MASSO

Documentation

v5.79 - 11 December, 2023

How to use this documentation

Using QR codes for viewing interactive content and watching instructional videos.

Table Of Contents

1. MASSO Documentation

Welcome to MASSO documentation. You can quickly search for information using the **search bar** on the top right.

This documentation covers the **MASSO G2**, **MASSO G3** and **MASSO G3 Touch** controllers.

We have prepared the following **quick links** to help you find the right information for your project.

[Installing MASSO]

[Quick Start Guides]

[Current Software Versions]

[Machining with MASSO]

[Getting Support]

[Original Equipment Manufacturer (OEM)]

[Purchasing]

2. Warnings and Cautions

WARNING: Indicates circumstances or practices that can lead to personal injury as well as damage to the controller, the machine, or other equipment.

CAUTION: Indicates circumstances or practices that can lead to damage to the controller or other equipment.

INFORMATION: Indicates important information.

3. MASSO AI

MASSO has introduced MASSO AI to help you find answers to your questions quicker and easier.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Introducing MASSO AI

INFORMATION: MASSO AI gets it's information from the MASSO Documentation. It is unable to provide links but if you can the search function of this documentation to find out even more.

4. myWorkshop

Step1 Log into myWorkshop

https://myworkshop.masso.com.au

Login using your account email address and password.

If your initial account registration link has expired please select **Request Account Activation link** and a new registration email will be sent.

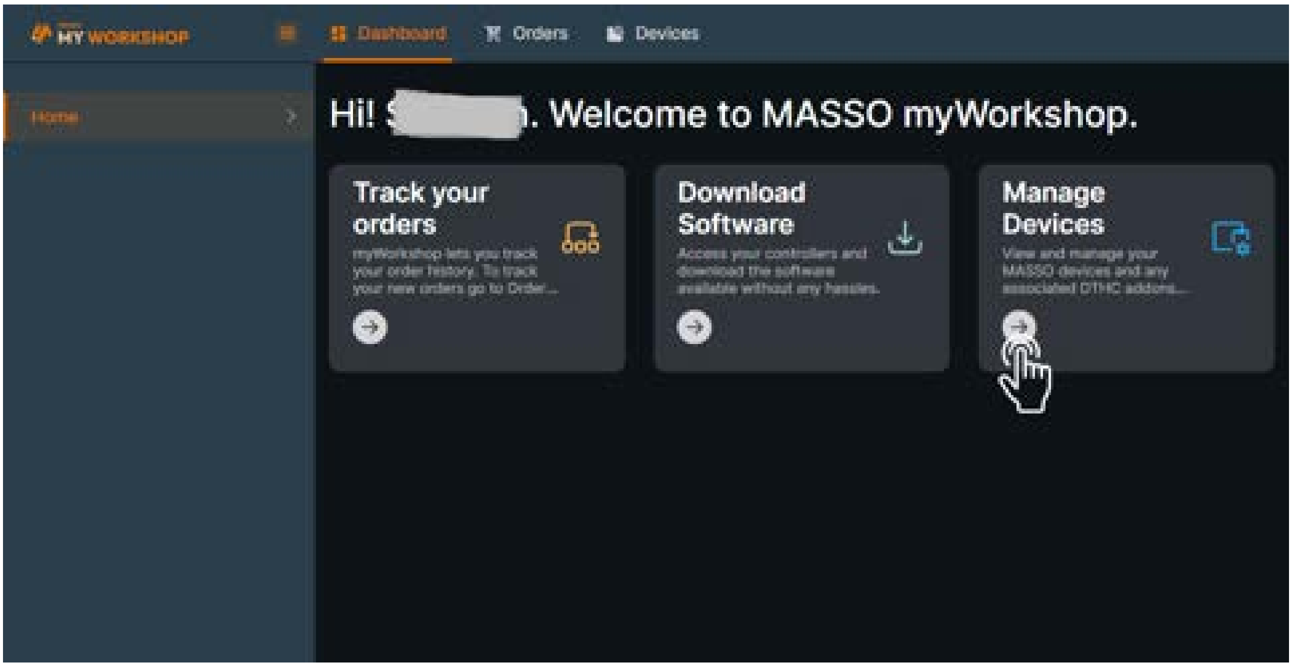
Please be patient as it can take a several of hours before you may see the activation email.

Please check your Spam folder and do not request a new activation or it will send a 2nd email and the link in the 1st email will not work when it arrives.

If you cannot remember your password please use the **Forgot Password** link

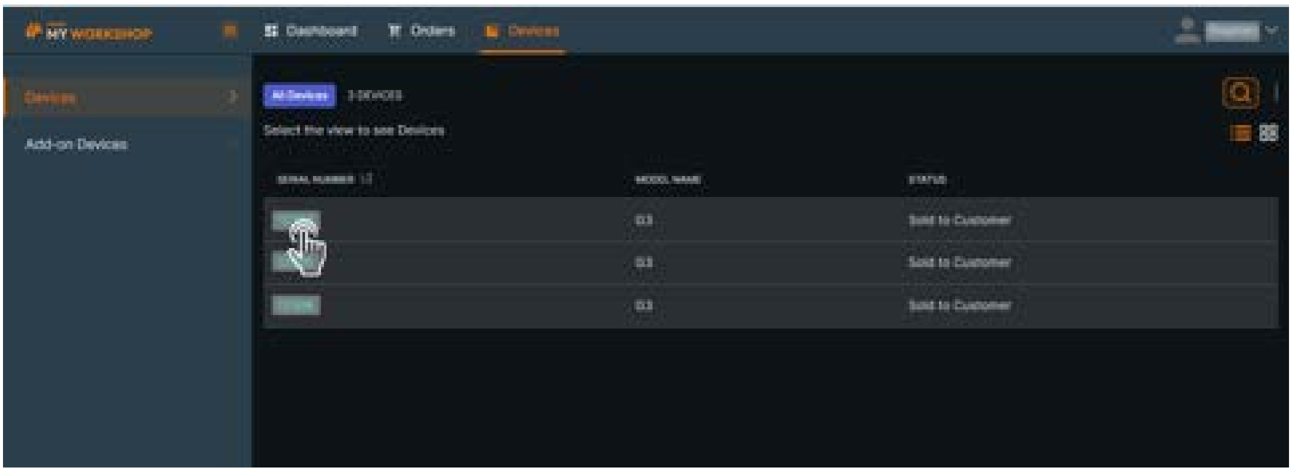
If you do not receive your password reset email please check your Spam folder

Step 2 Click Manage Devices

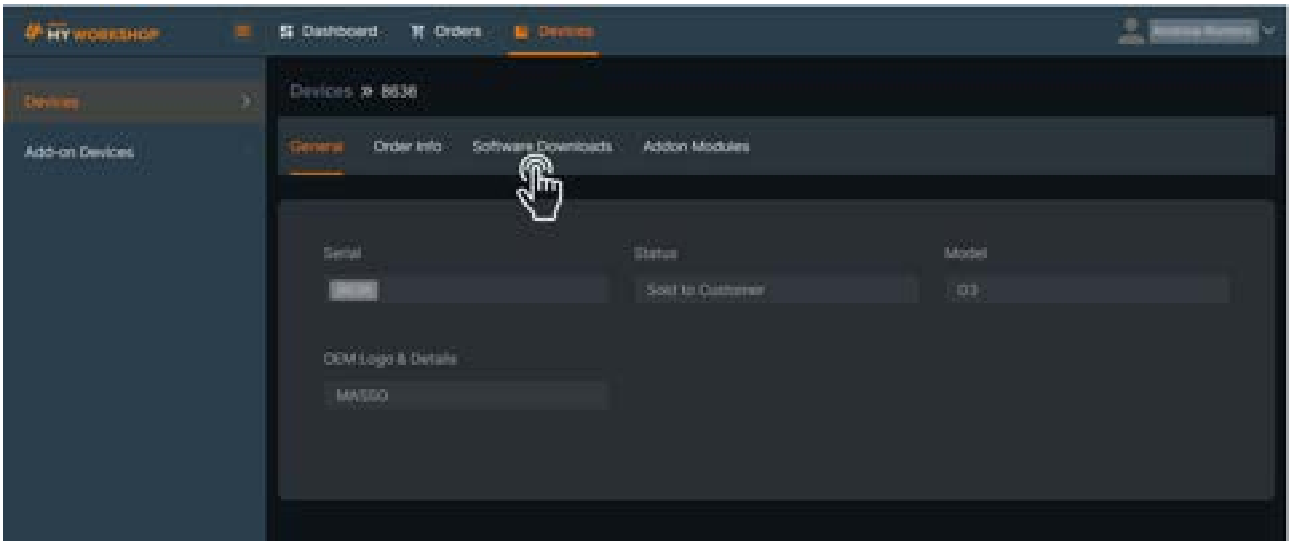


Step 3 Click your Serial Number

Click on the Serial number of your MASSO you want to download



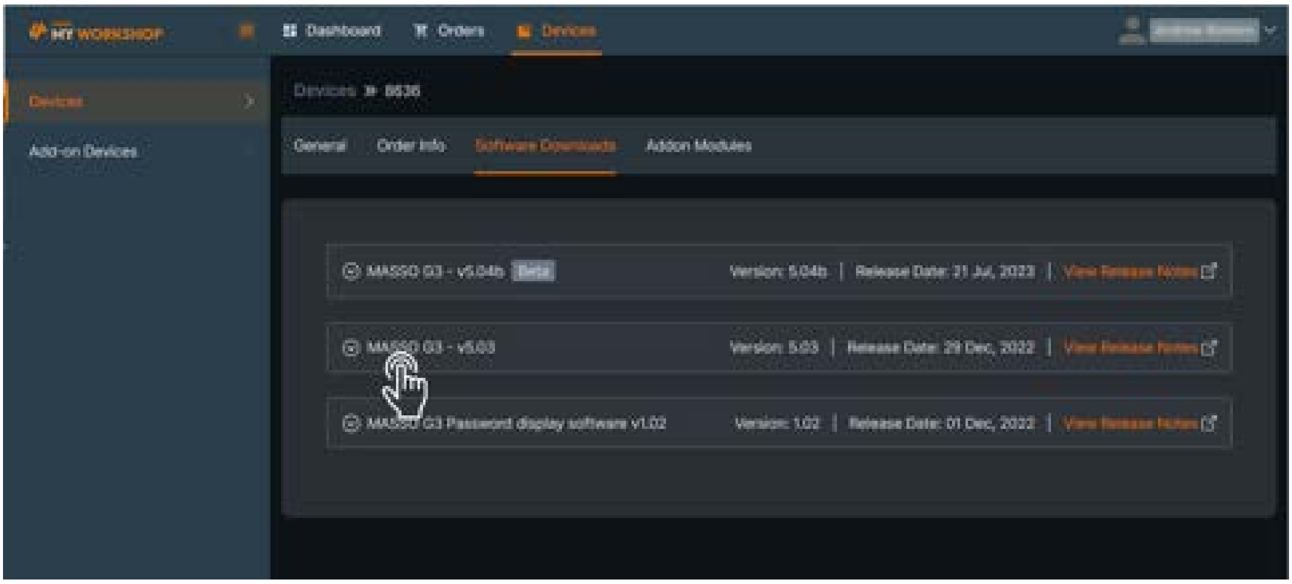
Step 4 Click Software Downloads



Step 5 Select software version

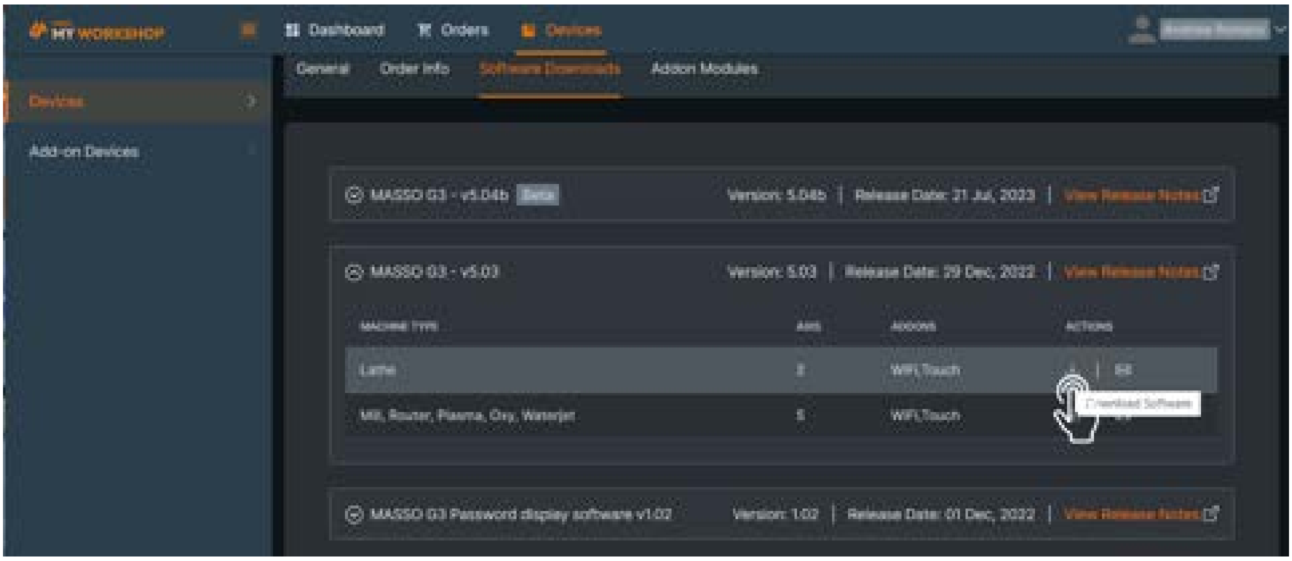
Click on the downward arrow or the name of the software version (as indicated in the image below) you wish to download.

You can see what has changed in this version by clicking View Release Notes found alongside the release date.



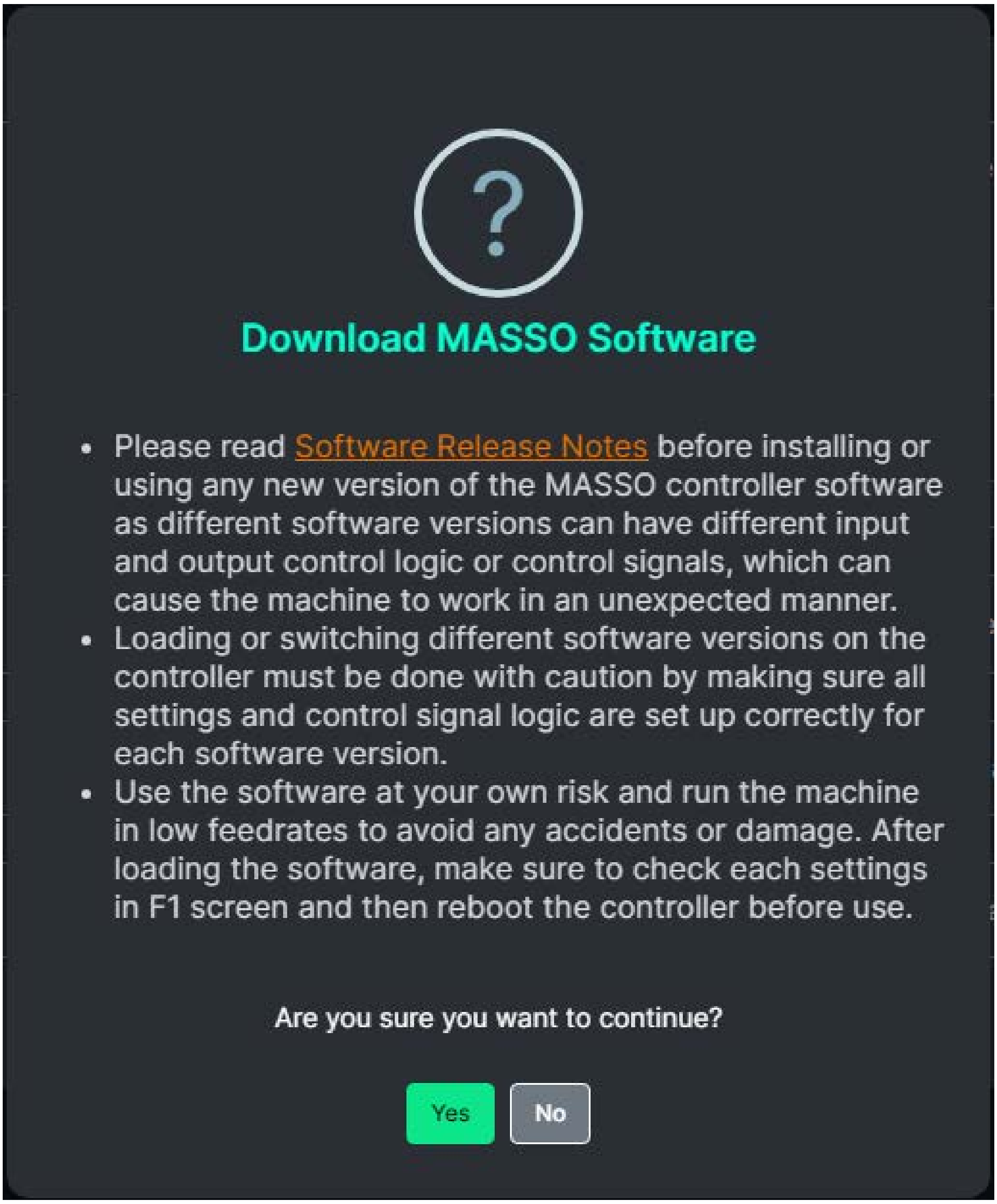
Step 6 Download Software

Click on the Download icon to download the latest version



A popup will open requesting you to download the software release notes and read them before installing.

