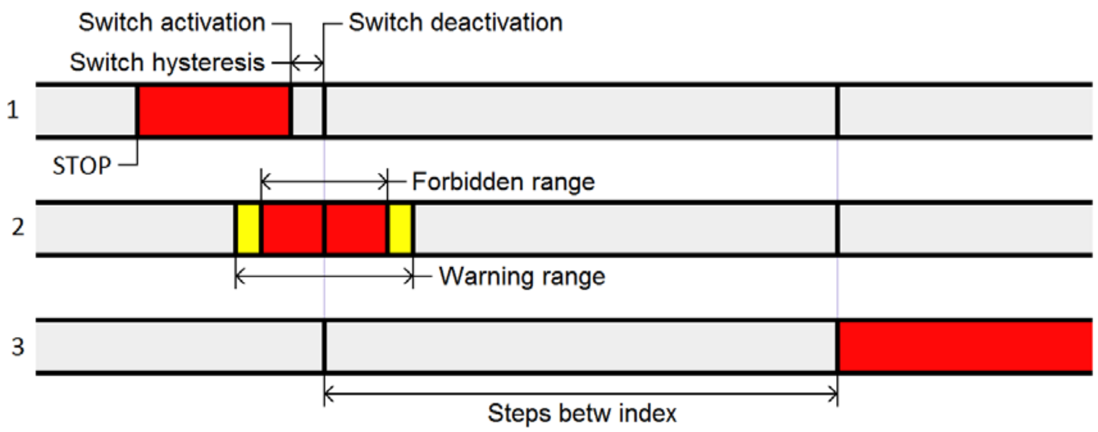
INFORMATION

If homing process stopped while we were running a machine for the first time then we should first check if „Steps between index" parameter is set correctly.

The safety feature applies for homing using a switch and for homing on index.

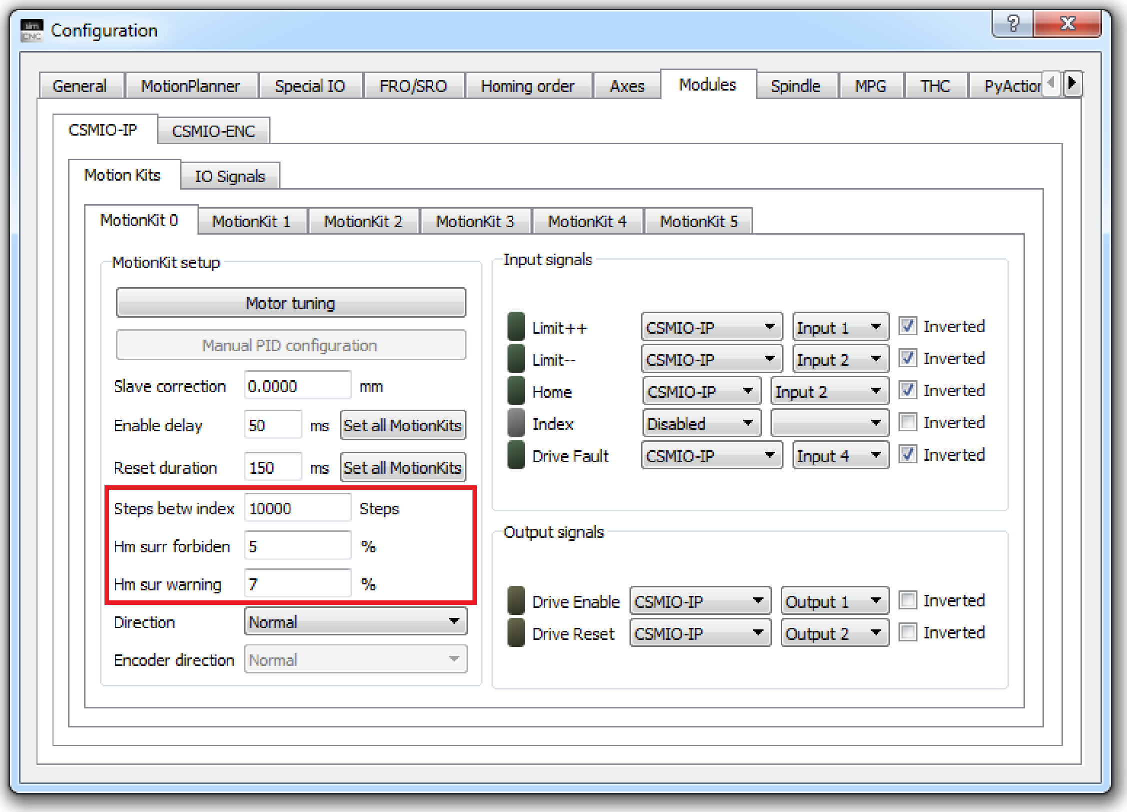
d) All safety features (CSMIO/IP-S, CSMIO/IP-A controllers)
Mutual protection if all the safety features at homing using a switch and for homing on index.

In the drawing below you can see the areas where the individual security works. Such location of the areas minimizes issues caused by a switch or index signal.



9.2. Homing safety parameters configuration (CSMIO/IP-S, CSMIO/IP-A)

Select as follows „Configuration > Settings > Modules > MotionKit 0"



a) "Hm forbidden range" parameter

HOMING ON INDEX FORBIDDEN RANGE - The parameter determines width of a „Forbidden range". The value is shown in percents (%) of the „Steps between index" parameter value. For example, if we have a 10 000 pulses/rev encoder (incl. all edges) and we set the parameter to 5%, the range width will be 500 pulses of an encoder or a linear scale.

<u>How to set the parameter value?</u>

- If a switch is accurate the 5% value is fully sufficient.
- If a switch isn't accurate enough we should set 10% value.
- The maximal value possible is 20%.

b) "Hm warning range" parameter

HOMING ON INDEX WARNING RANGE – The parameter determines width of a „Warning range". The value is shown in percents (%) of the „Steps between index" parameter value. For example, if we have a 10 000 pulses/rev encoder (incl. all edges) and we set the parameter to 7% s the range width will be 700 pulses of an encoder or a linear scale.

How to set the parameter value?

- If a switch is accurate the 7% value is fully sufficient.
- If a switch isn't accurate enough we should set 15% value.
- he maximal value possible is 30%
- If "Hm warning range" and "Hm forbidden range" value is equal the warning range will be inactive.

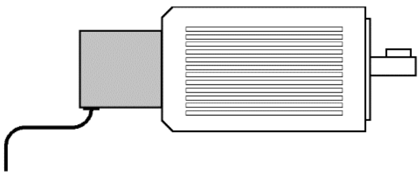
c) "Steps between index" parameter

STEPS NUMBER BETWEEN INDEX - as the name says it's a number of pulses between next Index signals. Setting the parameter depends on a controller and source of the signals we use as well us on our wiring.

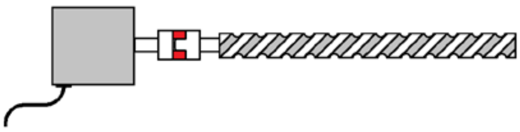
How to set the parameter value? The target value must be carefully calculated basing on the information below:

- CSMIO/IP-S controller :

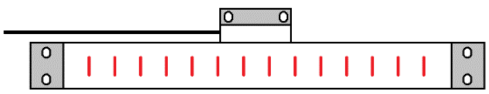
An encoder installed to a servo motor
In this case the parameter means an encoder pulses number per one revolution (incl. all edges) including a gear ratio used in a servo drive for step/dir signal. In other words the parameter is a number of step/dir pulses required to turn a servo motor shaft one full rev.



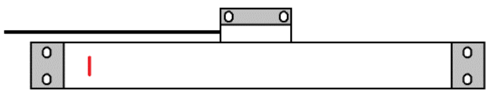
An encoder installed to a ball screw
In this case the parameter means an encoder pulses number per one revolution (incl. all edges) including a gear ratio used in a servo drive for step/dir signal. In other words the parameter is a number of step/dir pulses required to turn a ball screw one full revolution.



A linear scale with many Index signals
In this case the parameter means a linear scale pulses number from one index signal to another index signal (incl. all edges) including a gear ratio used in a servo drive for step/dir signal. In other words the parameter is a number of step/dir pulses required to cover the axis distance from one index signal to another.



A linear scale with one Index signal
If a linear scale has only one index signal, the parameter will not matter and we should put its value to correspond with a few millimeters move of an axis. For example, if the axis move is 5mm then the parameter will be five times this value of pulses number per one 1mm of a linear scale (incl. all edges) including a gear ratio used in a servo drive for step/dir signal. In other words the parameter is a number of step/dir pulses required to move the axis by 5mm.



ATTENTION!

