

Usually CNC machines use one motor per machine axis, e.g.:

- one motor for X axis
- one motor for Y axis
- one motor for Z axis

However, some CNC machines can use two motors for particular axis. In many cases this is the axis that moves machine's gantry. In such case, *master* and *slave* axis concept is used.

-From motion control software standpoint this means that we need to configure master and slave axis outputs of controller in settings.

-From controller standpoint this means that controller will generate identical pulses on two separate axis outputs.

-From CNC machines standpoint this means that machine will use two motors for one axis.

In a situation where machine's gantry is not squared – one of the axis motors that move the gantry, either master or slave, is not at the same position as the other one(e.g. One of the motors lost steps etc..), user would need to home each motor separately to achieve squareness. A second limit switch for slave motor is needed.

As soon as you use two motors for one machine axis, you cannot have separate motion of master and slave axis - this is because controller needs to sustain synchronized motion of both motors at all times. We can do this with a simple workaround.

PlanetCNC TNG supports such procedure quite easily by creating new machine profile or using g-code parameters for specific machine settings.

This tutorial will describe procedure of using new machine profile for gantry squaring:

- Create new machine profile for gantry squaring
- Re-configure master and slave axis as two new independent axes
- Configure limit switch inputs and SPU values of independent axes
- Configuration of homing script code for gantry squaring
- Performing the gantry squaring procedure on machine

Before we start, just a quick description of the current machine situation used for this tutorial:

- Machine has 3 axes

- Machine gantry moves along the X axis

- X axis uses two motors

- Each X axis motor uses corresponding limit switch for reference(homing)

- Limit switch for master motor is connected to controllers limit switch input 1 and limit switch for slave motor is connected to controllers limit switch inputs 4

- Master and slave axis outputs are set at controller axis outputs 1 and 4.

1. Create new PlanetCNC TNG machine profile. This profile will be used for gantry squaring procedure.

Create new profile following this tutorial:

<https://planet-cnc.com/create-new-profile-planetcnc-tng-software/>

You can name it "Gantry Squaring" profile.

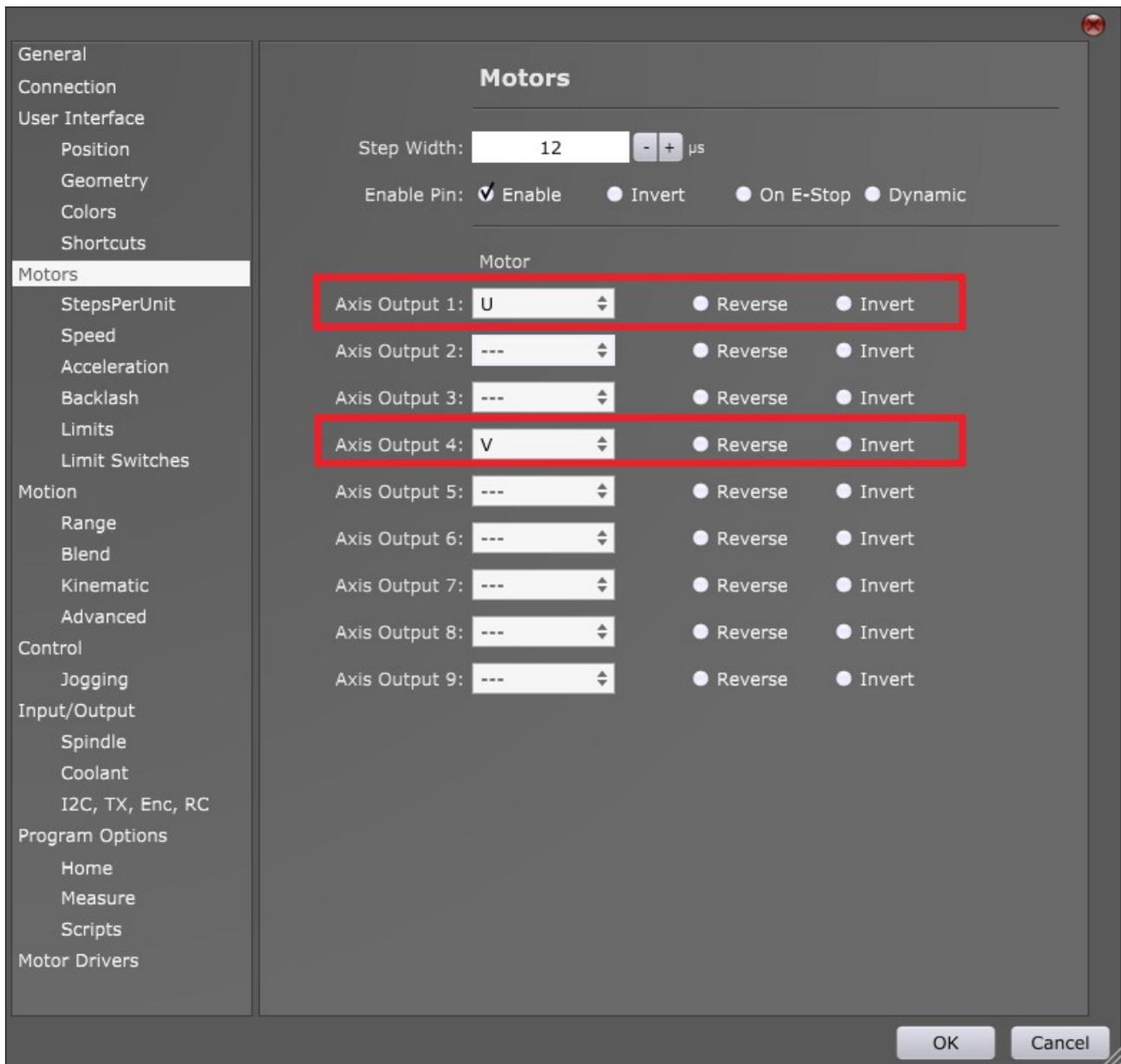
2. Start your Gantry Squaring profile.