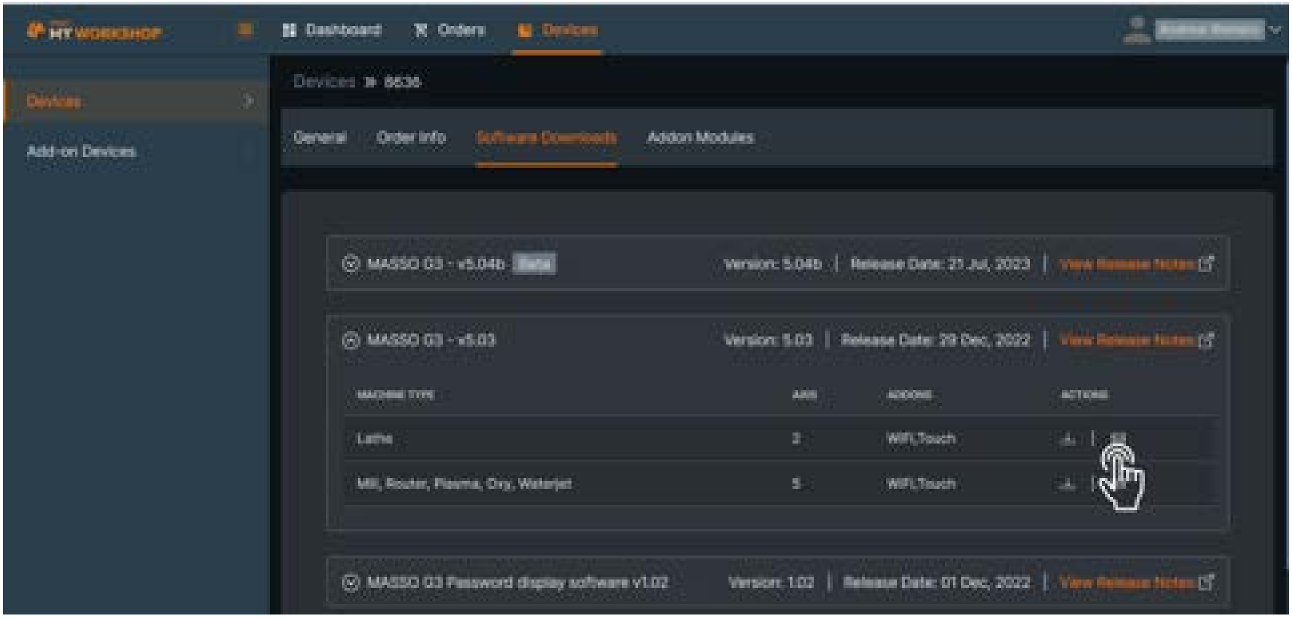
Click the **Yes** button to start the download

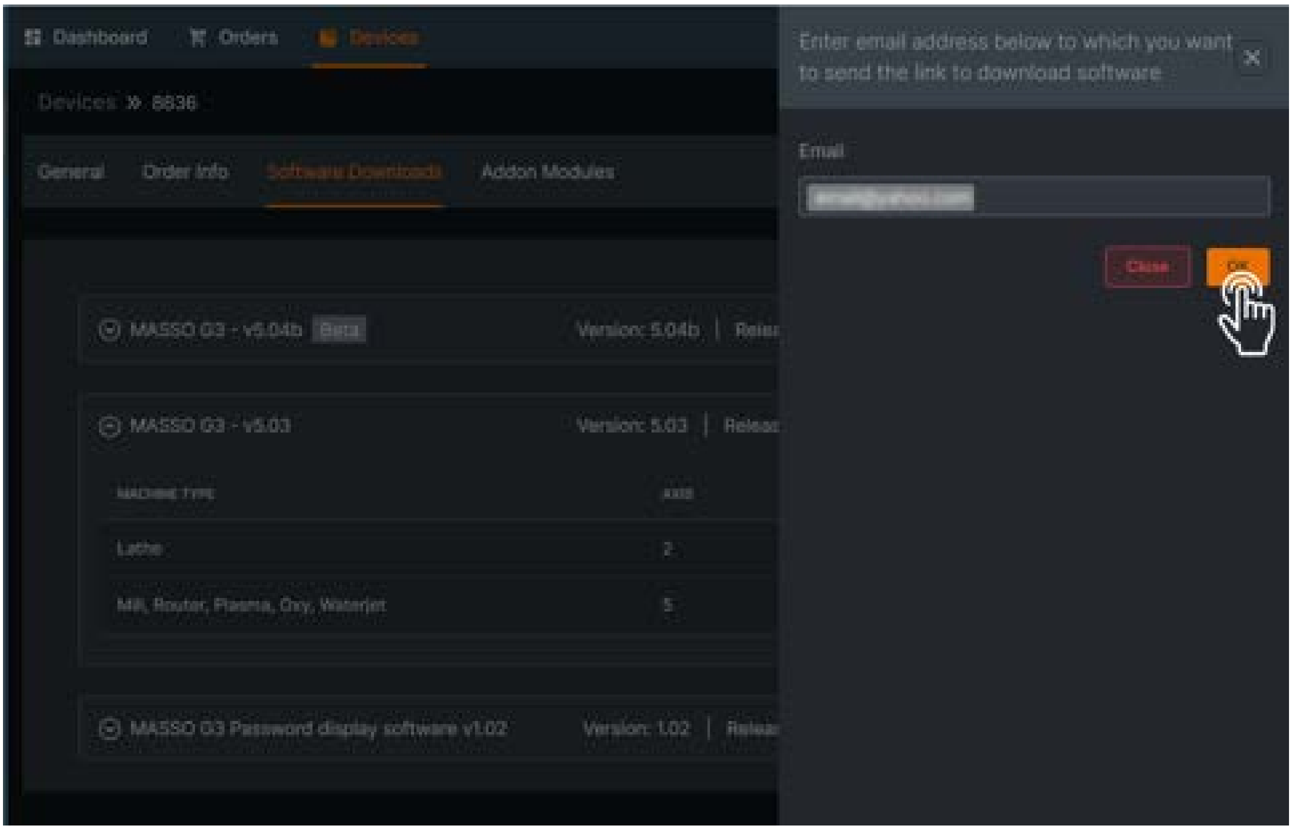


Step 6 Email Software

To Email a link to the software, click the Email icon next to the software version you wish to download and the Email Software Download Link box will open. The Email address will already be filled in with your registered Email address however you can enter a different address if you wish to have it sent elsewhere.

Click Send Email and you will receive an email with the Software download link.





Read other subtopics below:

4.1) Adding a DTHC

4.2) OEM and Distributors

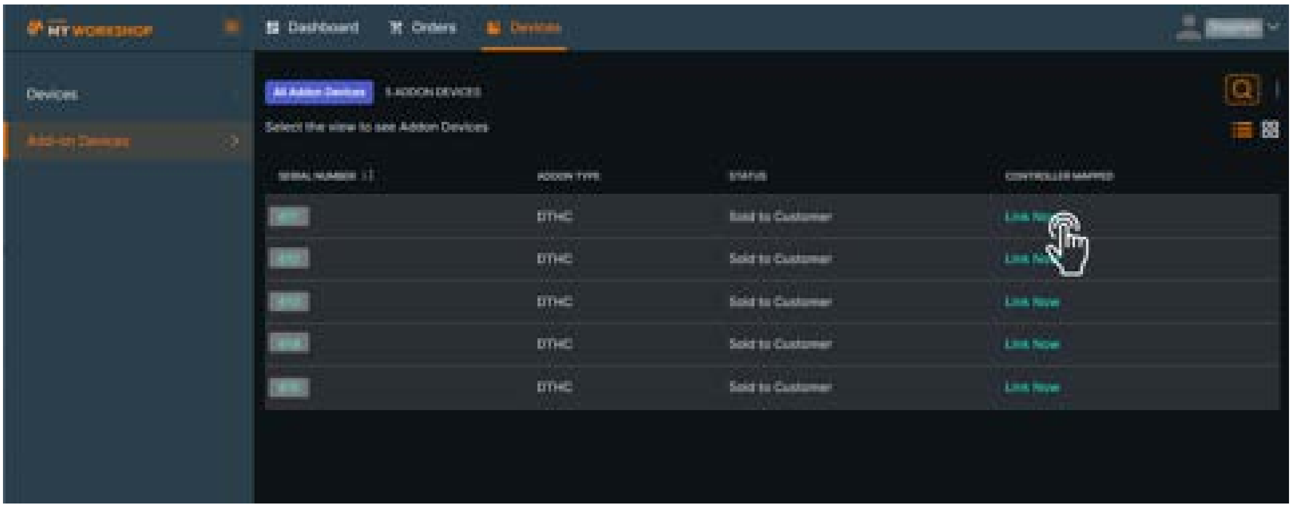
4.1. Adding a DTHC

DTHC Linking

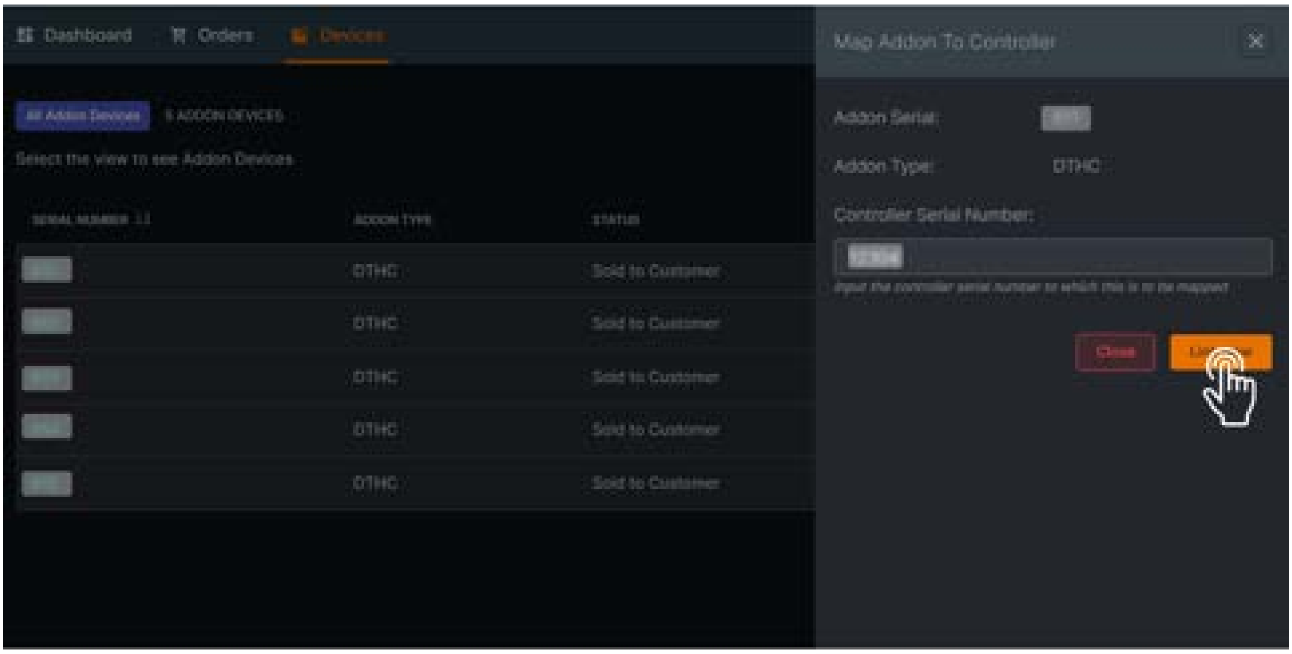
Users can now assign a DTHC device that has been purchased to a controller from my Workshop

Once logged into your my Workshop you can do the following to manage and link an Add-on DTHC device.

- Select Devices menu on the top and then select Add-on Devices from the left side bar.
- You will see a list of DTHC serial numbers that you have purchased.
- Check your DTHC serial number and select Link now to link a DTHC to a controller as indicated in the image below.

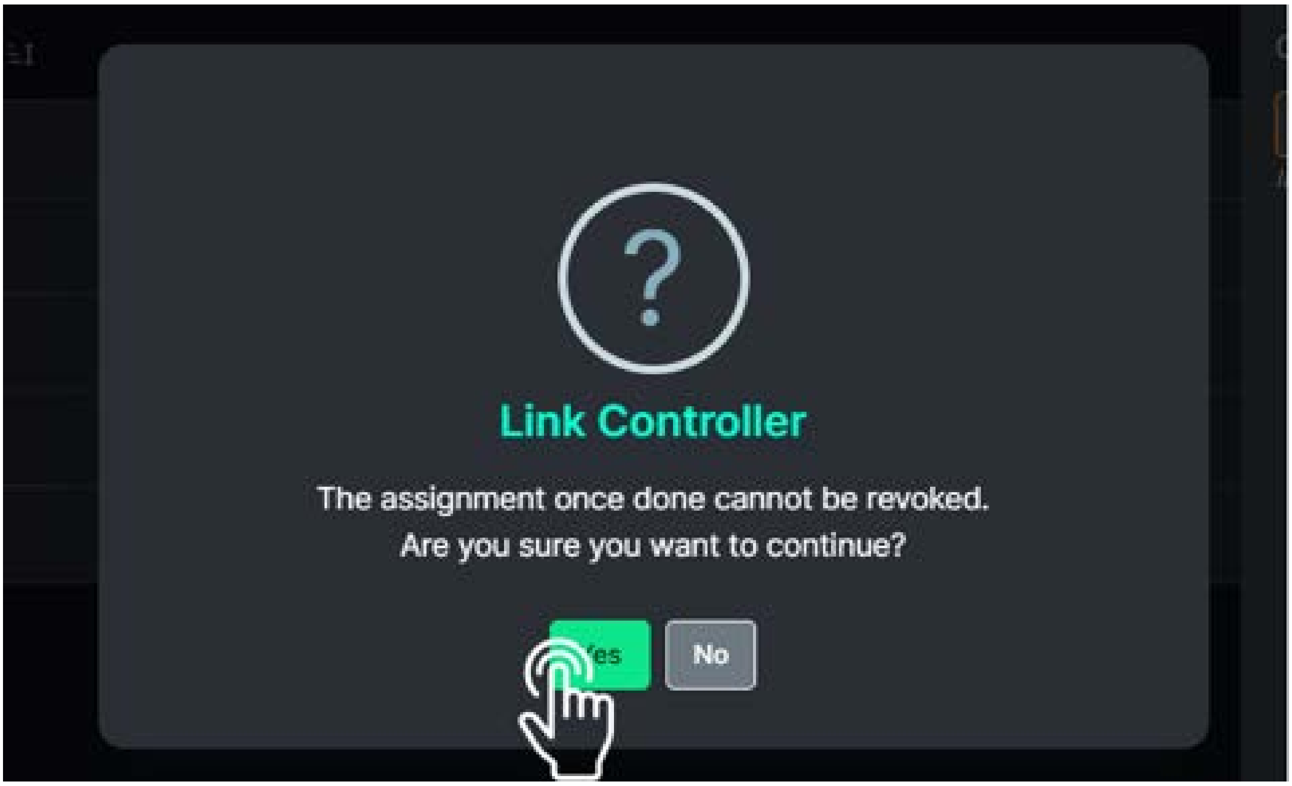


- This will open a window from right side of screen. Enter the Controller serial number to be linked.
- Click the "Link Now" button as indicated in image below.