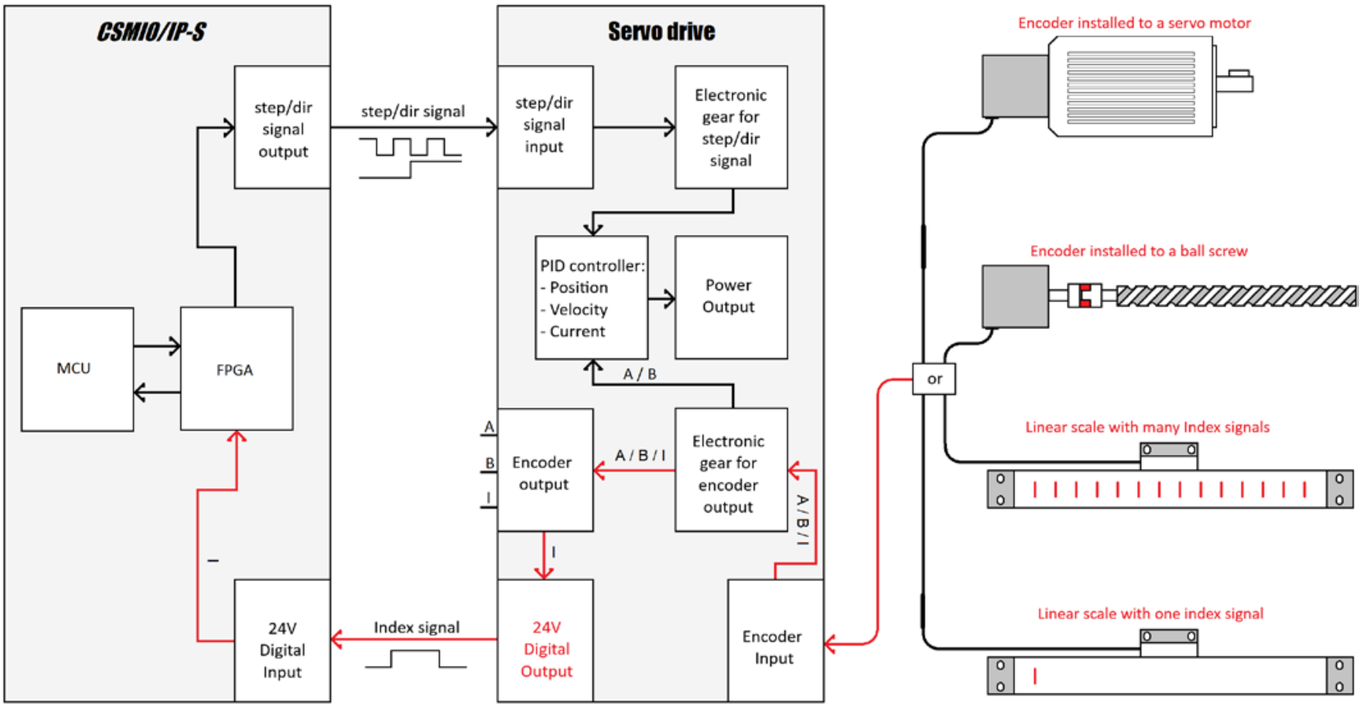
In case if a servo drive has „Electronic gear for encoder output" we recommend setting the lowest resolution. By that an index signal will be longer and easier to notice by a CSMIO/IP-S motion controller (shown in the drawing below).

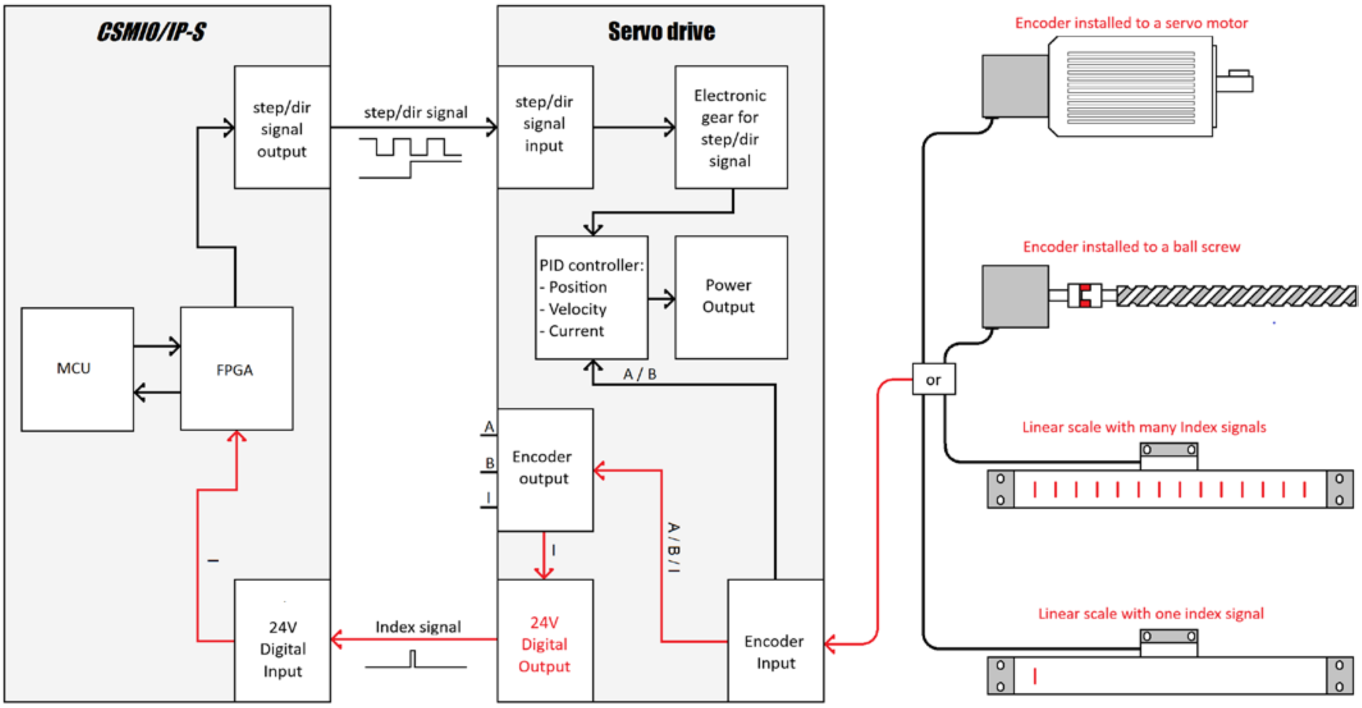
You should use the „Electronic gear for encoder output" especially if your servo drives have high-resolution encoders (e.g. Delta ASD B2 and A2).

CSMIO/IP-S without using „Electronic gear for encoder output" can easily detect an index signal coming from encoders with resolution of 10 000 p/rev (incl. all edges).

All the mentioned sources of an Index signal are available to a CSMIO/IP-S controller through:

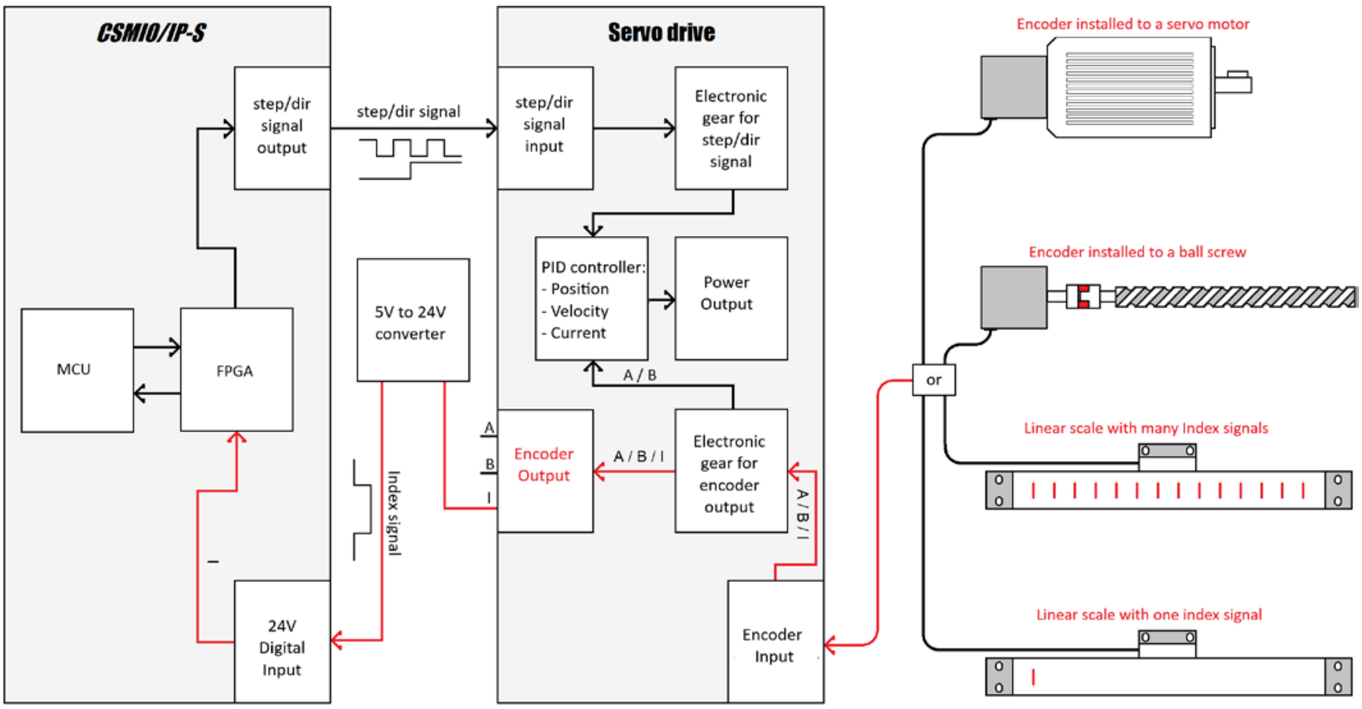
24V digital outputs of a servo drive
The output provides easy and fast Index signal connection to a motion controller. However not all servo drives provide index signal on 24V digital output.