2.1 In Gantry Squaring profile settings, we now configure current master and slave axis motor outputs (this tutorial uses axis outputs 1 and 4) as independent U and V axes.

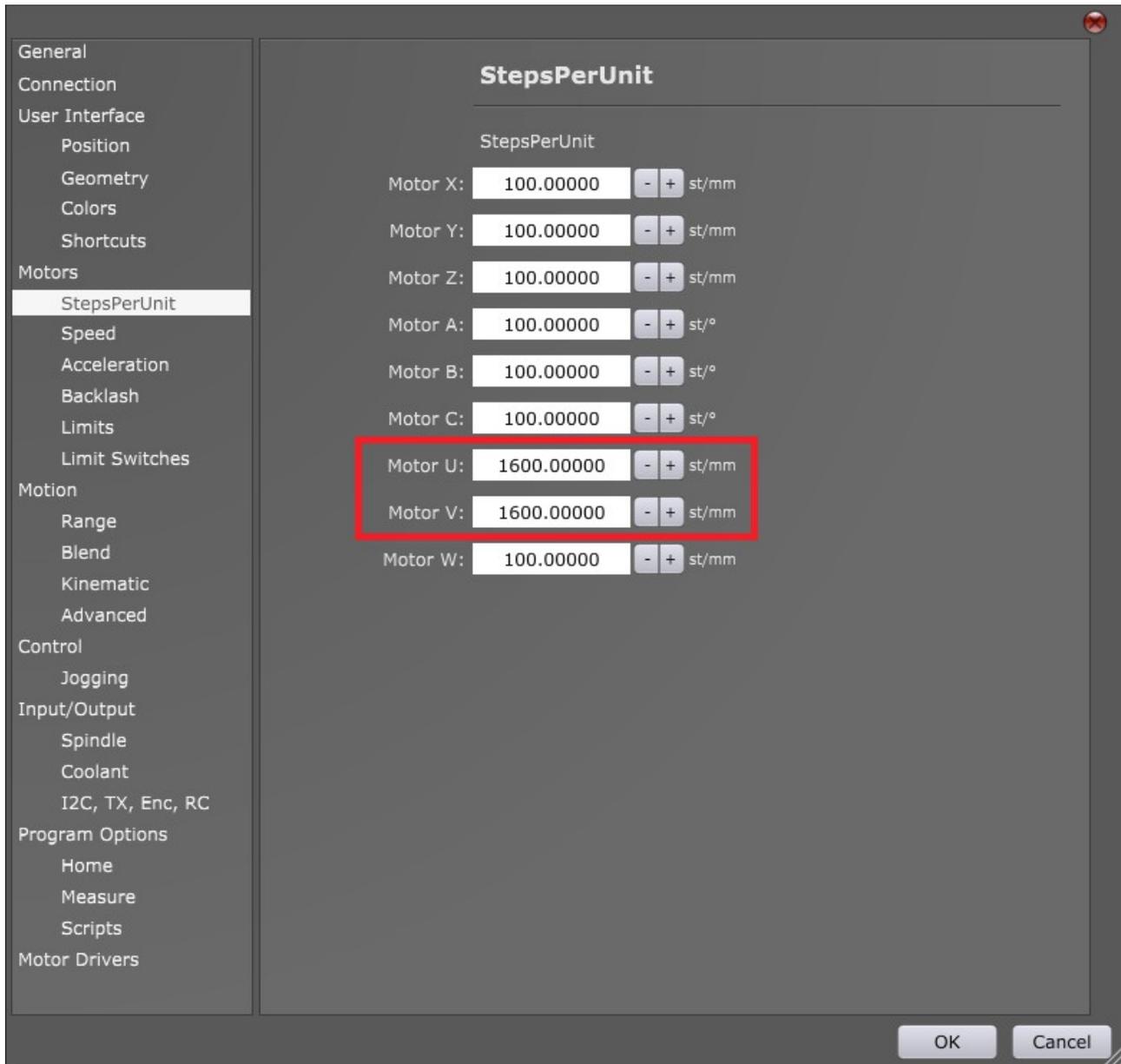
Outputs 1 and 4 because, our gantry moves along the X axis. X master and X slave axis outputs are configured at 1st and 4th axis output of controller.