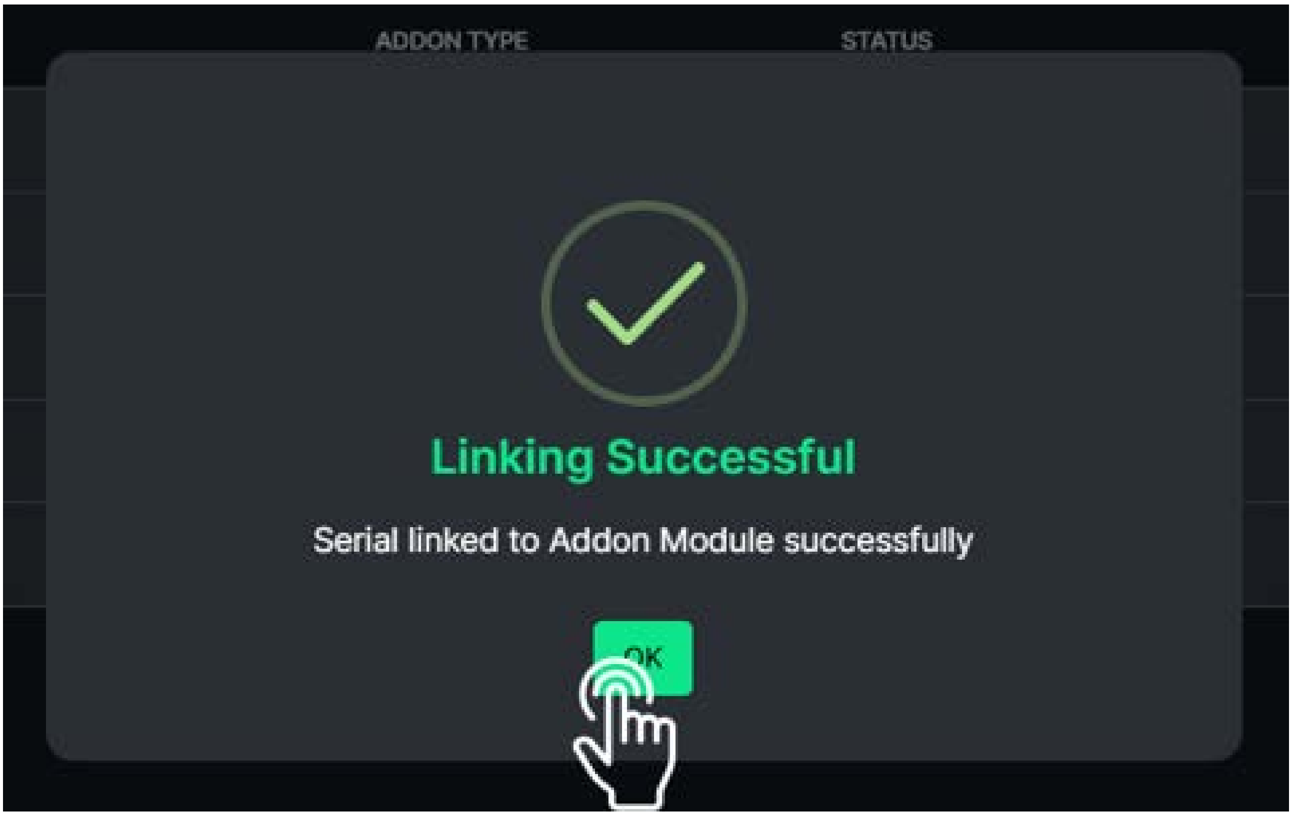


WARNING: Please be careful as once the DTHC module is linked, it cannot be unlinked.

- There will be a pop up window saying “The assignment once done, cannot be revoked. Are you sure you want to continue?” Meaning once the DTHC module is linked, it cannot be unlinked.
- Select Yes to link.



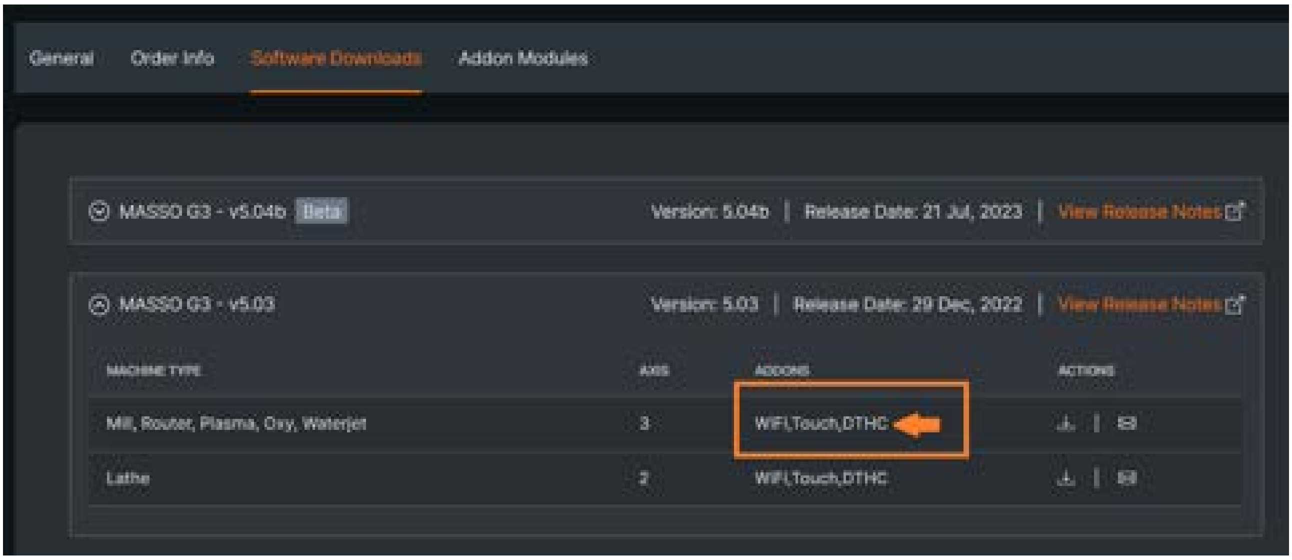
• Once linked there will be a pop up saying “Linking successful”



• Once the add-on device has been linked, the serial number should appear under Controller Mapped for the DTHC serial number you have linked it to.

• You can now download the new software for the controller from my Workshop and load it into MASSO. It will now include the DTHC software add-on highlighted below.

The DTHC will not work until this new software version is loaded onto MASSO.



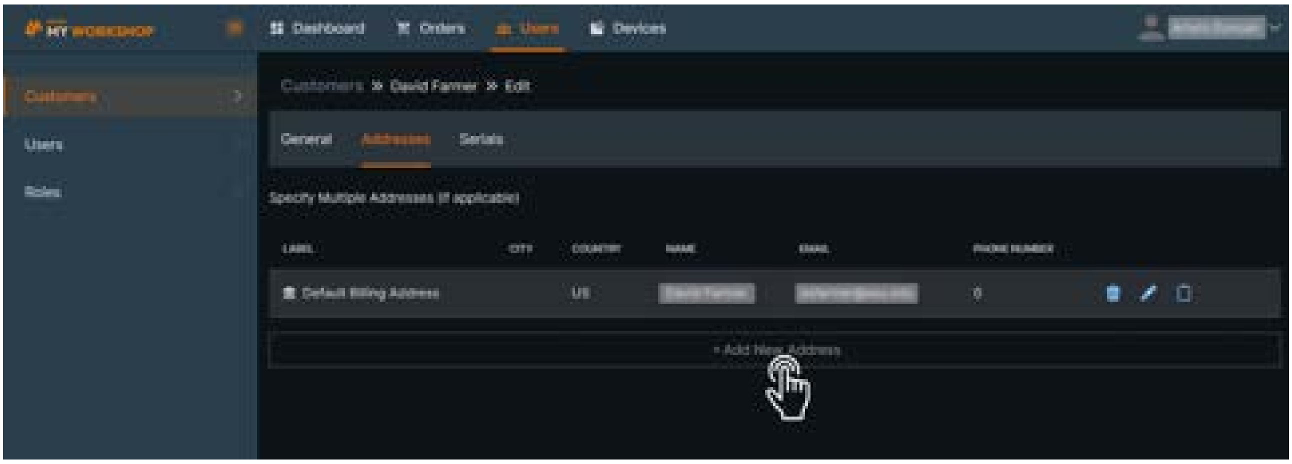
4.2. OEM and Distributors

When a customer purchases a MASSO G3 or MASSO Touch from an OEM or Distributor the seller will assign the serial number in myWorkshop.

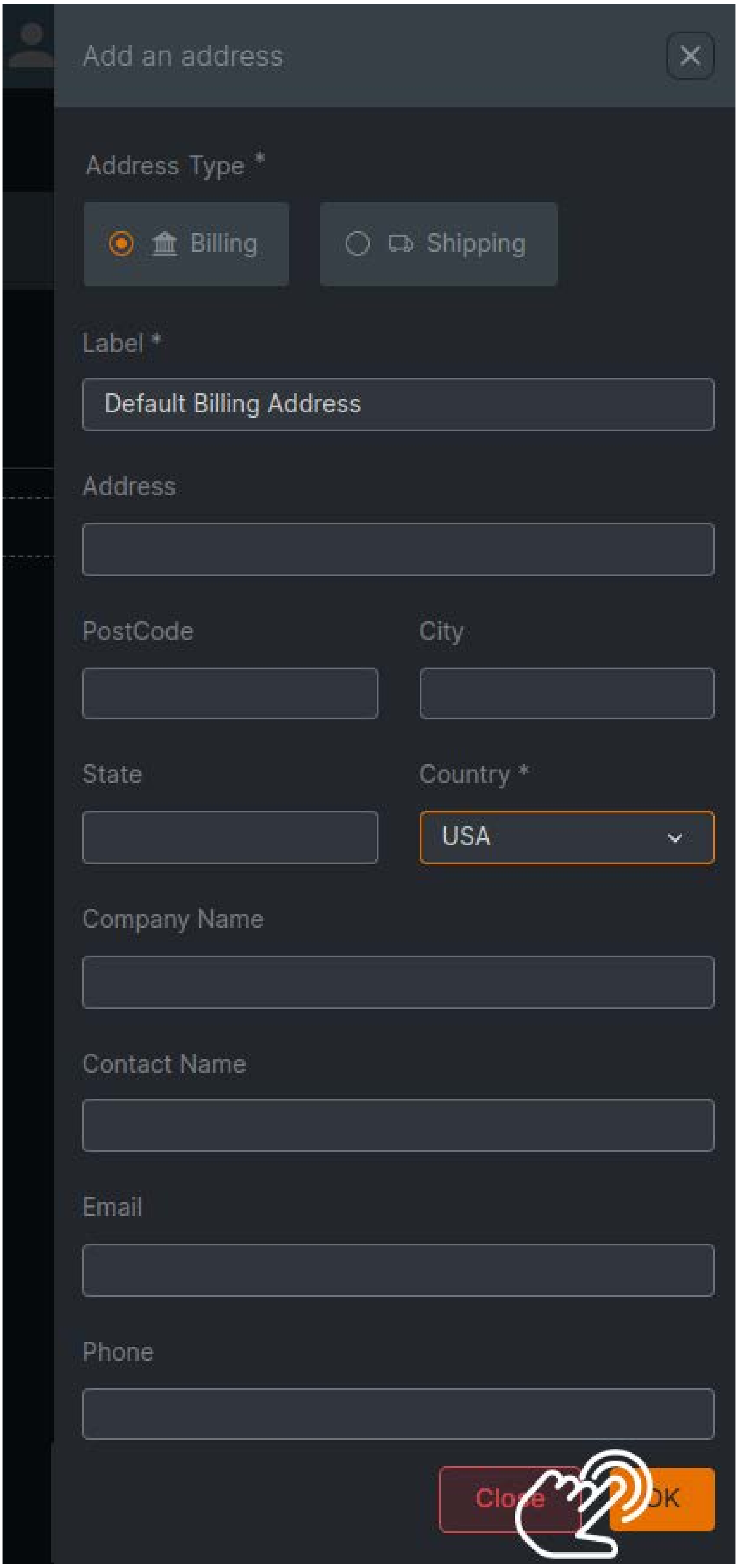
Assigning the serial number to the purchaser will create a myWorkshop account for them, allowing them to sign in and get the initial software as well as future updates.

Creating your customers:

- Log into myWorkshop using your OEM / Distributor credentials
- On the topbar menu click on **"Users"** and then click **"Customers"** on the right side navigation bar.
- Click on the **"New"** button towards the top right-hand side of the screen.
- Enter customer email ID.
- Enter all required details about the client in the **General** tab.
- In the **Addresses** tab, at least one **Billing** address and one **Shipping** address is required. The address can be left blank but the **Label** and **Country** fields are required.
- Click the **"Save"** button.



This will open a window in the right side of screen, where you can add the address and then press "OK" button. You will be prompted to enter mandatory fields if you miss them. Mandatory fields are marked with a *


Add an address
Address Type *
Billing
Shipping
Label *
Default Billing Address
Address
PostCode
City
State
Country *
USA
Company Name
Contact Name
Email
Phone
OK

Creating customer orders and assigning MASSO serial numbers:

- Log into myWorkshop using your OEM / Distributor credentials
- On the top menu click on **"Orders"** and then the submenu **"Customer Orders"**.
- Click on the **"New"** button towards the top right-hand side of the screen.
- Type at least 3 letters of the customer names and select from the list displayed.
- Select a Billing and Shipping Address from the options available once you have selected a customer.
- Type in an order reference in the Ref. Order Number* field.
- Next, go to the **"Order Details"** tab and click on the **"Add Device"** button.
- In the new window displayed on the screen, enter the serial number of the controller and press the "OK" button.
- Next click on the **"Select Variant"** drop-down and select your machine type.
- Click the **"Save Changes"** button.
- **INFORMATION:** The above steps can be repeated to add more serial numbers to the same order.
- Order tracking details can be added by going to the "**Shipment Details"** tab. If your shipment provider is not listed in the list then please contact support@masso.com.au to have your shipment partner added to the system.
- Click on the **"Save"** button towards the top right-hand side of the screen to complete the order.

myWorkshop Client Access

For detailed instructions on how your client can sign in to myWorkshop, please visit the section on myWorkshop in this Documentation.

myWorkshop

Read other subtopics below:

4.2.1) Linking DTHC

4.2.1. Linking DTHC

DTHC Linking

These instructions are for Distributors wanting to:

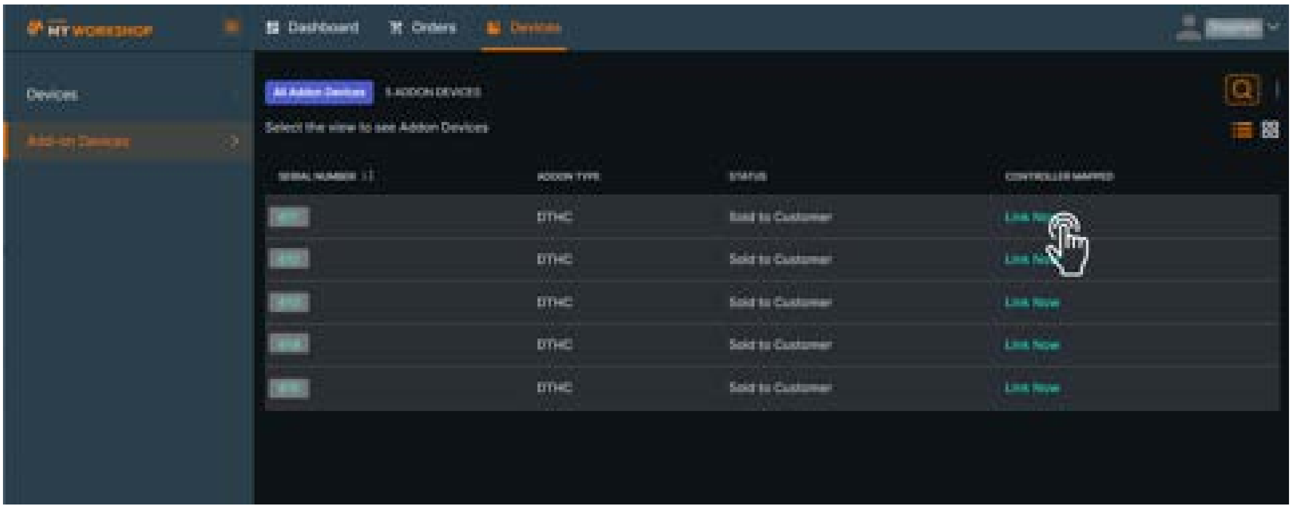
1. Link their DTHC device to a Controller
2. Add a DTHC device to a customer order