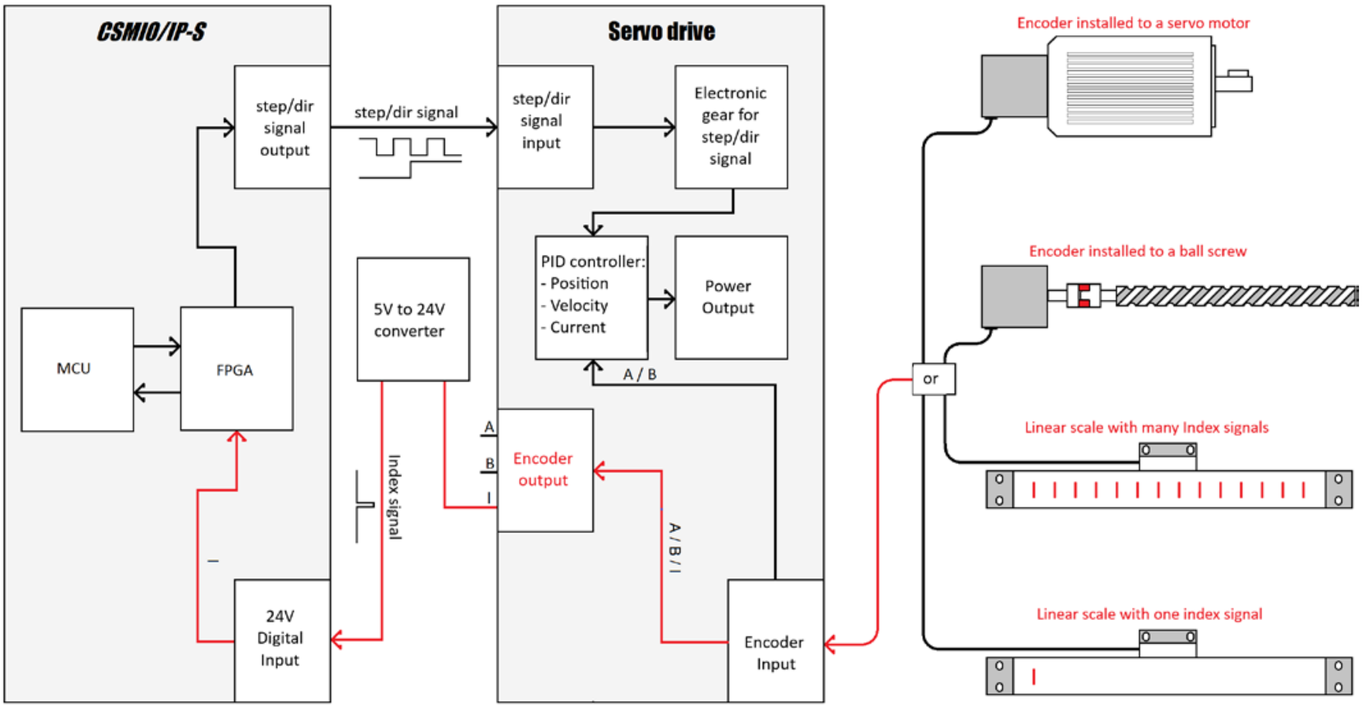




Encoder outputs

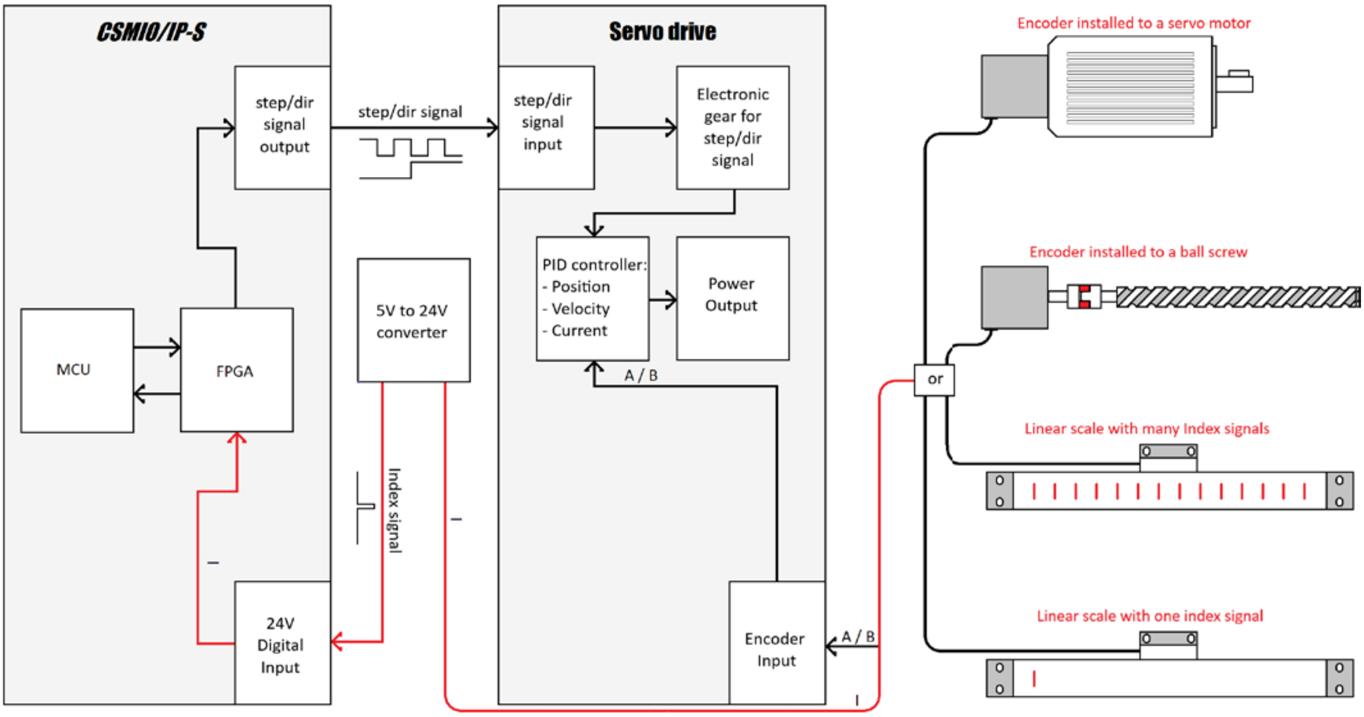
The output should be used if a servo drive doesn't have the previously mentioned output. Connection of „Encoder output" to a CSMIO/IP-S controller requires a 5V to 24V voltage converter.





Encoder or linear scale outputs

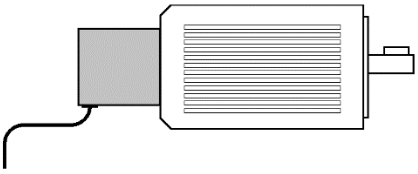
The output can be used as a last resort if a servo driver doesn't have any of the two outputs mentioned above. Connection of „Encoder or linear scale output” to a CSMIO/IP-S controller requires 5V to 24V voltage converter.



- CSMIO/IP-A controller

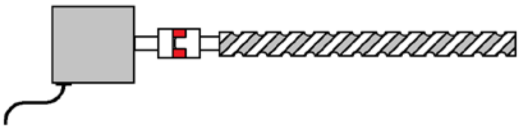
An encoder installed to a servo motor

In this case the parameter means an encoder pulses number per one revolution (incl. all edges) In other words the parameter is pulses number received by a CSMIO/IP-A controller after turning a servo motor shaft one full rev.