U and V because, in order to avoid confusion and possible mishap we try to avoid regular letter names such as X;Y, that is why we assign letter U for master axis and V for slave axis.

File/Settings/Motors/Axis Outputs:



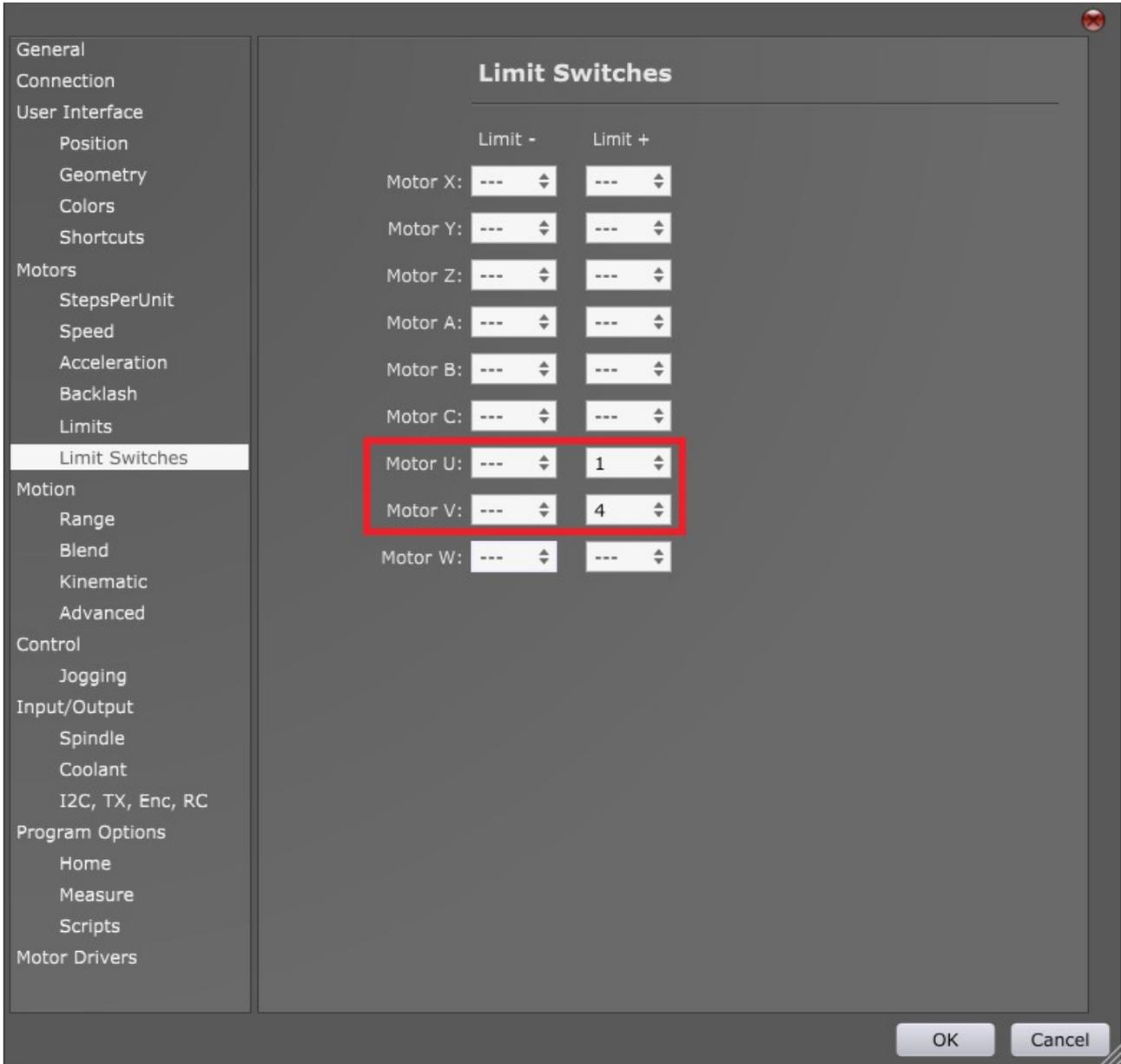
2.2 Set SPU values for U and V motors:



2.3 Configure limit switch inputs of master and slave axis motors.

Make sure that you set your limit switch inputs for axis motors that you choose in chapter 2.1. In our case we need to set limit switch inputs for axes U and V.

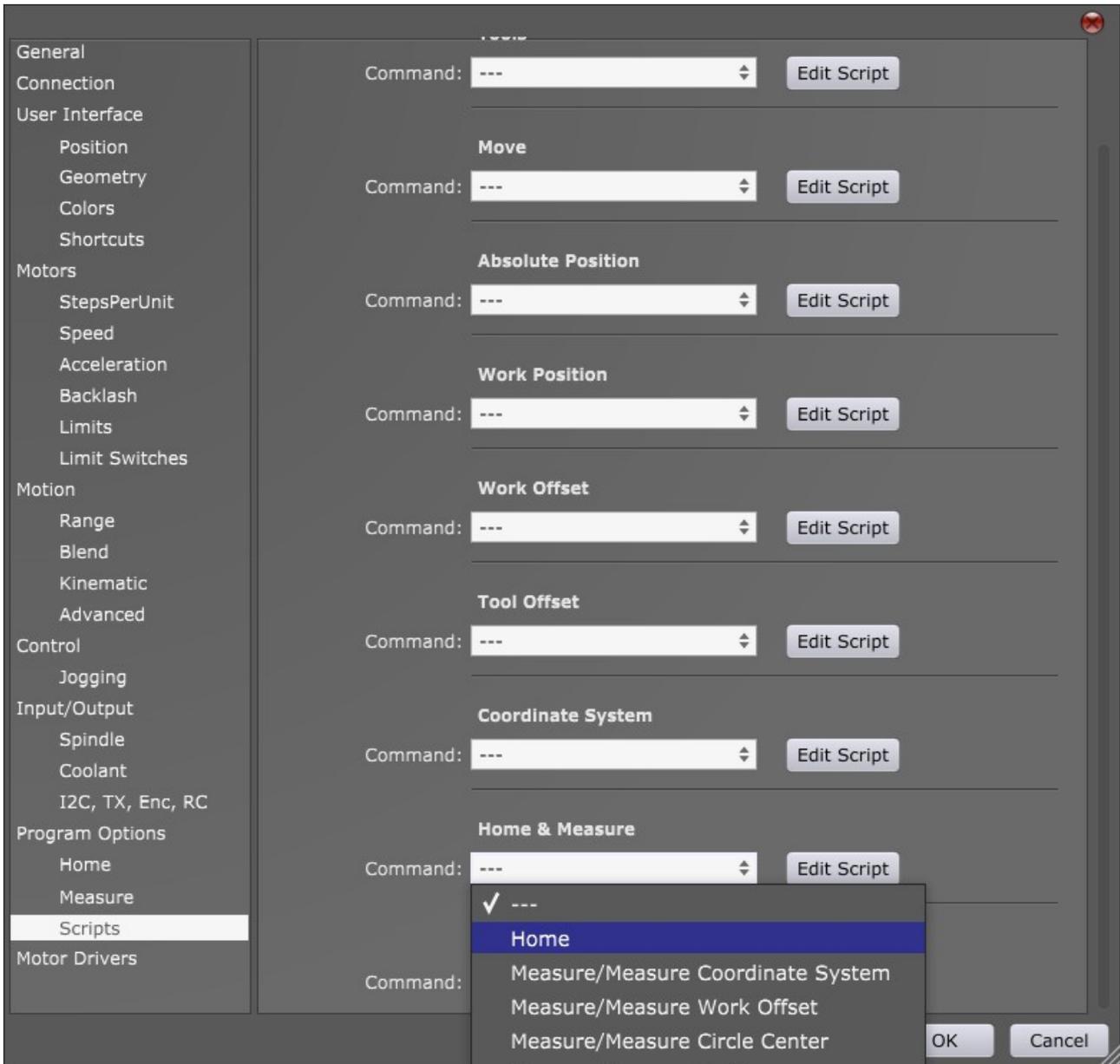
Also be attentive to direction of limit switch, + or -.