How to Link DTHC Device to Controller

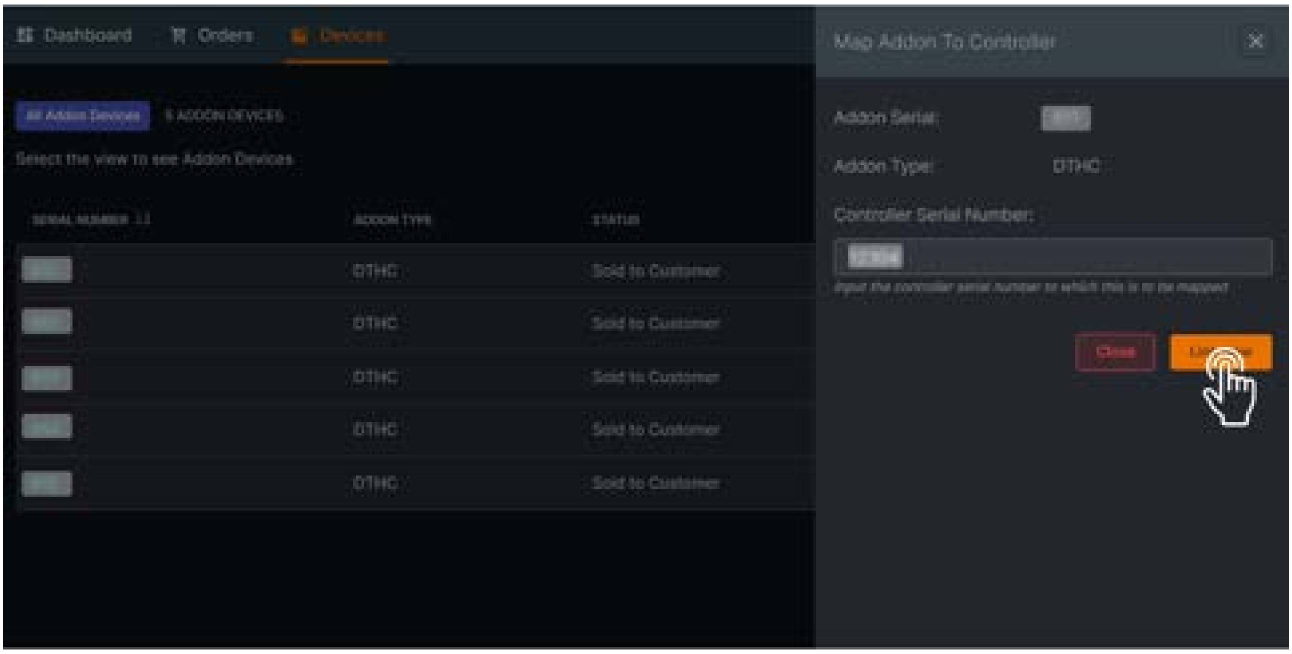
NOTE - Please note that Distributors wanting to link the DTHC device to a Controller - once it is linked, it requires to be sold as a package.

Once Distributor is logged in they should do the following to manage and link their DTHC device.

- Select **Devices** from the top menu bar and then click Add-on Devices menu from the left side bar.
- This would show a list of DTHC serial numbers
- Select Link now to link a DTHC to a controller as indicated in the image below.

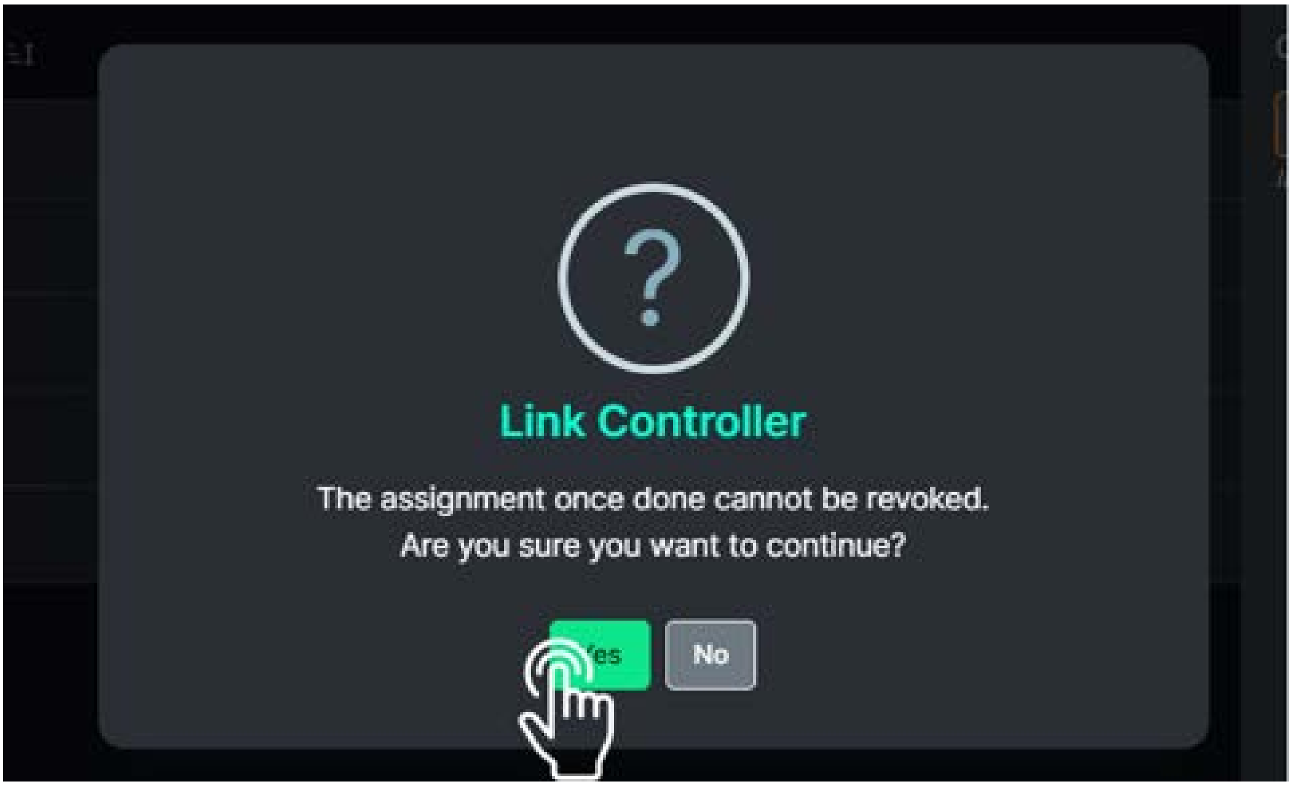


- This will open a popup from right side of screen, where in you provide the MASSO serial to link and press "Link Now" button

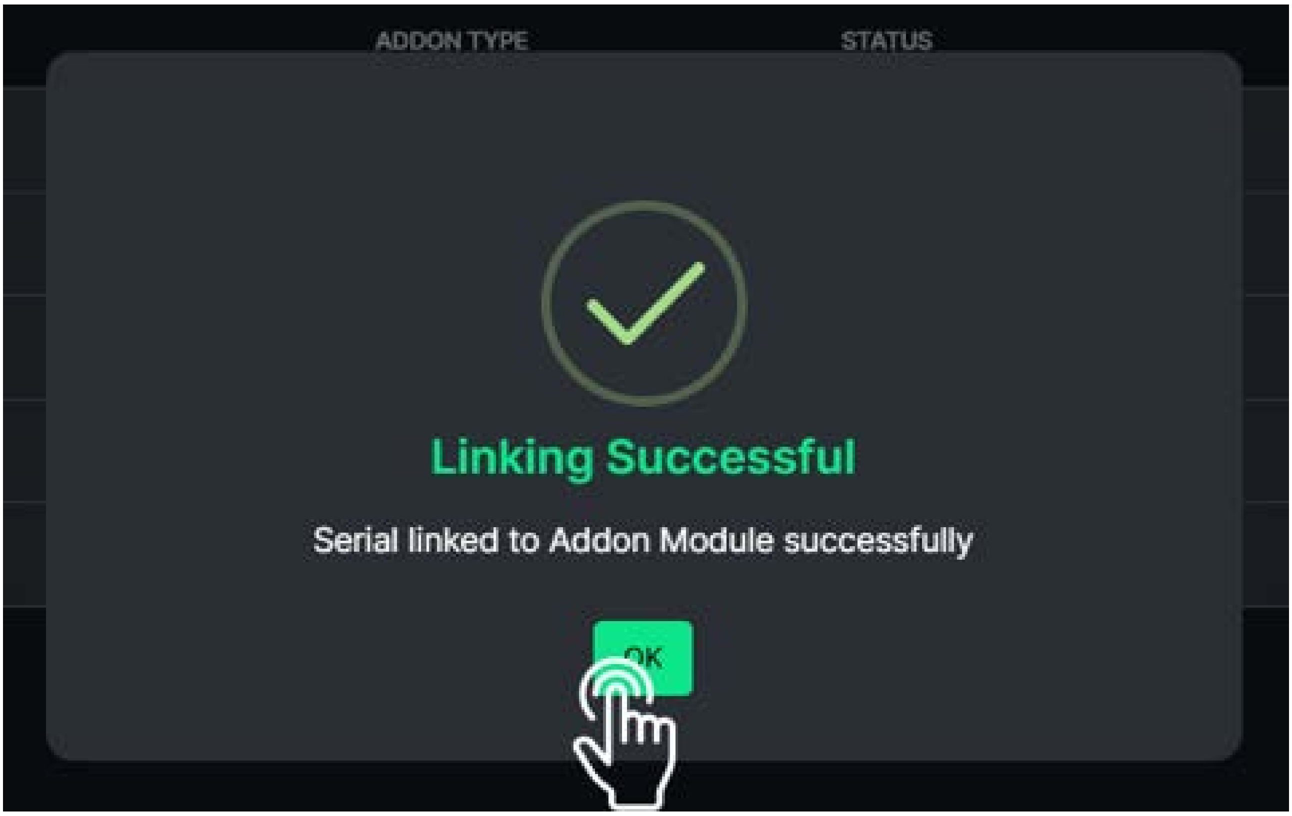


WARNING: Please be careful as once the DTHC module is linked, it cannot be unlinked.

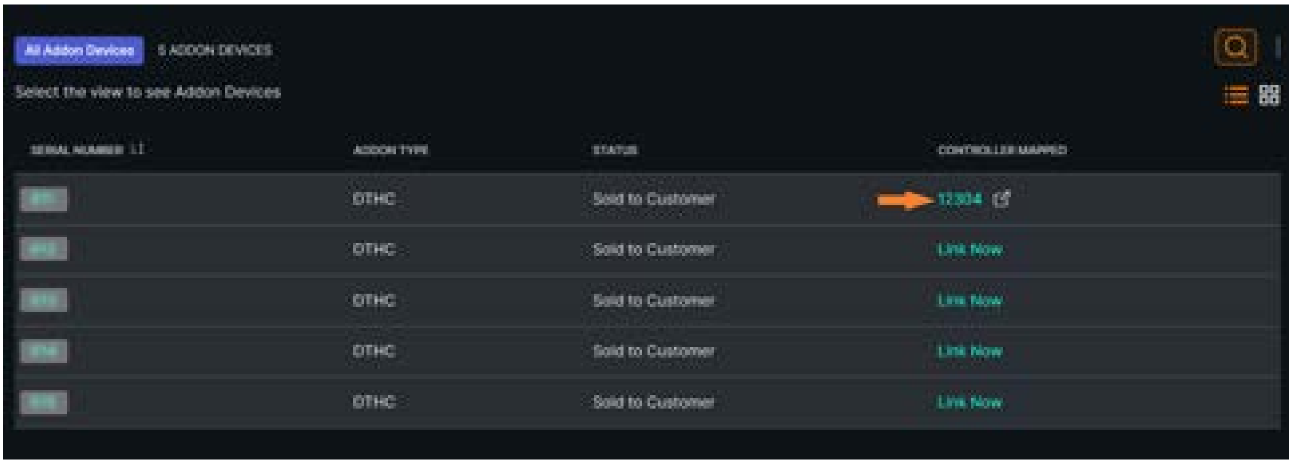
- There will be a pop up window saying “The assignment once done, cannot be revoked. Are you sure you want to continue?” Meaning once the DTHC module is linked, it cannot be unlinked.
- Select Yes to link.



- Once linked there will be a pop up saying “Linking successful”



- Once the add-on device has been linked, the serial number should appear under
- Controller Mapped for the DTHC serial number you have linked it to.



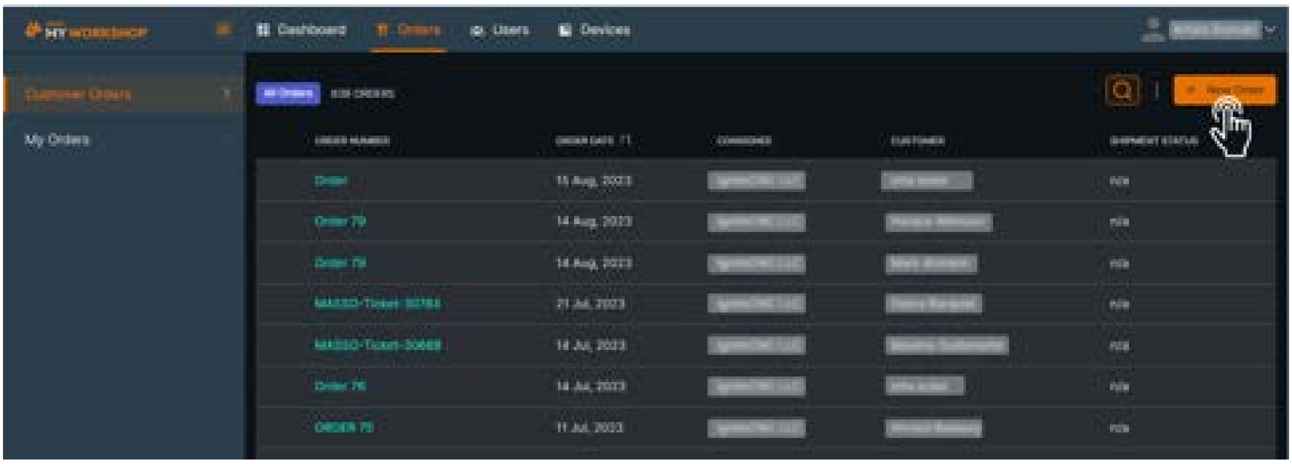
- You can now download the software for the controller and it will include the DTHC software add-on.

How to Add DTHC device to Customer Order

Note: if a DTHC device is already linked to a controller, then just add the controller to the order and the DTHC will be added automatically to Add-on.

The following instructions are for Distributors who sell Controllers and DTHC devices and shows how to add a DTHC device to a customer order.

- Select Orders from top menu bar and then click Customer Orders from the left side navigation bar.
- Click "New Order" button as indicated in the image below.