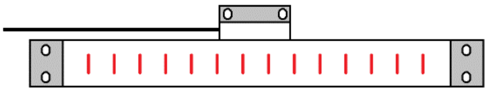
An encoder installed to a ball screw

In this case the parameter means an encoder pulses number per one revolution (incl. all edges). In other words the parameter is pulses number received by a CSMIO/IP-A controller after turning a ball screw one full rev.



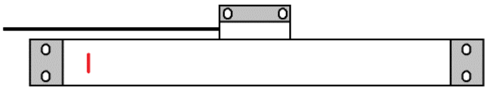
A linear scale with many Index signals

In this case the parameter means a linear scale pulses number from one index signal to another index signal (incl. all edges). In other words the parameter is pulses number received by a CSMIO/IP-A controller after covering by an axis the distance from one index signal to another.



A linear scale with one Index signal

If a linear scale has only one index signal, the parameter will not matter and we should put its value to correspond with a few millimeters move of an axis. For example, if the axis move is 5mm then the parameter will be five times this value of pulses number per one 1mm of a linear scale (incl. all edges). In other words the parameter is pulses number received by a CSMIO/IP-A controller after the axis moves 5mm.



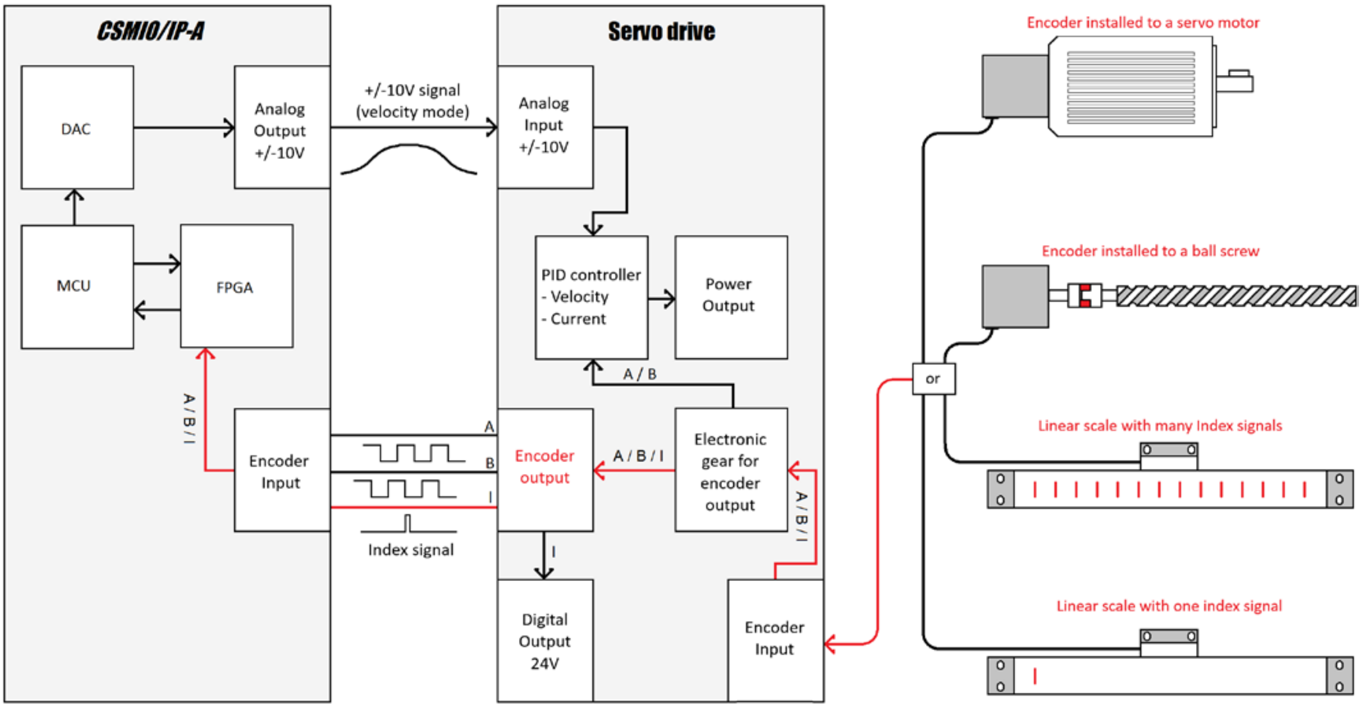
ATTENTION!

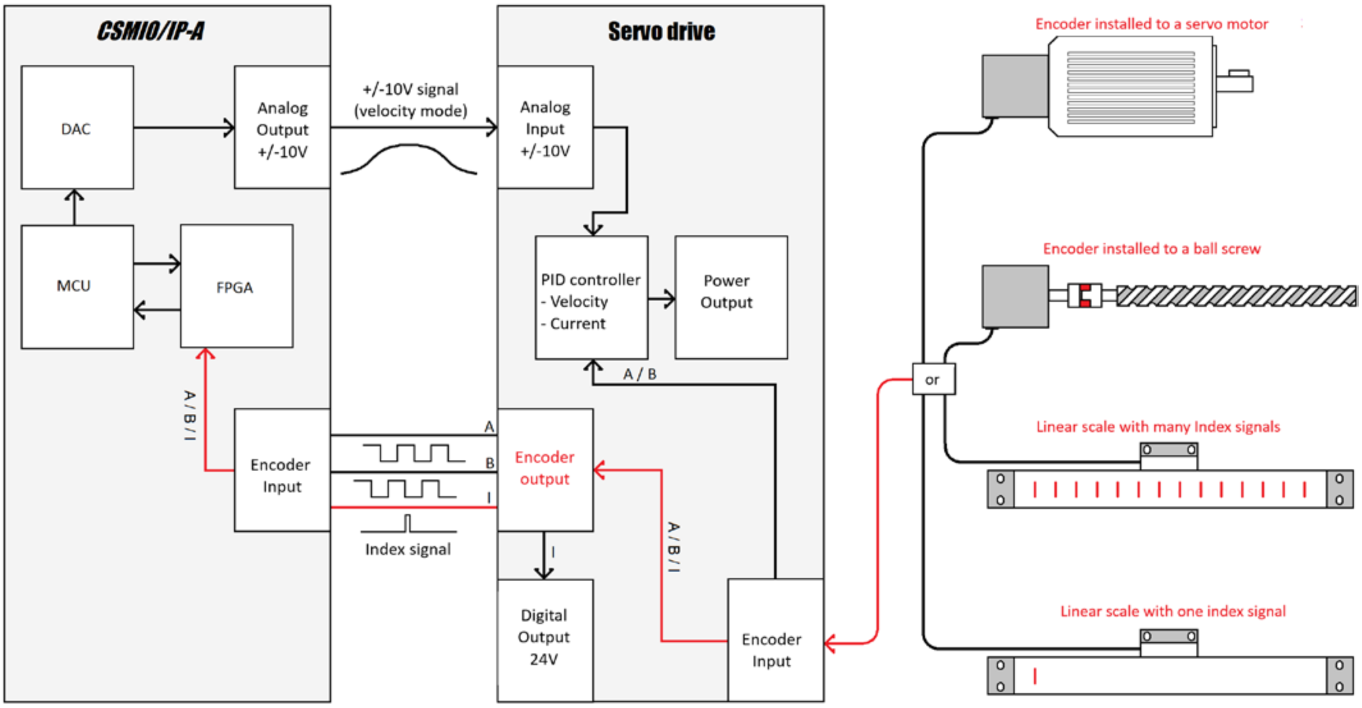
In case if a servo drive has „Electronic gear for encoder output" it must be included when calculating the parameter.