3. Generate and open Homing script file

In PlanetCNC TNG software click: File/Settings/Program Options/Scripts. Locate *Home & Measure*.

Select *Home* command and click *Edit Script*. Homing script file will open in your default text editor.



4. Please replace the existing default homing script code with the code below:

```
(name,Square Homing, 0)
o<chk> if [#<_hw_limit> ne 0]
  (msgdlg,ERROR Limits are triggered)
  M2
o<chk> endif
#<error> = 0

G38.1 U+10 V+10

o<chk> if [#<_hw_limit> eq 9]
  ///!!this number is the sum of both limit switch values.
  //See lookup table below at chapter 4.1 why this code uses number 9.
  (print,Both axes are square)
  G10 L9 U0 V0
  G0 U-1 V-1
o<chk> elseif [#<_hw_limit> eq 1]
  ///!!this number depends on which limit input your master axis limit
  switch is connected.
  //In this example, limit switch is connected to limit input 1.
  //See lookup table below at chapter 4.1 why this code uses number 1.
  (print,LIMIT pin 1, X Master)
  (print, Limit input number 1 triggered, squaring second axis)
  G10 L9 U0 V0 X-1
  G0 U-1 V-1

  G38.1 V+10
  G10 L9 V0
  G0 V-1
o<chk> elseif [#<_hw_limit> eq 8]
  ///!!this number depends on which limit input your slave axis limit switch
  is connected.
  //In this case, limit switch is connected to limit input 4.
  //See lookup table below at chapter 4.1 why this code uses number 8.
  (print,LIMIT pin 4, X Slave)
  (print,Limit input number 4 triggered, squaring first axis)
  G10 L9 U0 V0 X-1
  G0 U-1 V-1

  G38.1 U+10
  G10 L9 U0
  G0 U-1
o<chk> else
  #<error> = 1
o<chk> endif

o<chk> if [#<error> eq 1]
  (msgdlg,ERROR, wrong limits triggered)
o<chk> endif
M2
```

4.1 PLEASE NOTE!

Before using new script code, go through script code to check limit switch input numbers. Change numbers in the code in order to fit your limit switch situation.

*Here is a simple lookup table for limit input numbers.

Dedicated limit switch input number	Number Value used in script code
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128

5. Execute Gantry squaring procedure

-Start Squaring procedure by clicking button for Homing in the left vertical toolbar

-Once procedure is over, both axes will be at the same position relative to corresponding limit switches. Gantry should now be squared. Close Gantry Squaring profile.

-Use your working profile in order to home also remaining axes.