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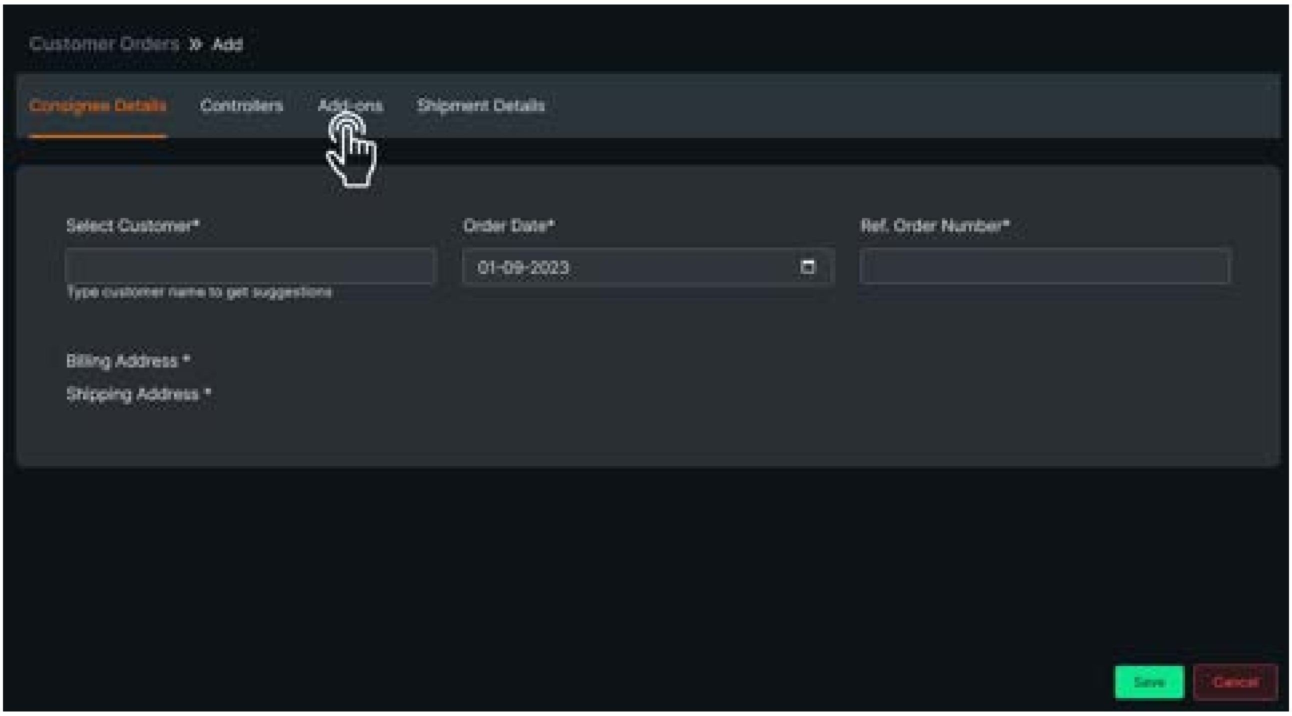
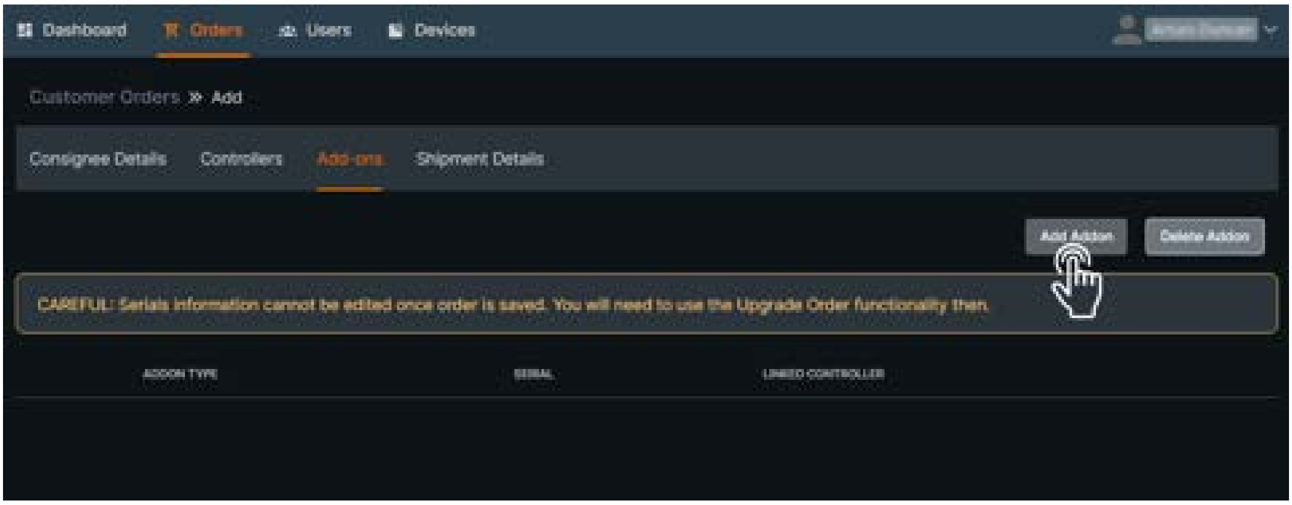
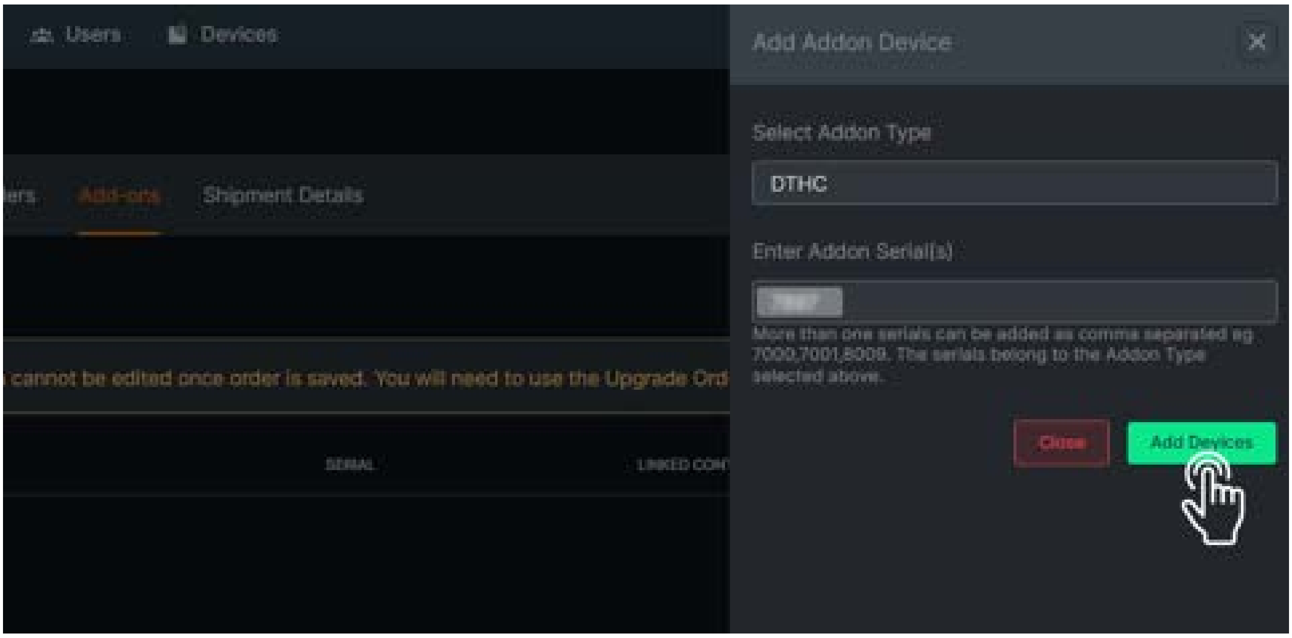
- Select Consignee details
- Add customer name in Select Customer
- Select a Billing Address from options available once you will select a customer
- Select a Shipping Address from options available once you will select a customer
- Type in reference order number in Reference Order no.
- Then click on "Add-ons" tab.

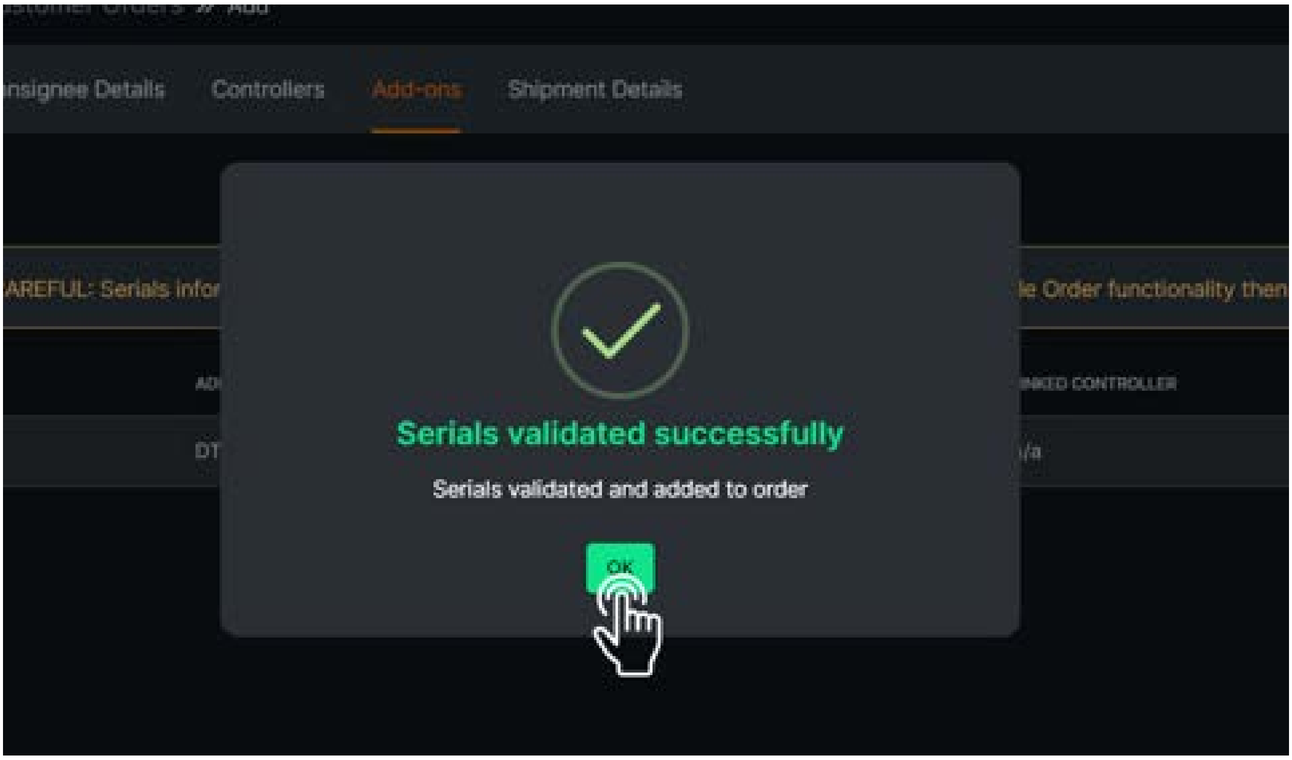


- Click Add-on button

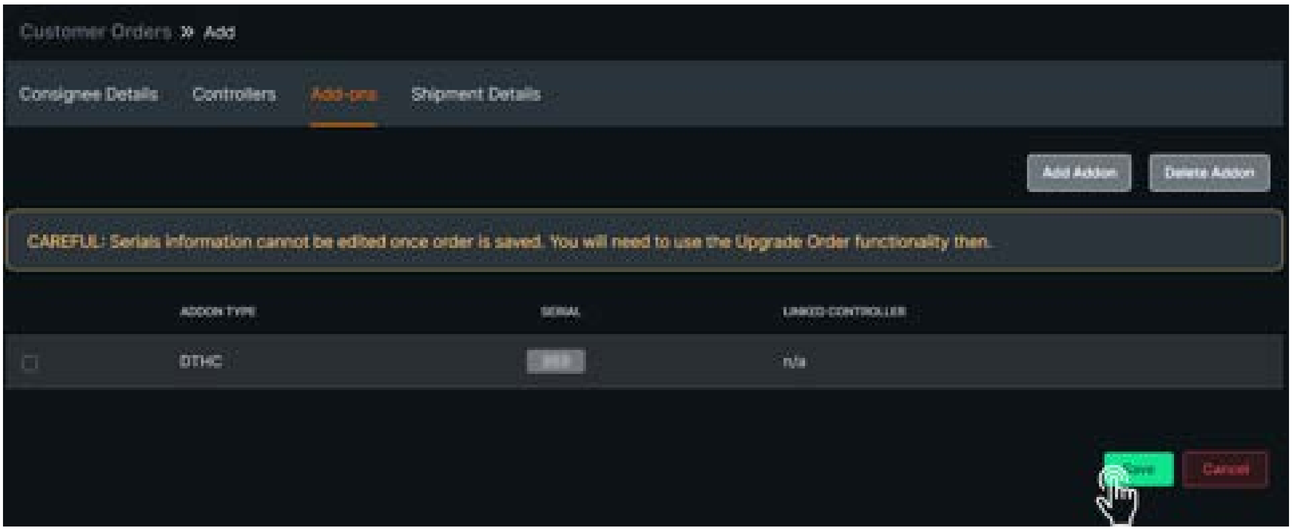


- This will open a popup on right side of screen. There Select Add-on type from the drop menu = DTHC and then add the DTHC serial number that is to be sold to customer.
- Then click "Add Devices" button





- Select Save button at the bottom of the screen. This will Save the order.



- The add-on order is now complete.

5. MASSO - FAQ's

Read other subtopics below:

5.1. About MASSO

What is MASSO?

MASSO is an embedded 5 Axis CNC controller. It is a stand-alone controller with built-in processor, motion controller, spindle control, WiFi, and I/O interfaces. MASSO comes with software to run Mill / Router, Plasma, Laser, Waterjet, Lathe and other machines.

How many axis does MASSO have?

All MASSO controllers are 5 axis

Where can I get download MASSO controller software?

When you purchase your MASSO controller, an account for MASSO myWorkshop is created for you to manage controllers and software. If the unit was purchased through a machine manufacturer or a distributor then your myWorkshop account will be created by them. If for some reason you haven't received the myWorkshop details, email support with your MASSO serial number and email address. We will send you login details of your myWorkshop account where you can download your software. All current software and future software updates are available inMyworkshop https://docs.masso.com.au/my-workshop

Can you send a trial version of the software or can I run the MASSO software on a PC?

MASSO is a stand-alone hardware unit and the software can only run on the MASSO controller hardware, hence the software can't be run on a PC.

Do I need motor drives for my motors ?

Yes, you will need motor drives, MASSO outputs STEP\PULSE and DIRECTION signals which will then be connected to your stepper or servo motor drives. Each of these requires different drive technologies and the drive must be matched to the motor for optimum performance.

What is the difference between MASSO G3 and MASSO Touch?

- MASSO Touch has an integrated touch screen with MASSO G3 inside.
- MASSO G3 does not come with a touch screen.
- Please see our FAQ page about MASSO Touch https://docs.masso.com.au/MASSO-Touch-FAQ

I have a Mill ,Plasma and Lathe, can I use MASSO to run multiple machines?

- Yes, MASSO can be used to run Mill, Plasma or Lathe. When you purchase your MASSO you are given access to all software and can change between software when you power on your MASSO.
- Each software version has its own personal configuration file which you can load when you load the software
- The process to change between software and load the configuration file takes approximately 90 seconds from start to ready to run.
- There is no extra cost for using multiple software's on one MASSO controller.

Can I load a DXF file into MASSO

No, MASSO is a CNC controller and uses only Gcode. You need to write or use CAM software to create your Gcode

Where can I get a post processor for my CAM software?

MASSO has links to some CAM software post processors in the documentation.

If your supplier is not listed please contact them and ask if they have a post-processor available or if they can write one for the MASSO CNC Controller.

https://docs.masso.com.au/cam-post-processors

Can I transfer Gcode files from my computer to MASSO over a network?

- Yes, MASSO can connect to your computer via WiFi network and by using MASSO Link software. This will allow you to send files to MASSO, download the tool table from MASSO and monitor progress and alarms while it is machining.
- MASSO Link is available for PC, macOS and Linux https://docs.masso.com.au/getting-started-guides/machining-with-masso/wi-fi-connectivity

How easy is MASSO to set up?

- This is a hard question to answer as it depends on the person doing it and their level of understanding. To assist with the initial setup we have published quick start guides on each machine type and other useful subjects. We also have a forum where users can ask questions about their builds.
- MASSO makes things easier as there is no need for the user to source a PC, motion controller and interface boards, load the software and drivers for each and then troubleshoot for compatibility issues. MASSO provides all of these in a single package ready for use.
- https://docs.masso.com.au/quick-start-guides

Can MASSO be used for equipment other than CNC machines?

Yes. MASSO is an easily programmable controller that has inputs, outputs and precision motor control. If your application has needs for these functions then MASSO may be suitable. MASSO has the ability to autoload a program on powerup and run the program in an infinite loop making it suitable for many applications.

What USB ports does MASSO have?

MASSO G3 & MASSO Touch have four USB A ports. The ports are USB2 which will work with USB3 flash drives and hardware which is backwards compatible. MASSO does not have USB C ports.

5.2. MASSO Touch - Frequently asked questions

Does MASSO Touch come with a G3 installed?

- Yes, The MASSO Touch comes with a G3 already mounted in it's cabinet and connected to the Touch screen ready to go.
- It also includes the Estop as well as the red and green buttons.
- MASSO Touch does not come with a power supply and will require a 24 volt DC power supply with a minimum current capacity of 1.5 amp.
- The case is not physically deep enough to install a power supply inside.

Can a normal MASSO-G3 controller be installed and used inside the MASSO Touch model?