All the mentioned sources of an Index signal are available to a CSMIO/IP-A controller through:

Encoder output

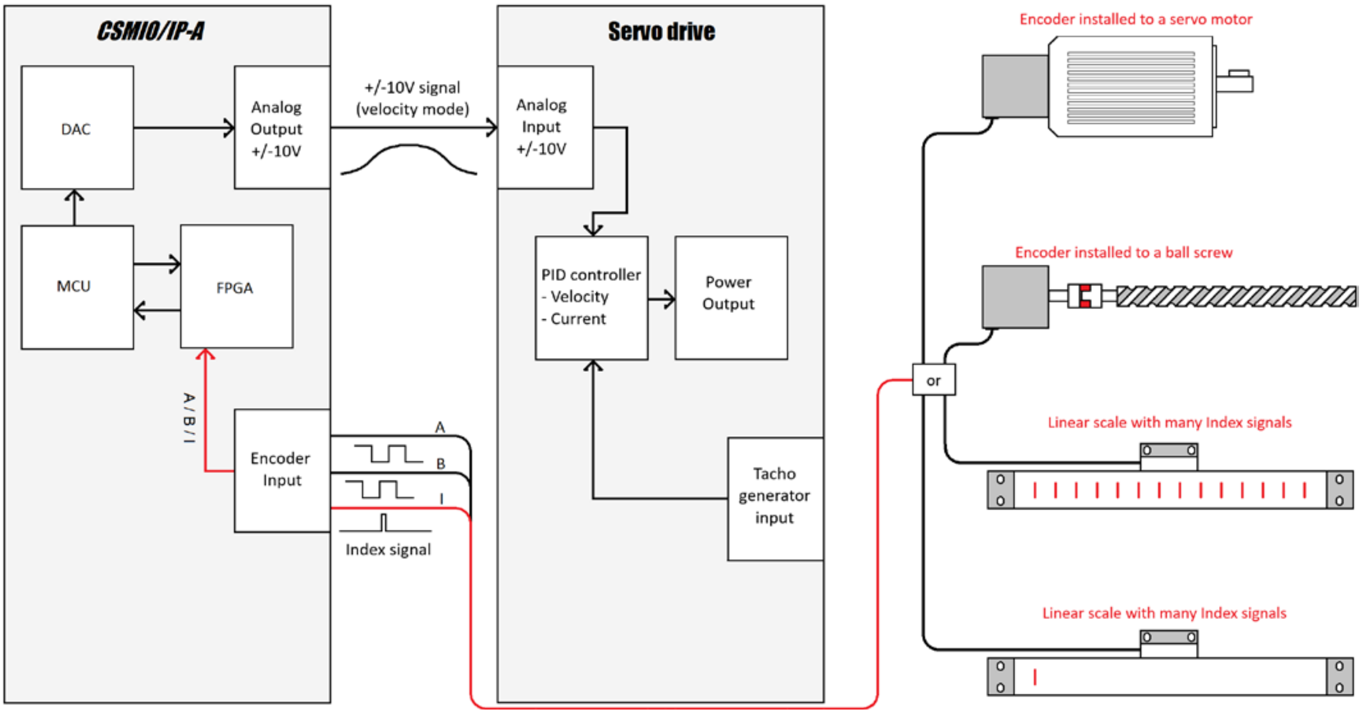
The main task of the „encoder output" it to provide feedback signals (channel A and B) and at the same time an index signal (channel Z) to a CSMIO/IP-A controller. In this situation the index signal connection is only about to connect „encoder output" signals of a servo drive to an „encoder input" of a CSMIO/IP-A controller. More accurately, we connect „GND(0V)" with „GND(0V)", „A+" with „A+", „A-" with „A-", „B+" with „B+", „B-" with „B-", „Z+" with „Z+", „Z-" with „Z-". Pin +5V of a CSMIO/IP-A controller is not used.





Output of an encoder or a linear scale

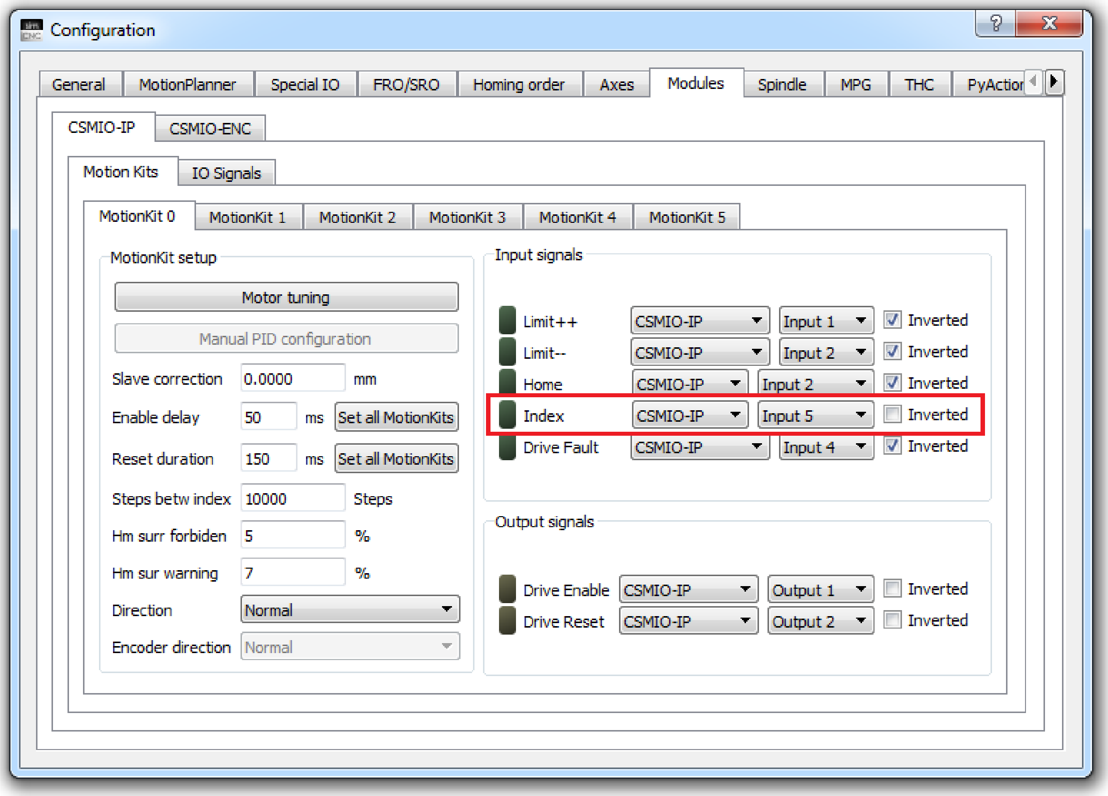
The main task of the „output of an encoder or a linear scale" is to provide feedback signals (channel A and B) and at the same time an index signal (channel Z) to a CSMIO/IP-A controller. In this situation the index signal connection is only about to connect „output of an encoder or a linear scale" signals to an „encoder input" of a CSMIO/IP-A controller. More accurately, we connect „GND(0V)" with „GND(0V)", „+5V" with „+5V", „A+" with „A+", „A-" with „A-", „B+" with „B+", „B-" with „B-", „Z+" with „Z+", „Z-" with „Z-".



9.3.Index signal configuration (CSMIO/IP-S, CSMIO/IP-A)

Select as follows „Configuration > Settings > Modules > MotionKit 0 >"

- CSMIO/IP-S controller



INDEX - is an input signal (digital, 24V) used in homing process on switch and index. We set the signal only if we use a CSMIO/IP-S controller as it should be sourced from any 24V digital input.

ATTENTION!

The „Index" signal can only be connected to a CSMIO/IP-S controller.

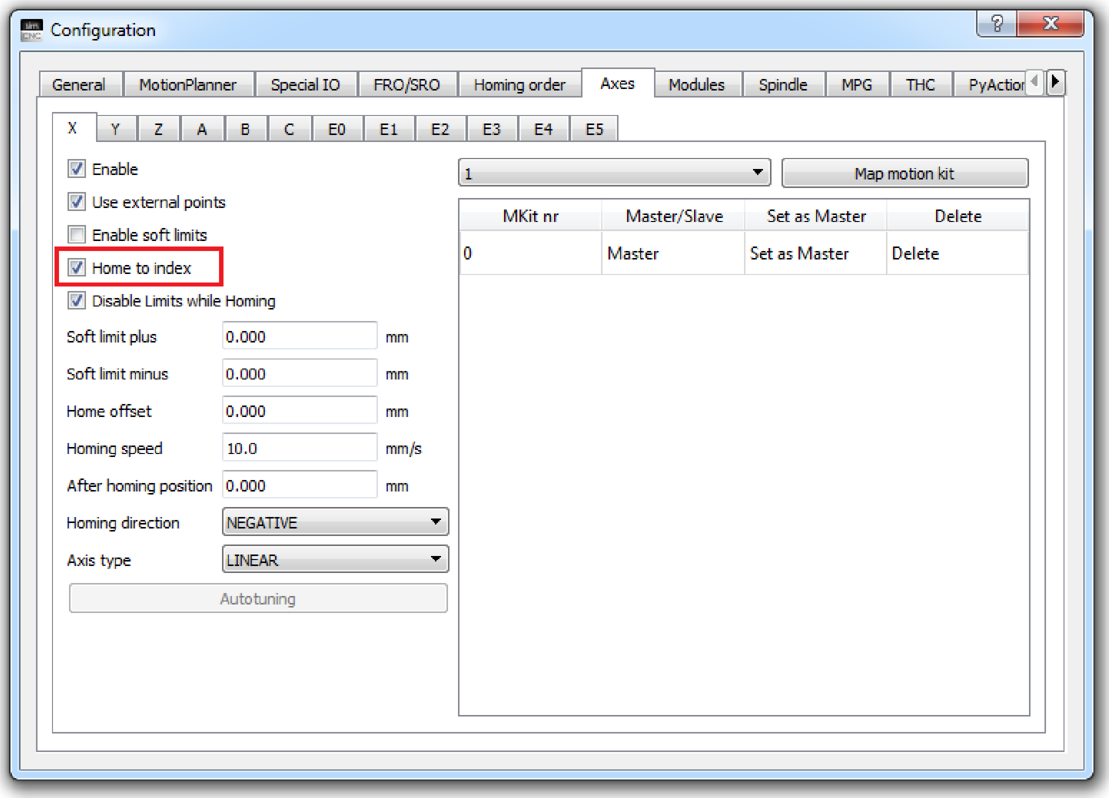
- CSMIO/IP-A controller

A CSMIO/IP-A controller doesn't require „Index" signals configuration as they are sourced from encoder inputs and as we know encoder inputs channels are permanently assigned to „MotionKit" with the same number. Below you can see the internal signal number 24 assigned permanently to the „MotionKit 0". The areas for „Index" signal configuration were blocked in this case.

9.4. Precise homing on index activation (CSMIO/IP-S, CSMIO/IP-A)

Select as follows „Configuration > Settings > „Axes” > „X”

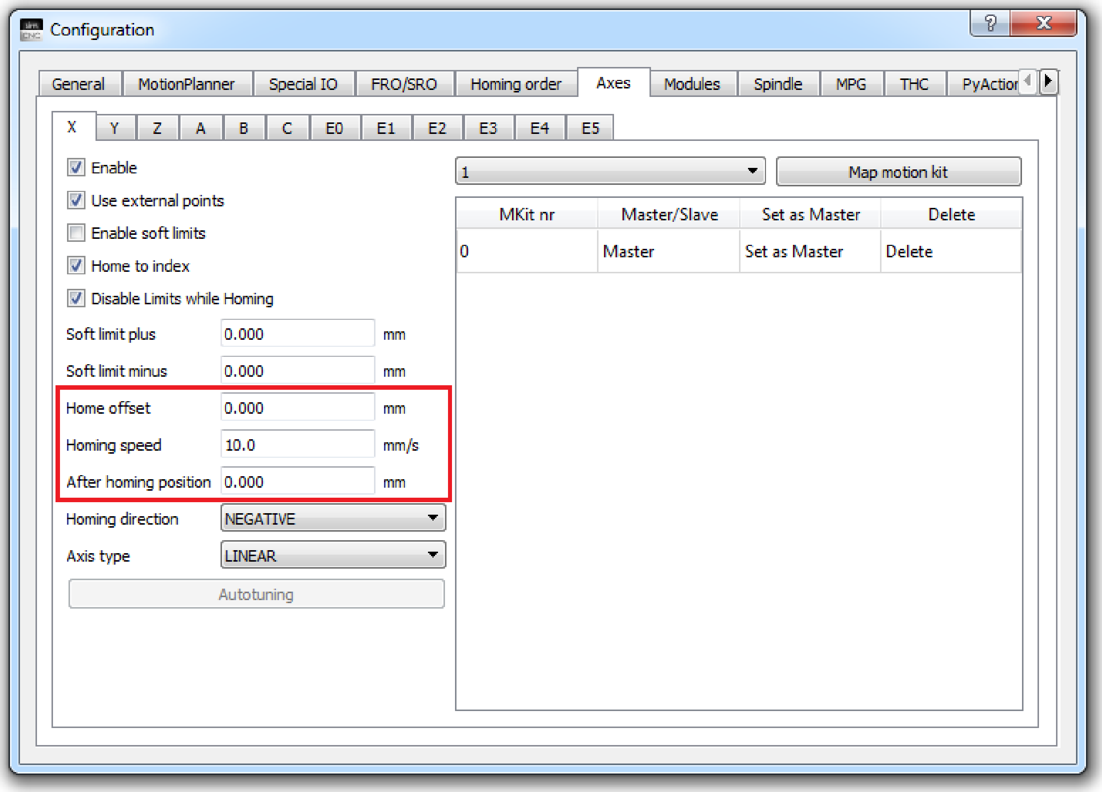
The „Homing on Index” option is only available for CSMIO/IP-S and CSMIO/IP-A controllers. CSMIO/IP-M controller doesn't support homing with a switch and an index signal.



INDEX HOMING – is the option to reference an axis by finding a homing switch and an index signal in the second place.

9.5. Additional homing options (all CSMIO/IP controllers)

Select as follows „Configuration > Settings > „Axes” > „X”



a) "Homing Offset" parameter

HOMING OFFSET – a parameter used to move an axis right after homing.

How to set the parameter value? Target value of the parameter must be selected according to needs.

- If we want to make a 10 millimeter move in positive direction of an axis, the parameter value must be 10.
- If we want to make a 10 millimeter move in negative direction of an axis, the parameter value must be -10.
- If an axis should stay on its place after homing, the parameter value must be 0

The parameter is especially useful if for homing we only use switches, inductive switches (minimal hysteresis value) which are homing and limit switches at the same time. In this situation there is a risk that as a result of vibrations after axis homing, any of these switches will be activated again. This will cause an emergency stop. To solve it we should move an axis even by just 1 mm.

b) "After homing position" parameter

POSITION AFTER HOMING – the parameter defines a value of machine coordinates after homing and the additional move mentioned above (if used).

How to set the parameter value? Target value of the parameter must be selected according to needs.

- If we want the coordinates value to be 20, the parameter value must be 20.
- If we want the coordinates value to be -20, the parameter value must be -20.
- If we want the coordinates value to be 0, the parameter value must be 0.

Both the mentioned parameters can be used at the same time creating many different combinations.

c) "Homing speed" parameter

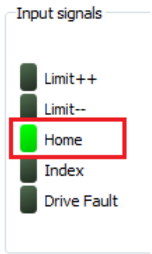
HOMING SPEED – the parameter defines at what speed an axis will move towards a homing switch during homing.

How to set the parameter value? Target value of the parameter must be selected according to needs but we have to remember that:

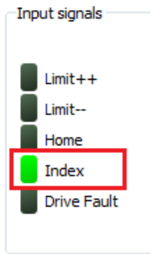
- the higher the homing speed is, the longer is the braking distance.
- moving off the switch is 4 times slower than moving towards the switch. By this feature we can use higher values of „Homing speed".

9.6. The first homing (all CSMIO/IP controllers)

First we should check how our switches responsible for homing work. Go to „Configuration > Settings > Modules > MotionKit 0 > Input signals" and press the switch to activate or, if you are using an inductive switch, put a steel object to it. If the switch works correct it should light up on the „Input signals" tab.



If we also use an index signal form homing (CSMIO/IP-S and CSMIO/IP-A) we should check them as well. Unfortunately, it's not that easy and it requires a lot of patience as the an „Index" signal is very short. To verify if the „Index" signal works correctly you should turn a motor shaft very slowly until the Index won't light up on the „Input signals" tab. In case of a CSMIO/IP-S controller, where the index signal is sourced from a servo drive with „Electronic gear for encoder output" the signal is much easier to find (more information in chapter IX p. 9.2 section c).

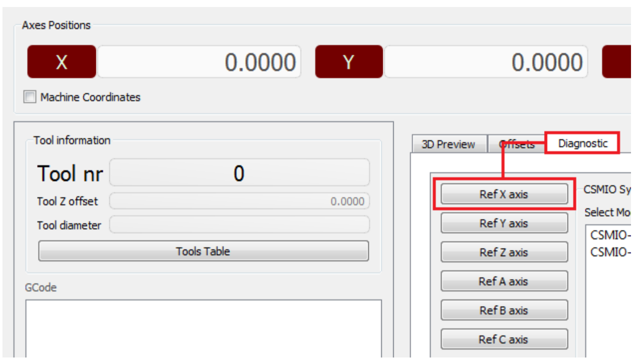


To keep full control over the first homing try it's recommended to temporarily set the „Homing speed" (chapter IX p. 9.5 section c) to a relatively low value and to set an axis using a JOG mode (chapter VIII p. b) more or less in the middle of its range of motion. Such an axis setting and low „Homing speed" value gives us the time to possibly stop homing if we would notice something worrying.