- The MASSO Touch model has special electronics to drive and control the LED screen. The normal MASSO-G3 model is designed to connect to VGA screens with a 15pin VGA connector and can't run LED/LCD screens and can't be used with MASSO Touch.

Can the MASSO-G2 controller be installed and used inside the MASSO Touch model?

- No, the MASSO Touch model has special electronics to drive and control the LED screen. The normal MASSO-G2 model is designed to connect to VGA screens with a 15pin VGA connector and can't run LED/LCD screens.
- NOTE: Even if a small add-on module to connect the VGA connector of the MASSO-G2 controller to the MASSO Touch screen is made available, MASSO-G2 does not have the memory to add MASSO

Touch capacitive touch drivers or screen layouts to support full touch features.

Can the MASSO G3 inside the MASSO Touch be removed from the box?

- No, It is not possible to move the G3 out of the Touch control box.
- The LCD driver limits distance between the driver and screen.
- If you do not want to run your cable directly into the MASSO cabinet please have a look at the MASSO G3 Touch Wiring module which will extend the connections out of the MASSO Touch cabinet.

MASSO G3 Touch Wiring Module Instructions

The MASSO G3 Touch Wiring Module can be purchased here

What is the resolution of the screen?

- The screen resolution is the same as of normal G2 and G3 models, 1024x768 pixels.

What material is the enclosure made of?

- The front part of the enclosure is made of ABS plastic.
- The rear mounting plate is made of anodized aluminum.
- The touch glass is made of toughened capacitive touch glass.

What is the enclosures IP (Ingress Protection) rating?

- The unit does not have or require cooling fans which means that there is no internal positive or negative pressure to pull dust particles. The front part assembly with the rear panel has a lip to prevent dust or water from going into the system but direct dust or liquids should be avoided.
- The rear panel also has mounting holes and a cutout for wiring, the user should make sure to cover or close these during installation.

Will the normal MASSO-G3 and MASSO Touch software be different or will have different features?

- Both the models will have exact same software features and user interface.
- MASSO Touch was developed as per client and OEM requests to have an integrated design and also to solve issues with 3rd party touch screen not working.
- Both the models will have software updates released at the same time with same features added.

Can the two red and green buttons on the unit only be used for cycle start and stop?

- The buttons are wired to normal inputs and can be assigned any function from the F1-Setup screen.

What's the weight of the unit?

- The MASSO Touch weighs about 4.5kg (9.92lb).

What is MASSO Touch operating and Storage temperature range?

- Operating Temp.: -30 ~ 70 °C or -22 ~ 158 °F
- Storage Temp.: -40 ~ 70 °C or -40 ~ 158 °F

Mechanical dimensions and mounting information?

- Please use this link **CLICK HERE**

5.3. Purchasing MASSO

Can I order directly from your Website?

Yes, we send our product worldwide. Simply select what you would like to purchase, add it to the cart and proceed to checkout. Here the shipping will be calculated for you and you can complete the purchase.

I ordered Mill instead of Plasma, can I change my order?

All MASSO units use the same hardware. When you register your MASSO you will receive Mill, Plasma and Lathe software and can load whichever one you want at any time.

How much will it cost to send?

The easiest way to determine this is to go to our online shop, add the items you want to the cart, and when you proceed to the checkout you can enter your country and address. The shipping will be calculated for you before you proceed to the final checkout.

I sold my MASSO, can I transfer my license to the new owner?

Please email us from your registered MASSO myWorkshop account, provide the email address of the new owner and the serial number to be transferred. New login details to myWorkshop will be sent to the new purchaser. To find your serial number see >>>HERE<<<

I purchased a 2nd hand MASSO, can I transfer the license to my name?

Please request the seller to email us from their MASSO myWorkshop account and provide your email address and the serial number of your MASSO controller. New login details to my Workshop will be sent to you.

To find your serial number see >>>HERE<<<

5.4. Machine conversion and Builds

I want to convert a machine to use with MASSO, will it work?

- Unless your machine is more than 5 axis or has unusual requirements the answer is generally yes.
- We do not know the specifics of your CNC machine, how it is wired and what hardware it has. It is the responsibility of the person converting the machine to evaluate the existing hardware for compatibility.
- The conversion of a CNC machine needs to take into account many factors.
- What drives you have and what connections they have. What Spindle you have and the VFD connection. What inputs and outputs you need. You need to evaluate each existing item to see if it conforms to the MASSO standard and replace those items that do not comply. If you are unsure about a specific piece of equipment please consult the manufacturer's documentation.

Can you supply a wiring diagram for my machine conversion?

- MASSO does not offer a machine conversion or machine design service.
- We do provide example wiring diagrams in our documentation. We have example wiring diagrams for a selection of stepper and servo drive types as well as spindle VFDs.

What equipment do I need to convert my CNC machine?

To establish your requirements you need to do an inventory of what your machine currently has that you can reuse and what you would like to add.

Example of a basic mill requirements

- MASSO G3 or MASSO Touch
- Keyboard, Monitor and mouse if using MASSO G3, not needed for MASSO Touch
- USB Flash drive
- Power supply for MASSO
- Motor drives using STEP/PULSE and DIRECTION signaling, can be stepper or servo
- Power Supply for motor drives
- Spindle with VFD or router
- Homing sensors/switches, one for each axis motor
- MASSO relay board used for external Estop to motor drives, Tower lights, etc.
- Tool setter for auto tool zero.
- Encoder, required for lathe when threading.
- E-Stop Button

Optional

- Pendant
- Encoder for spindle (Used when threading on Lathe)

What can MASSO provide for my machine?

MASSO provides CNC controllers and the following accessories available from our web store

- Relay module
- DTHC Torch Height Controller for Plasma
- Homing sensors
- MPG Pendant
- Optical encoder for Spindle
- Estop switch
- Closed loop stepper motors

https://www.masso.com.au/product-category/sensors-accessories/

We do not provide other products and you will need to source them from other suppliers which specialize in these components.

5.5. Motors and Drives

Do I need drives for my motors?

Yes, MASSO interfaces with both stepper and servo motors using STEP/PULSE and DIRECTION signaling.

I have 2 motors on my Y axis, will it work with MASSO?

- Yes. MASSO can do both hardware and software slaving.
- Please see the link below for slaving options
- https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/slave-axis

I have a NEMA 23 or 34 motor. Will it work with MASSO?

- NEMA defines the motor mounting only.
- MASSO does not interface directly with motors. The motor connects to the drive and the drive connects to MASSO. If your servo or stepper drive uses STEP/PULSE and DIRECTION signaling then it will work.

Will a particular drive work with MASSO?

If your drive is designed to work with STEP/PULSE and DIRECTION signals then it will work with MASSO. Please consult your drive manual for signal requirements. If you have an older motor drive that uses analog or PWM signals, this will not work. You may be able to upgrade the drives to modern ones using STEP/PULSE and DIRECTION signaling and use these to drive your existing motors.

How do I wire my motor drives?

- It is not possible to provide diagrams for every drive however there are only 2 basic methods of connection. Differential and common ground modes.
- Example drive connection diagrams are provided in the MASSO documentation.
- https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/axis-servo-stepper-examples

I want to use Servos with MASSO, how do I connect the motor encoders to MASSO?

When connecting servos the encoder connects directly to your servo drive which monitors the position and will send an alarm to MASSO in the event of position loss, the drive is then wired to MASSO using STEP/PULSE and DIRECTION signals. There is no need or option to connect the encoder from motors to MASSO.

What size motors do I need for my machine?

Motor size depends on a number of factors. Type of machine, required maximum speed, the weight of the axis being moved. This is outside the field of the CNC controller. Please consult an engineer who specializes in this field of machine design.

What motors and drives do you recommend?

MASSO does not recommend any specific 3rd party equipment.

We can supply closed loop stepper motors in sizes 2Nm & 3Nm

5.6. Plasma

Does MASSO include a built in THC?

- There is no built in THC but you can use the MASSO DTHC specifically designed to integrate with MASSO.
- MASSO DTHC requires a Plasma that has a built in divider.

Does MASSO supply an THC to use with MASSO?

Yes - The MASSO DTHC is specially designed to work with the MASSO G3 & MASSO Touch

https://docs.masso.com.au/wiring-and-setup/plasma-torch-height-control/installing_masso_dthc

Can I use Third party THC's with MASSO?

MASSO uses any THC's that outputs UP / Down and Arc OK signals such as the Proma150 or Price AVHC, any system able to provide these signals can be used with MASSO.

How do I turn on the Plasma with MASSO?

An input can be designated Plasma On / Off and is used to start and stop the Plasma.

You can configure any of the MASSO G3 TTL outputs as the Plasma on/off and connect it to your Plasma via the MASSO Relay Module

What equipment do I need to convert / Build my CNC machine?

To establish your requirements you need to do an inventory of what your machine currently has that you can reuse and what you would like to add.

Example of basic Plasma requirements

- MASSO, Keyboard, Monitor and mouse or a MASSO Touch
- USB Flash drive
- Power supply for MASSO
- Motor drives using step and direction signaling
- Power Supply for motor drives
- Homing sensors, one for each axis motor
- MASSO relay board used for Turning Plasma on and off, external Estop to motor drives, Tower lights, etc.
- Plasma source

Optional

- MASSO DTHC
- Pendant

Please see these pages for additional information.

https://docs.masso.com.au/quick-start-guides/setup-masso-plasma

5.7. Lathe

MASSO Lathe uses the same MASSO hardware as our other MASSO controllers but uses a different software.

It is not combined with the other MASSO tools and as a result it does not support combined lathe and mill functionality.

MASSO Lathe is a 2 axis and one spindle only, the X & Z axis and there is no option to extend the number of axis on the Lathe or have more than one spindle.

MASSO lathe users can change to Mill software at any time by downloading different software form myWORKSHOP and installing it on the controller.

When this is done it can become a 5 axis mill, waterjet, laser or plasma machine.

Lathe software is 2 axis only and cannot be increased.

C axis

MASSO does not have C axis support

Spindle

MASSO can be used with spindles that utilize 0-10v, PWM or step and direction for speed control.

The spindle cannot be indexed.

These is 1 spindle speed control output and it cannot be used to control the speed of a live tool.

Gearboxes and pulleys

MASSO does not support the use of Gearboxes and pulleys.

There is no option to to change gear ratio and the spindle speed does not reflect the change of gear when selecting speed.

This must be worked out manually though the RPM will report the actual spindle speed on the screen as it is taken directly from the spindle encoder if one is fitted.

Live tooling

MASSO does not support the use of live tooling.

If you have a tool that simply turns on and off then you can use Gcodes M64 & M65 to do this eg a die grinder.

Threading

MASSO supports threading using the G32 command.

For threading the spindle must have an encoder installed with a quadrature A & B with a Z pulse for threading.

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/spindle-rpm-encoder

Lathes that have manual speed control can still do threading as it is not the requested speed of the lathe that determines the threading cycle but the encoder.

This means that no matter what speed the spindle is rotating the thread will be correct.

Tool changer

MASSO has a wide range of tool changer support available including manual tool change.

Please see the following page and compare your tool changer to the ones built into MASSO
https://docs.masso.com.au/wiring-and-setup/tool-changers/lathe-tool-changers

If your tool changer does not conform to one of the existing tool changer logics built in to MASSO then you can contact support to see if one can be written for your tool changer type.

You will need to supply

- A complete explanation of how the tool changer works.
- A description of the logic required in a step by step format. This must include all inputs, outputs and timings.
- A video of the tool changer in action would be helpful to understand the tool changer operation.
- Any other information or documentation about the tool changer.

Setting up your MASSO Lathe

For more detailed information on setting up a MASSO lathe please see:

[redacted]

```
https://docs.masso.com.au/quick-start-guides/setup-masso-lathe
```

5.8. Encoders

Can I use an encoder on my Spindle?

- MASSO has provision for a spindle encoder in both Mill and Lathe software.
- Lathe uses the spindle encoder for threading to ensure correct feed synchronization with the Z axis.
- Mill uses the encoder to report the spindle RPM.
- https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/spindle-rpm-encoder

Can I use absolute or linear encoders on my axis?

MASSO does not support the use of absolute or linear encoders to determine the position.

This includes Glass scales or absolute position encodes built into motors.

Encoders are not used home the machine. Homing sensors or switches are required on each axis to home the machine.

5.9. Spindles

Will a particular spindle work with MASSO?

- MASSO provides a 0~10v, CW and CCW signals to control spindle speed (RPM).
- Two open-collector optical switches for forward (clockwise) and reverse (counter-clockwise) signals.
- If your VFD conforms to this format then MASSO will work with your spindle.

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/spindle-vfd-examples

Spindle drive options

- **VFD** - This would be a standard spindle drive setup with 0-10v drive signal.
- **PWM** - Designed to be used with H-Bridge drives 4Khz to 65Khz with 0-100% duty cycle
- **Step and Direction** - For use with servo drives using a 500hz to 25Khz step pulse rate

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/spindle-control

How do I connect my Spindle?

It is not possible to provide wiring diagrams for every VFD or provide advice on how to configure specific VFD’s. Please consult your VFD manual and VFD supplier for configuration settings.

Our documentation provides examples of some common VFDs and we have produced a step-by-step video explaining how to connect a VFD to MASSO.

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/spindle-vfd-examples

5.10. Tool Changers

Will MASSO work with my machine's tool changer?

MASSO has built in a range of tool changer logic for both Mills and Lathes. Please have a look at the current list of tool changers available and compare their logic to the logic requirements of yours to see if there is one suitable for your machine https://docs.masso.com.au/wiring-and-setup/tool-changers

My tool changer logic will not work with any of the current tool changer options.

If your tool changer does not conform to one of the existing tool changer logics built in to MASSO then you can contact support to see if one can be written for your tool changer type.

You will need to supply

- A complete explanation of how the tool changer works.
- A description of the logic required in a step by step format. This must include all inputs, outputs and timings.
- A video of the tool changer in action would be helpful to understand the tool changer operation.
- Any other information about the tool changer.

5.11. 5 Axis Machining

Machining strategies.

There are 2 machining strategies you can use with for 5 axis machining, continuous 5 axis machining and 3+2 axis machining.

MASSO can be used for machining using either strategy.

Continuous 5 axis machining

This is where all 5 axis move simultaneously under Gcode control to machine the part.

Example

```
N10 G1 X10 Y25 Z1.7 A48 B174   N20 G1 X12 Y25 Z2 A50 B174
```

In this example it will move all axis to the specified locations with all axis will arrive simultaneously and create a curved surface.

3+2 Machining

This is where the material is rotated into position using the A & B axis and are locked in place while 3 axis machining using the X,Y & Z axes machining is performed before rotation to a new position where it is again locked in position and more machining is performed.

Example

```
N10 G1 A48 B174  N20 G1 X10 Y25 Z1.7  N30 G1 A50 B174  N30 G1 X12 Y25 Z2
```

While this Gcode looks similar to the previous example it will produce a very different result.

Kinematics

The MASSO controller does not include TCP, (**T**ool **C**enter **P**oint) also known as RTCP, (**R**otated **T**ool **C**enter **P**oint) and TCPC, (**T**ool **C**enter **P**oint **C**ontrol)

MASSO does not do any kinematics.

All axis motion and machine kinematics must be done in CAM. If your tool length changes from the specified tool length in your Gcode program then the toolpaths need to be recalculated in CAM and a new Gcode file must be loaded into MASSO before machining starts.

Tool Length

Depending on the type of 5 axis machine you have the tool length needs to be measured from different points.

In a machine that pivots at the head the tool length is measured from the point of rotation. To get accurate machining the tool length from this rotation point must be the length specified in the Gcode file or it will not machine correctly. The machine operator needs to manually set to tool to the correct length for the job being machined. A jig would be the easiest way to manage this or use pre-measured tools in collets.

A, B & C axis

At present does not have a C axis but uses the A & B axis for angular movement only.

The ability to rename either the A or B axis as the C axis is currently in development and will become available in a future update.

If you have a C axis you need to rename the C axis to either the A or B axis in you Gcode Post processor.

The ability to rename either the A or B axis as the C axis is currently in alpha testing and will be released as a beta release in the near future.

Toolpath display

The MASSO screen shows only the X & Y axis looking down from above.

The display cannot be rotated to get views of the toolpaths from different angles.