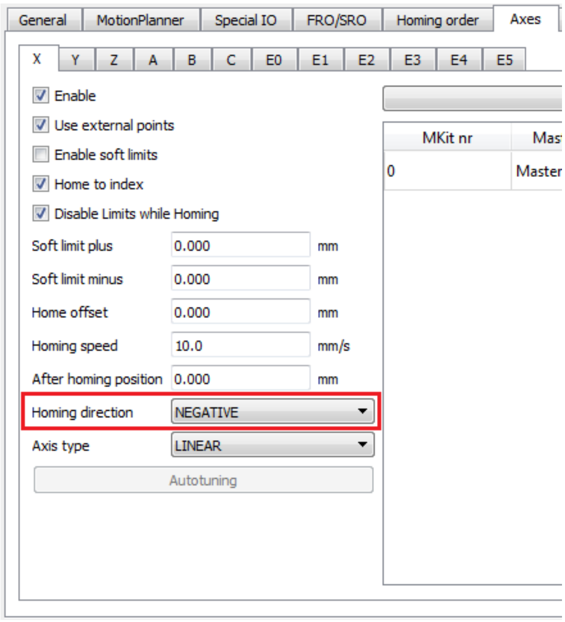
ATTENTION!

Homing can be stopped by E-Stop button or by „Stop" and „Enable" on simCNC screen.

After all the above was done we can start our first homing of an X axis. Go to „Diagnostics" window on main simCNC screen and press „Ref X axis".



If homing direction is wrong we should stop the process and go to: „Configuration" > „Settings" > „Axes" > „X" and look for a „Homing direction" option and change it from „Negative" to „Positive".



NEGATIVE „Homing direction"– an axis will look for a homing switch by moving in negative direction.

POSITIVE „Homing direction" – an axis will look for a homing switch by moving in positive direction.

ATTENTION!

Before we select the „Homing direction" we have to properly set direction of axis motion (chapter VIII point b). Remember that axis motion direction affects „Homing direction".

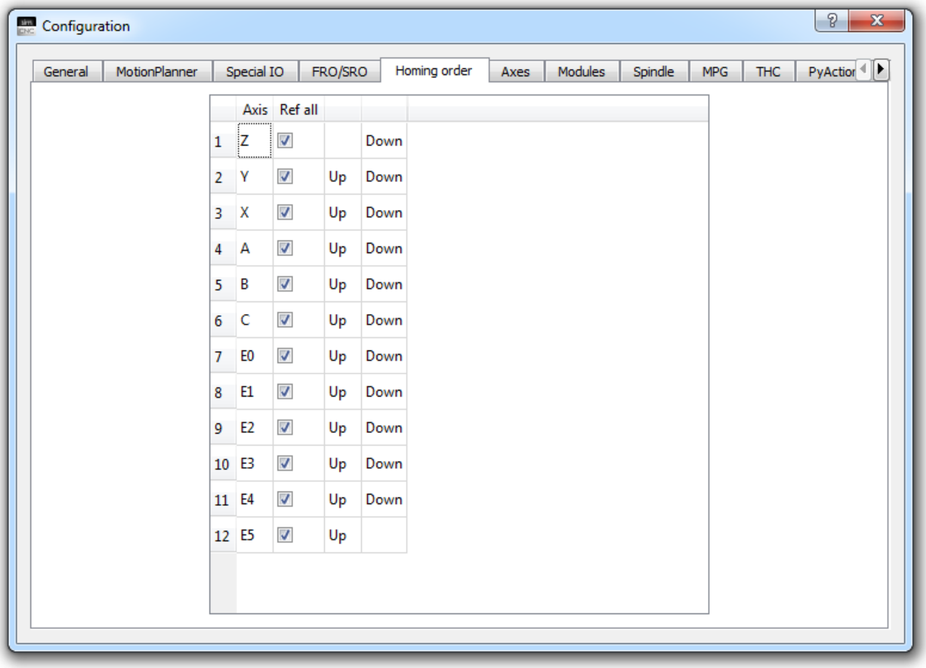
If we retry the homing but it will be stopped again:

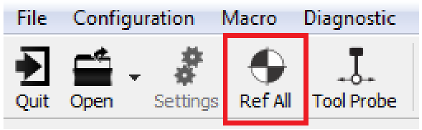
- for all CSMIO/IP controllers: after switch activation, right before axis direction change and displaying an error message of no switch signal - look for more information in chapter IX p. 9.1 section a).
- for CSMIO/IP-S and CSMIO/IP-A controllers: after axis direction change and displaying an error message about crossing „Forbidden range" - look for more information in chapter IX p. 9.1 section b).
- for CSMIO/IP-S and CSMIO/IP-A controllers: after axis direction change and displaying an error message of „Index" signal not found - look for more information in chapter IX p. 9.1 section c).

The mentioned chapters describe what steps we should take after the first interrupted homing process and what could cause it.

9.7. Homing order

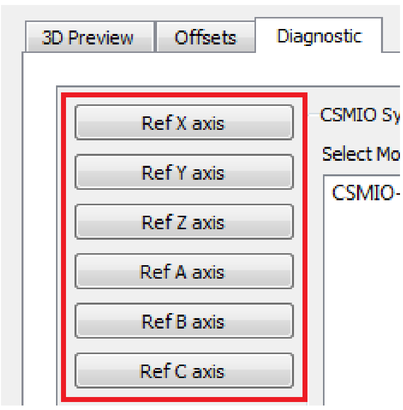
Select as follows „Configuration > Settings > „Homing order”





HOMING ORDER – with this tab we can change default order of axis referencing if we activate it using „Ref All” option placed on main simCNC screen. The homing order defined in the list shown above, from the top to the bottom. We can change it using the „Up” and „Down” buttons. If you press the „Up” button the relevant axis will go one position up and if you press „Down” the axis will go one position down.

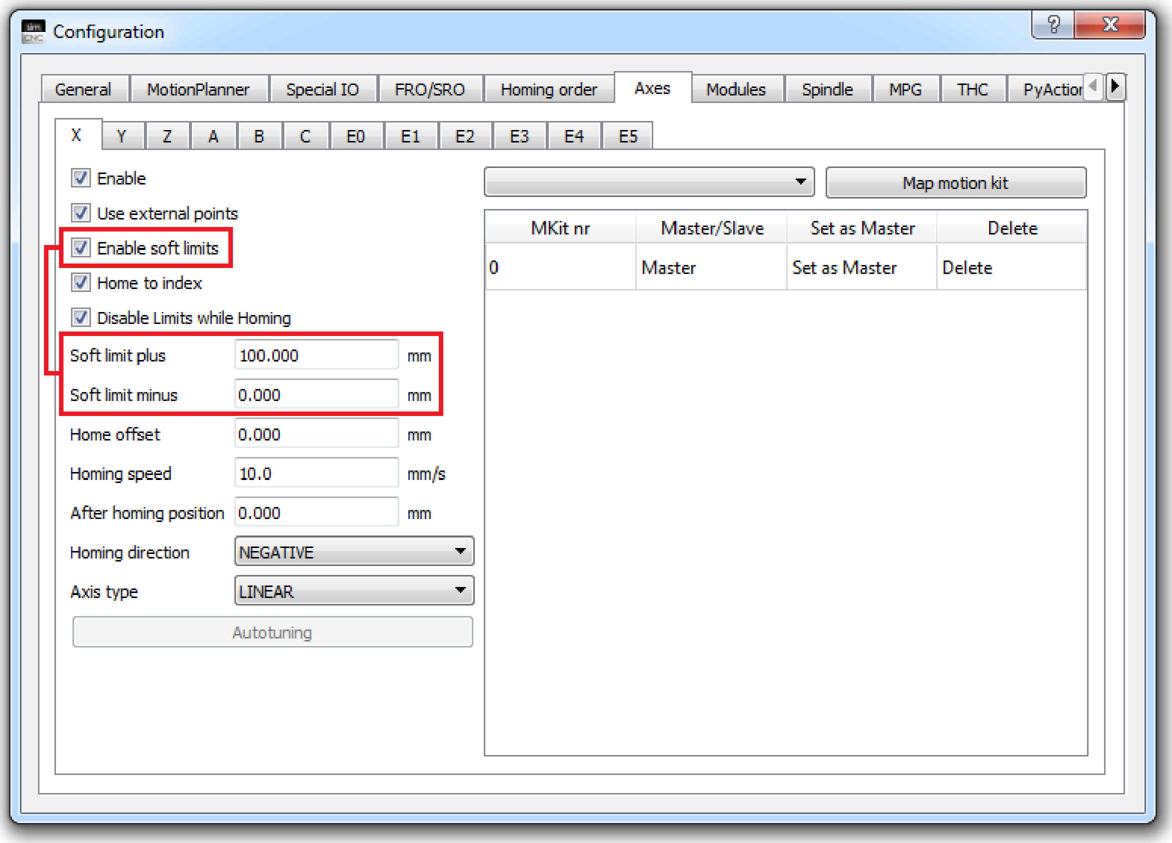
REF ALL – using this option we can exclude an axis from the list. If the axis is excluded it won't be referenced if we press „Ref All”.