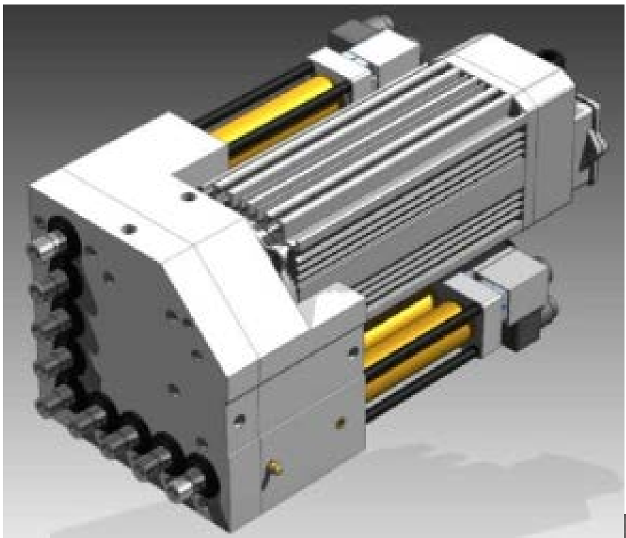
An example of an older MASSO G2 being used for 5 axis continuous machining can be seen here: [5 axis continuous machining]

For information on how he built his machine and how he uses it please watch his 4 part series on the machine build.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

DIY 5 Axis CNC Router ....Porsche Cayman Wing... CNC footage

5.12. Drill Heads, saws and EDM



These are specialized head units generally used in the cabinet building industry.

MASSO does not provide support for these types of head units at this time.

MASSO does not support use in EDM machines.

5.13. Support

How do I contact MASSO support?

MASSO support can be contacted either via email or via the MASSO support portal

- For easy administration of your support tickets try out the MASSO Support Portal
- How to use your MASSO support ticket Portal https://youtu.be/2NE4DFL4_Ck
- Support Portal Login page https://masso.freshdesk.com/support/login
- MASSO support can also be contacted via email at support@masso.com.au

What can MASSO support help with?

What we can support	What we can't support
Request MASSO software	Selecting/wiring motors and drives – For more info see MASSO Forums/Documentation
Bug Reports	How to use CAD/CAM software – For more info see Google/YouTube
Feature Requests	How to design/machine parts – For more info see MASSO Forums
OEM/Machine Manufacturers	Educating about electronics and wiring – For more info see Google/YouTube/MASSO Forums
Sales/Ordering	Retrofitting MASSO to a particular machine – For more info see MASSO Forums
Request to Add/Edit Documentation	Setting up and Programming Axis & Spindle Drives (VFD) – For more info see MASSO Forums/Documentation
Request to Add/Edit Video Tutorials	Creating/adding features to CAM post-processors – For more info check with your CAM Software Provider

Do you offer phone support?

As we have clients in all parts of the world, we are unable to offer phone support. Further by using the MASSO support portal or email allows for a record of questions and the answers to be available to members of the MASSO support team to follow up on and refer back to at a future date. It also eliminates issues of international time zones and assists with language barriers through the use of translation.

- For easy administration of your support tickets try out the support MASSO Portal
- Support Portal Login page https://masso.freshdesk.com/support/login
- How to use your MASSO support ticket Portal https://youtu.be/2NE4DFL4_Ck
- MASSO support can also be contacted via email at support@masso.com.au

What is the MASSO Support Portal?

- The support portal allows you to create and manage support tickets for each question, update, reply, check on progress, close a ticket and review old tickets that have been resolved.
- Support Portal Login page https://masso.freshdesk.com/support/login
- How to use your MASSO support ticket Portal https://youtu.be/2NE4DFL4_Ck

Using the MASSO Support Portal

The video below takes you through setting up the MASSO support portal step by step and demonstrates how to use it.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

MASSO 101 - Using MASSO Support Tickets

Reporting a Problem

When reporting a fault please include:

- Your MASSO serial number. To find your serial number see >>>HERE<<<
- A detailed description of the problem.
- A copy of your printable file..
- Anything else you feel is relevant.

Printable File

The printable settings file option is available on the MASSO G3 and MASSO Touch only.

To save your printable file press the 

button and the printable settings file will be saved as a txt file to your Flash Drive under the MASSO/Machine Settings folder.

5.14. Finding your MASSO Serial number

MASSO Touch and MASSO G3

On MASSO Touch and MASSO G3 the serial number can be found in the following places:

- On left hand side of the F1 screen
- On the Main Processor
- The serial number will be G3-xxxxx

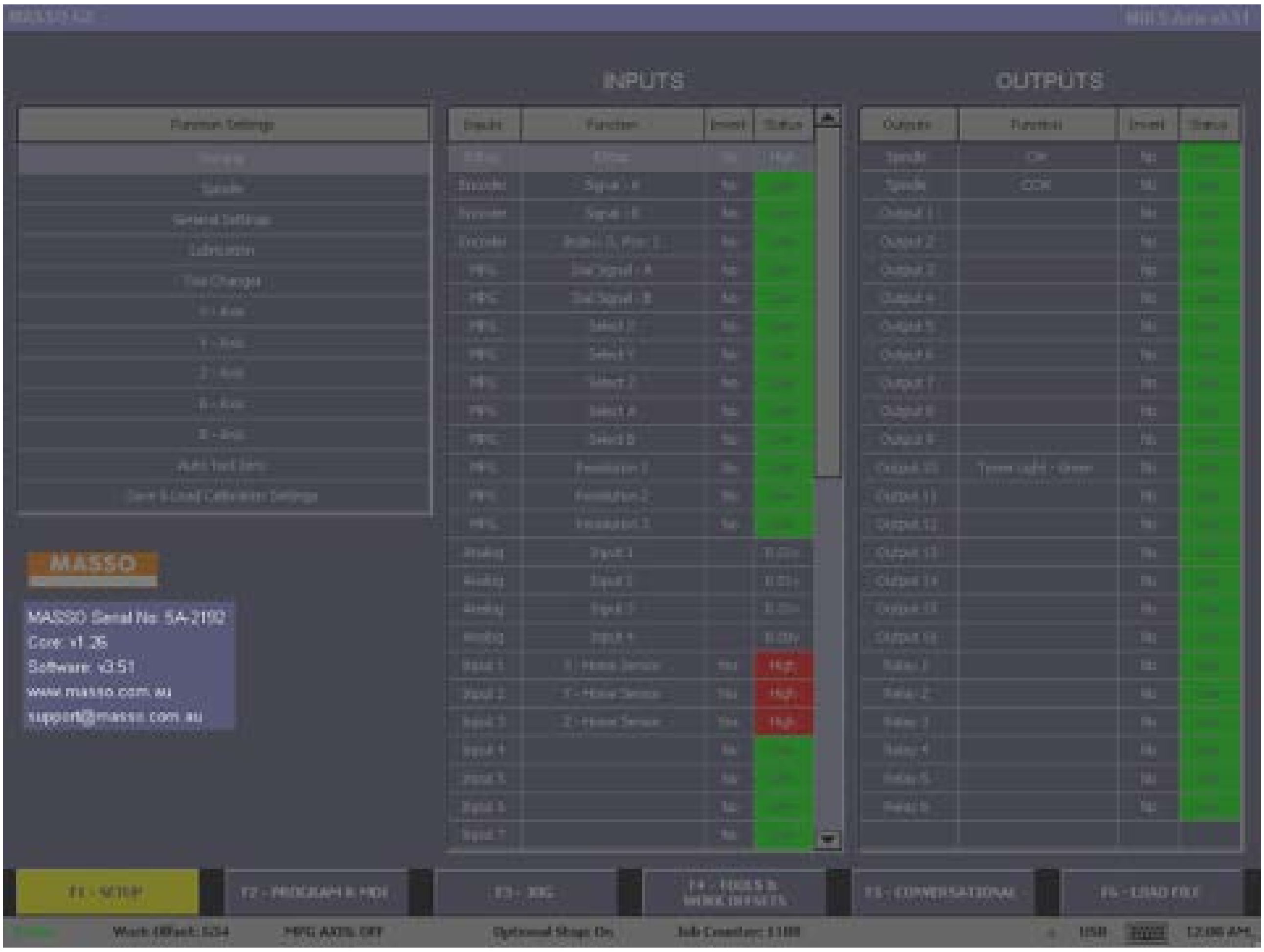
On the left side of the F1 Screen

On the Main Processor of MASSO Touch & MASSO G3

MASSO G2

On MASSO G2 the serial number can be found in the following places:

- In the Bottom left of the F1 Screen
- On the Front cover
- On the Main Processor
- The serial number will be 5a-xxxx



In the Bottom left of the F1 Screen

On the Front cover of MASSO G2

On the Main Processor of MASSO G2

6. Installing MASSO

Read other subtopics below:

6.1. Powering MASSO Touch

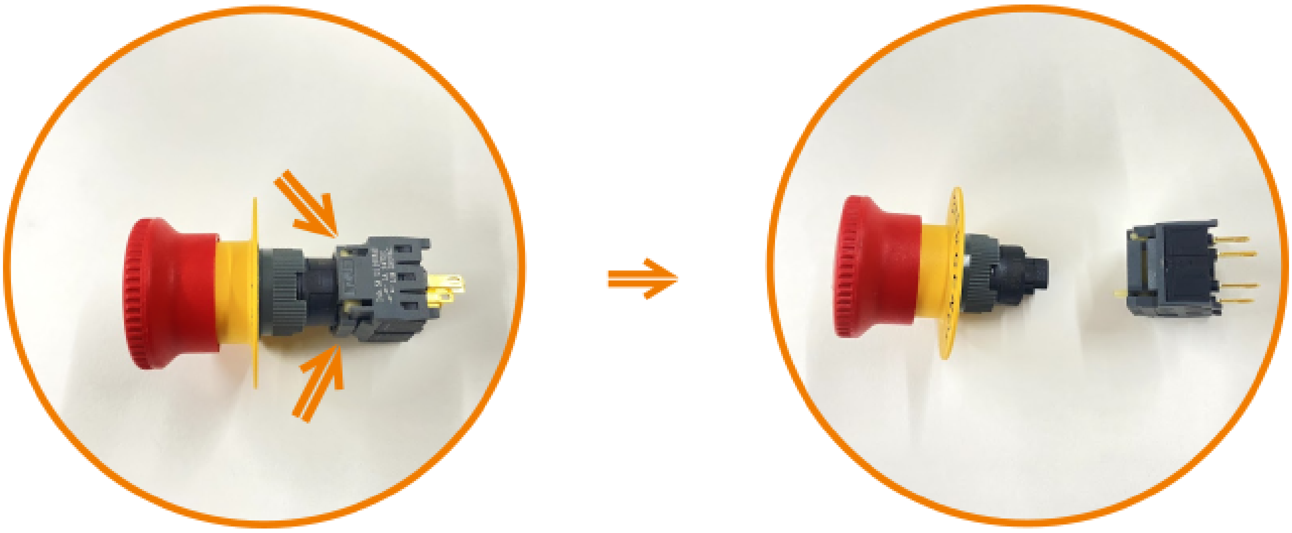
CAUTION: Semiconductor parts inside the unit can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by the warranty.

Open the enclosure by removing the four marked M5 HEX bolts. Please fully remove the four bolts and the swing open the top part towards the left side.

WARNING: When closing the enclosure and installing the M5 HEX bolts, please do not overtighten.

Installing the E-Stop button

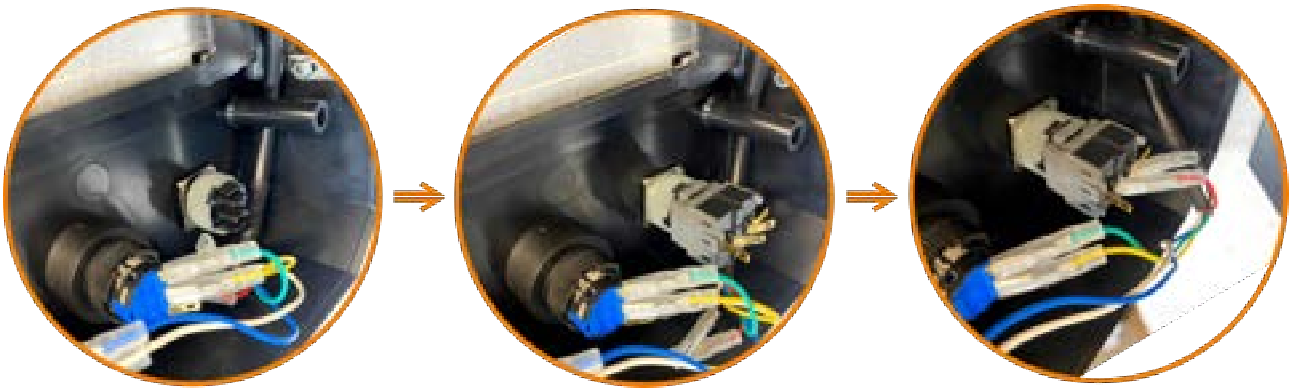
The E-Stop button needs to be installed first, please follow the steps to install the E-Stop button.



Press the two clips and pull the backside of the E-Stop button

Bend the switch button as shown above.

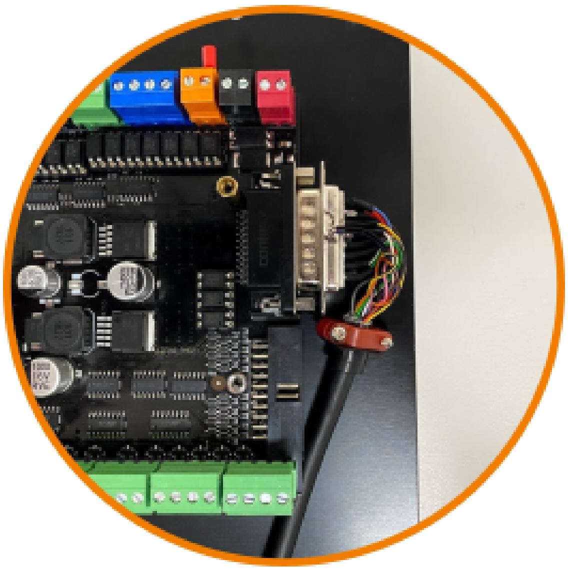
NOTE: Keep the direction of the switch as marked by the tab.



Install the E-Stop button, plugin the rear switch, and plug the wire crimps into the middle two pins.

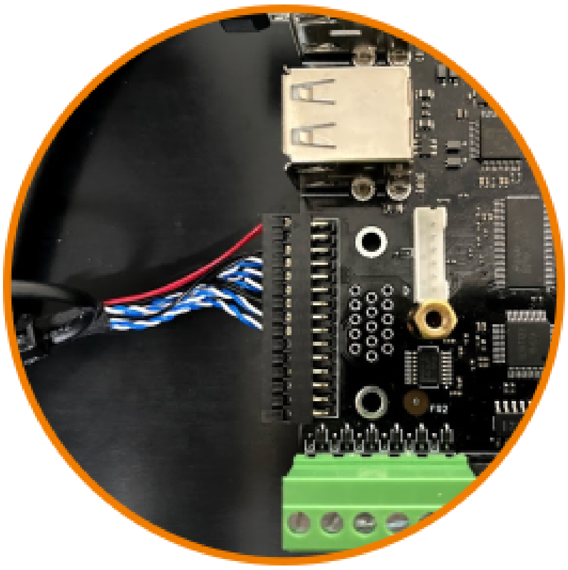
Installing MPG connector

For installing the MPG connector, remove the D-Connector plastic shell and install it as shown below.