We can still reference the excluded axis from the „Diagnostics” window on simCNC screen.

X. Software limits

Select as follows „Configuration > Settings > „Axes" > „X"



a) Select the „Enable soft limits" option

After selecting this option we get software limits referring to machine coordinates. The limits task is to limit axis motion range. If we try to cross the software limit in "JOG" or "MPG" mode, an axis smoothly stops on it. It's not possible to cross the software limit when executing a gcode script as simCNC software analyzes the gcode first while loading it. We can only cross the software limit executing Python scripts and some gcodes (e.g. probing rigid tapping) which operation can't be predicted in advance.

b) „Soft limit plus" and „Software limit minus" parameters

The software limit is defined by a value of the two parameters „Software limit +" and „Software limit -". A „Software limit +" value is the limit on the positive side of an axis and a „Software limit -" is the limit on the negative side of an axis. The parameters value refers to machine coordinates, that's why the limits are always in the same place.
In the picture above we can see a situation where the „Software limit +" value is 100, and the „Software limit -" is 0. It means that the axis can move freely from 0mm to 100mm of a machine coordinates range.

How to set the parameter value? Target value of these parameters must be selected according to needs and axis motion range.

- The parameters value should be adjusted this way to avoid „Limit++" and „Limit--" switches activation.
- If a machine is equipped with a stationary linear automatic tool changer then the parameters value should be set this way to avoid a collision of a spindle and the tool changers. This configuration requirement is to disable the „Software limits" option during M6 macro automatic tool change.

ATTENTION!

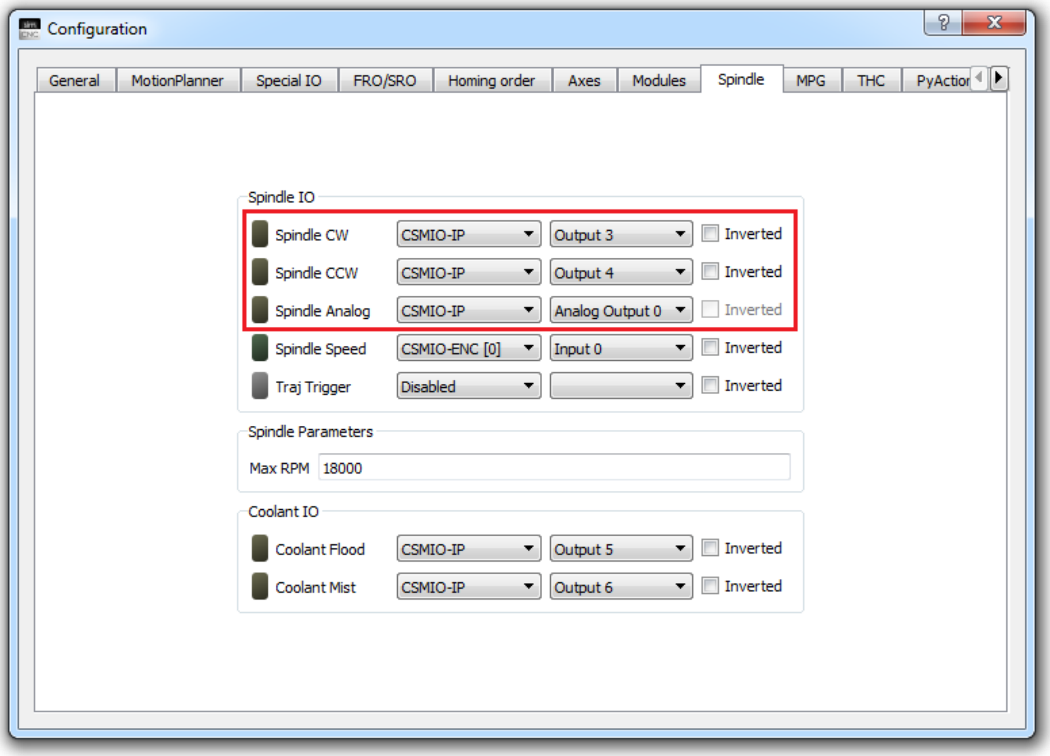
After selecting the „Software limits" option it's not possible to move a not referenced axis. It's to protect a machine against displacement of software limits.

XI. Configuration of spindle and coolant

Select as follows „Configuration > Settings > „Spindle"

a) Spindle control signals

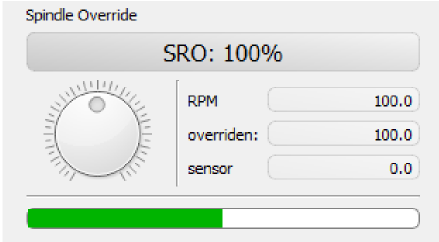
At this stage simCNC provides spindle control by 0-10V analog signal (rotational speed control) and two 24V digital signals (control of spindle direction). An example of such a control is a spindle driven by an asynchronous motor powered by a VFD.



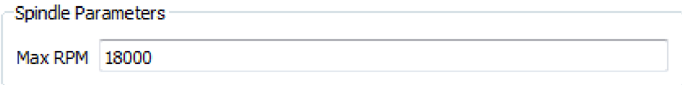
<u>SPINDLE CV</u> – (right revs) an output signal (digital, 24V), after receiving this signal a VFD should activate rotation of a spindle in a clockwise direction. We activate the signal with M3 command and deactivate it with M5 command from an MDI line or a gcode. We can also control the spindle manually (enable, disable) using the button place on simCNC screen (in the picture).

<u>SPINDLE CCV</u> – (left revs) an output signal (digital, 24V), after receiving this signal a VFD should activate rotation of a spindle in a counterclockwise direction. We activate the signal with M4 command and deactivate it with M5 command from an MDI line or a gcode. We can also control the spindle manually (enable, disable) using the button place on simCNC screen (in the picture).

SPINDLE OVERRIDE – an output signal (analog, 0-10V), that informs a VFD what rotational speed should a spindle get. We set the spindle speed with „S" command (e.g. S1000, where the 1000 is a revs number per 1 minute) from an MDI line or a gcode. Spindle rotational speed can be adjusted (changed) in range from 0% to 200% using the knob on simCNC screen (in the picture).



b) Spindle RPM calibration

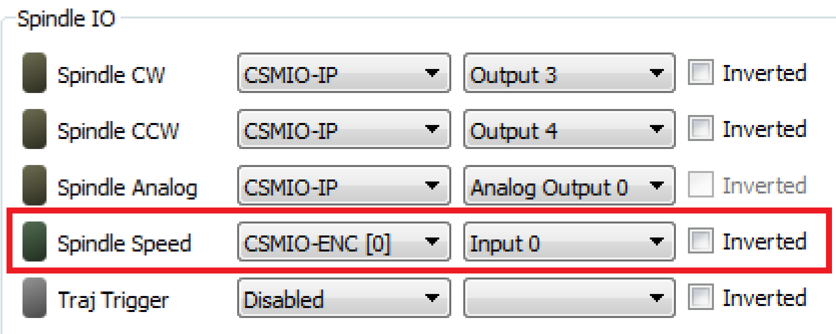


MAXIMAL RPM – the parameter defines maximal spindle speed. CSMIO/IP controller calibrates 0-10V analog output basing on this parameter.

ATTENTION!

As we need the spindle rotational speed we've set to coincide with the real spindle speed we can't forget about calibration of a 0-10V analog input of VFD in relation to maximal frequency it gets.

c) Spindle readout

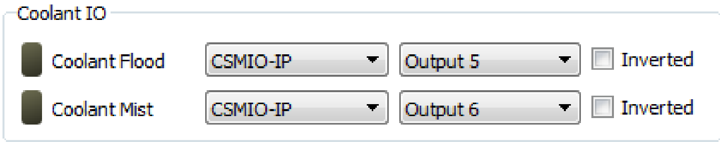


SPINDLE SPEED – encoder signal input of CSMIO-ENC module used to read current spindle speed. In the future it will be also used for threading and spindle positioning for tool change.

ATTENTION!

The CSMIO-ENC is supported by CSMIO/IP-S and CSMIO/IP-A controllers.
The „Inverted" option in case of the encoder signal input of CSMIO-ENC module changes direction of spindle speed measurement.

d) Coolant configuration



COOLANT FLOOD – an output signal (digital, 24V) for coolant pump activation. The signal is activated with M8, and deactivated with M9 command from an MDI line or a gcode. We can also control the coolant manually using the button place on simCNC screen (in the picture).

COOLANT MIST - an output signal (digital, 24V) for oil mist pump or other coolant substance activation. The signal is activated with M7, and deactivated with M9 command from an MDI line or a gcode. We can also control it manually using the button place on simCNC screen (in the picture).