LCD Cable connector

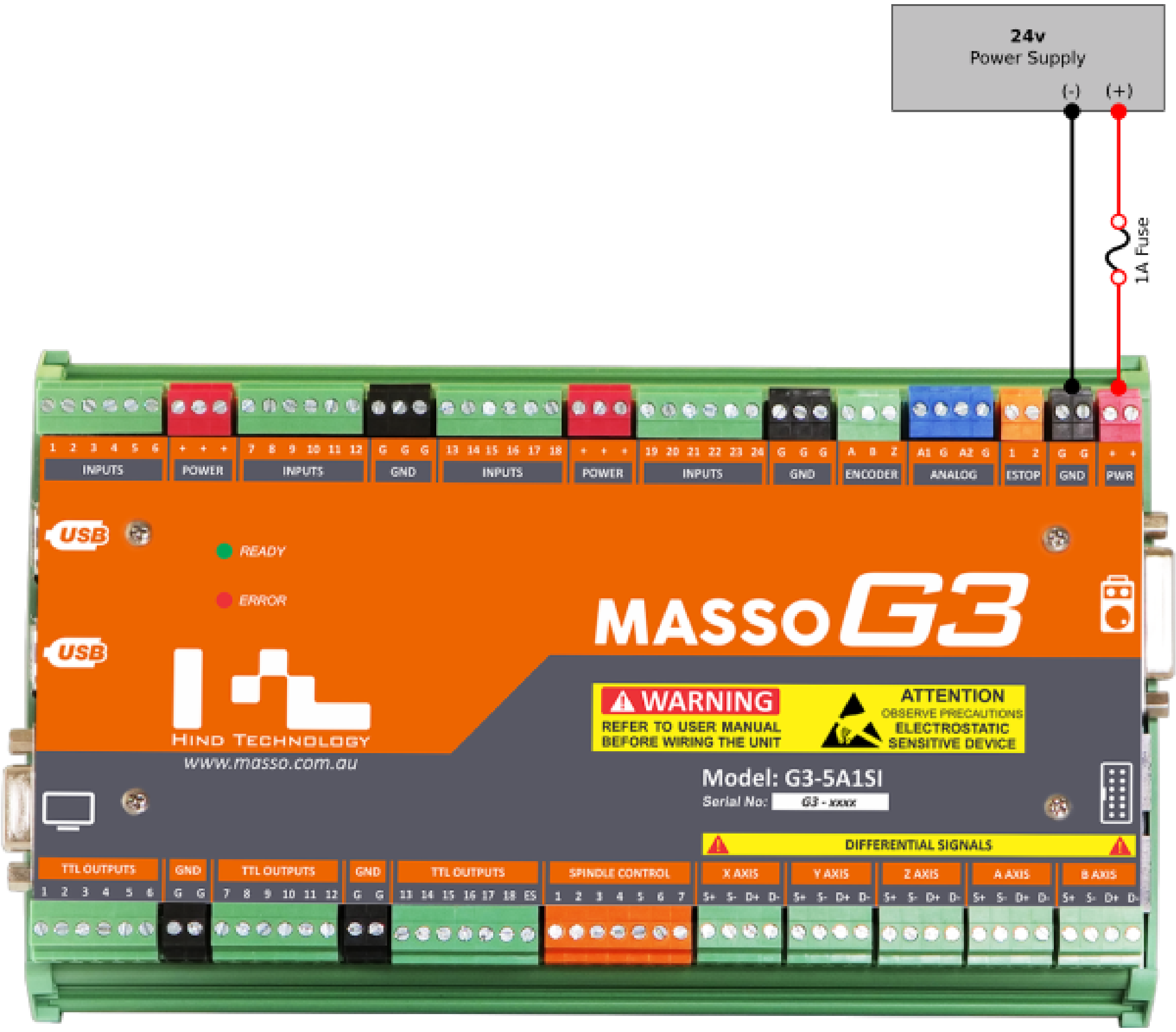
If for any reason the LCD cable has to be removed and installed back, it must be installed in the direction as shown below else the LCD or the MASSO controller might get damaged.



Powering the MASSO Touch

The MASSO Touch power supply connector is located at the top-right corner of the controller as seen in the picture below. MASSO Touch requires a power supply of **24 VDC** with a minimum of **1.5 Amps** output. Voltage not to exceed 25 **VDC** or be less than 23 **VDC**.

MASSO Touch will power on instantly once power is connected.



WARNING: The installation of a 1 amp fuse between your Power Supply and MASSO is required to protect against an accidental short circuit of the auxiliary power connectors on MASSO, such an event can damage the controller beyond repair.

WARNING: The MASSO Touch requires a power supply of nominal 24 **VDC**. Voltage not to exceed 25 **VDC** or be less than 23 **VDC**.

INFORMATION: There are multiple **Power (Red-colored)** and **Ground (Black-colored)** provided on the controller and can be used to easily wire drives, sensors and switches.

Some examples:

- The **Power** terminals can be used to provide voltage to sensors or switches for machine homing.
- The **Ground** terminals can be used to wire common ground signals between stepper or servo motor drives.

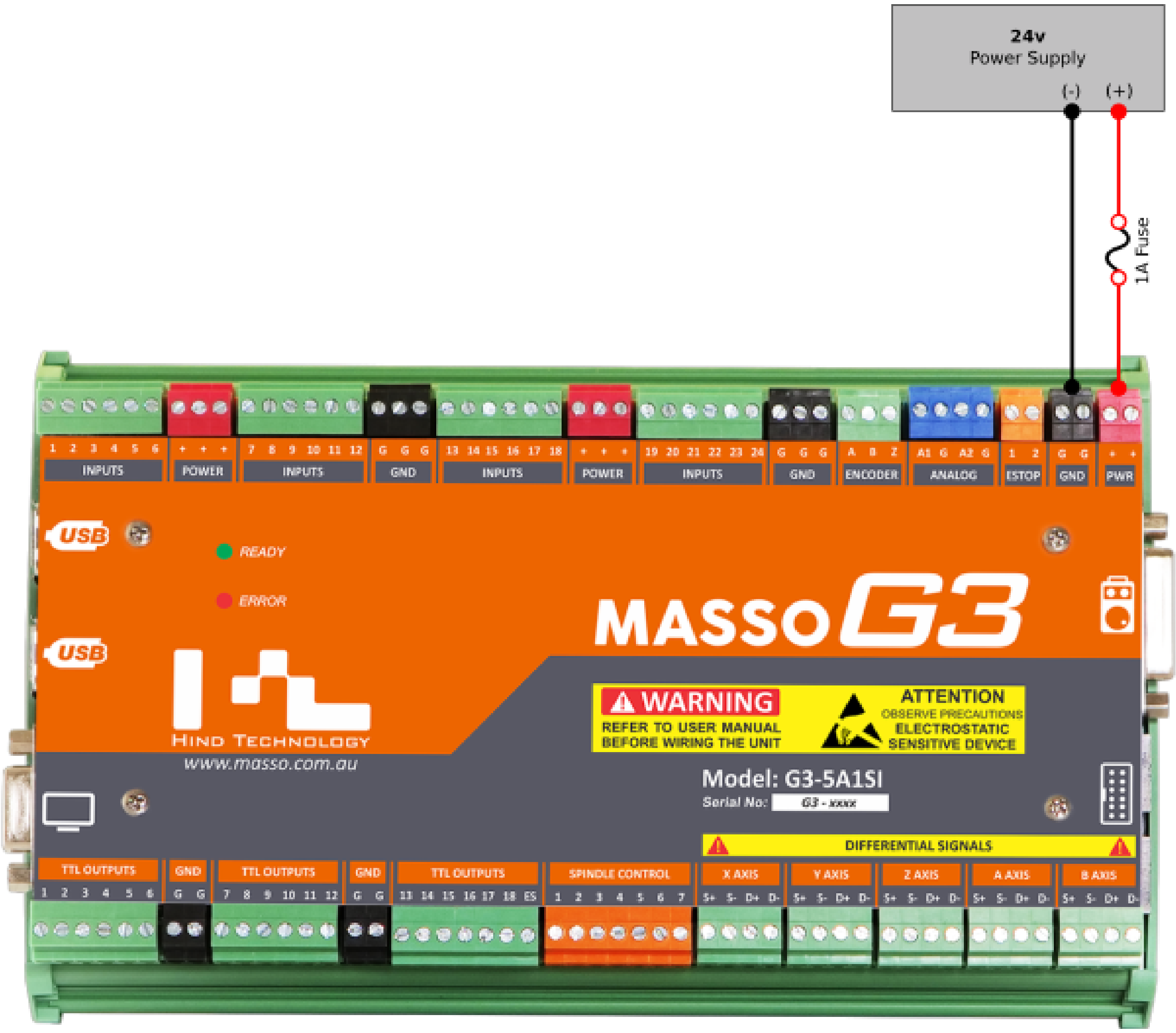
CAUTION: When using the auxiliary **Power** and **Ground** terminals on the controller the total current draw must not exceed 500mA across all terminals. Connecting high current loads can damage the controller beyond repair.

6.2. Powering MASSO-G3

CAUTION: Semiconductor parts inside the unit can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by the warranty.

The MASSO power supply connector is located at the top-right corner of the controller as seen in the picture below. MASSO requires a power supply between **12 and 24 VDC** with a minimum of **1.5 Amps** output. Voltage not to exceed 25 **VDC** or be less than 12 **VDC**.

MASSO will power on instantly once power is connected.



WARNING: The installation of a 1 amp fuse between your Power Supply and MASSO is required to protect against an accidental short circuit of the auxiliary power connectors on MASSO, such

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an event can damage the controller beyond repair.

WARNING: The MASSO G3 power supply not to exceed 25 **VDC** or be less than 12 **VDC**.

INFORMATION: There are multiple **Power (Red-colored)** and **Ground (Black-colored)** provided on the controller and can be used to easily wire drives, sensors and switches.

Some examples:

- The **Power** terminals can be used to provide voltage to sensors or switches for machine homing.
- The **Ground** terminals can be used to wire common ground signals between stepper or servo motor drives.

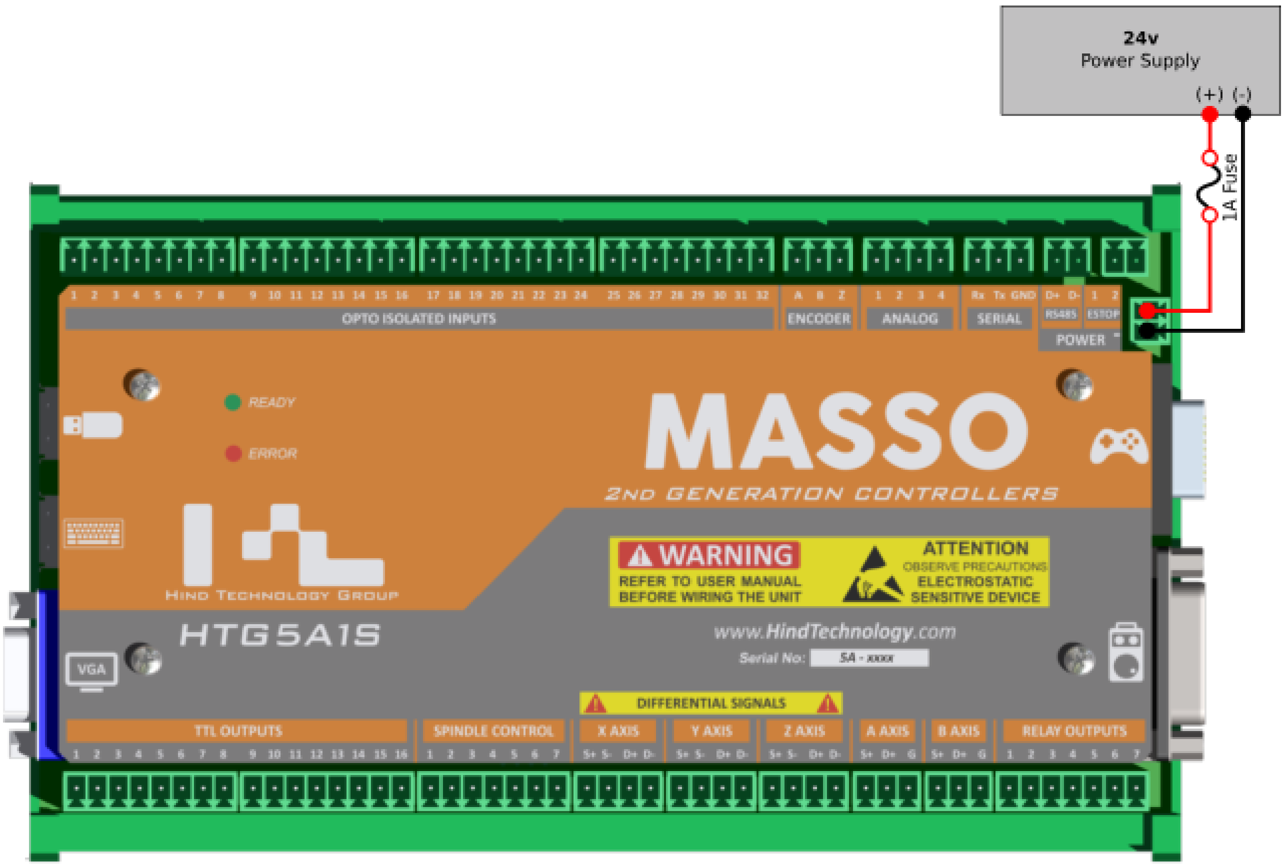
CAUTION: When using the auxiliary **Power** and **Ground** terminals on the controller the total current draw must not exceed 500mA across all terminals. Connecting high current loads can damage the controller beyond repair.

6.3. Powering MASSO-G2

> **CAUTION:** Semiconductor parts inside the unit can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by the warranty.

The MASSO power supply connector is located at the top-right corner of the controller as seen in the picture below. MASSO requires a power supply between **12 and 24 VDC** with a minimum of **1.5 Amps** output. Voltage not to exceed 25 **VDC** or be less than 12 **VDC**.

MASSO will power on instantly once power is connected.



> **WARNING:** The MASSO G2 power supply not to exceed 25 **VDC** or be less than 12 **VDC**.

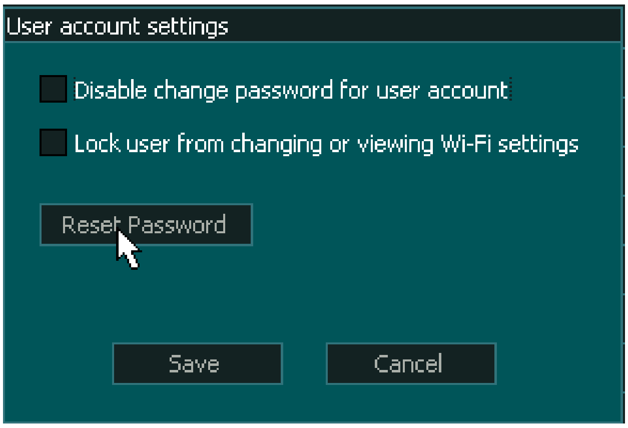
6.4. Password Reset

MASSO Touch & G3 User Password Reset

If you have lost the User level password but still know Admin password you can use the User password reset feature.

- Press F1 to go to the F1 screen
- Enter the Admin Password.
- Select User Account
- Press Reset Password
- Press Save
- The User password is not set to the default of **HTG.**

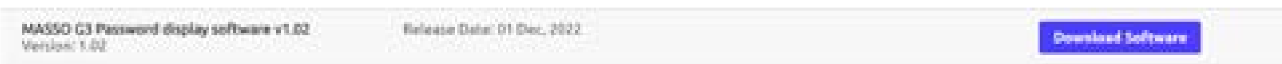
The Admin password is not changed and you can set a new User password.



MASSO Touch & G3 Admin Password Display

If you have lost the Admin password you can can download Password Display software from your myWorkshop portal.

Log into myWORKSHOP and download the Password Display software and a copy of the software you are currently running on MASSO if you don't already have it.



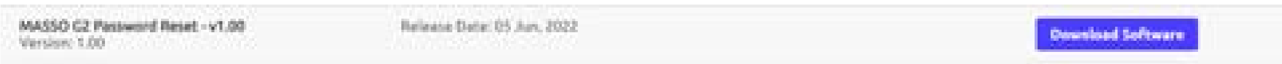
- Copy the Password Display software into the MASSO directory of your flash drive along with the current software version you are running on your MASSO.
- Restart MASSO and immediately press the F1 key multiple times or tap the screen of MASSO Touch

until the software load screen appears
- Select the Password Display Software v1.02 and install.
- Press ESC once the install process is complete.
- This will display both your User and Admin Passwords on screen.
- Note these down as you will need these to log in later.
- Restart MASSO pressing the F1 key multiple times until the software load screen appears
- Select the MASSO software you are running on your MASSO and install.
- Press ESC once the install process is complete.
- MASSO will start and you can now login using the passwords you noted down from earlier.

MASSO G2 Password Reset

If you have lost the Admin or User password you can download the Password reset software from your my Workshop portal.

Log into myWORKSHOP and download the Password Reset software and a copy of the MASSO software you are currently running on MASSO if you do not already have it.



- Copy the Password reset software into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading. This will reset both your User and Admin Passwords to default "**HTG**"
- Copy the MASSO software files into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading and restart MASSO.
- You can now login using the default password. "**HTG**"

Resetting the Password does not change the configuration settings of Masso.

CAUTION: Because the G2 Password Reset file and your Main software files have the same name it is easy to mix them up and accidently load the wrong software. This will not cause any damage to MASSO but may cause confusion.

6.5. Connecting a Screen

MASSO uses a standard **15 pin female VGA connector (1024 x 768 screen resolution)**

INFORMATION: If the monitor only supports HDMI input then a simple VGA to HDMI converter can be used.

INFORMATION: The display is a 4:3 aspect ratio and will look distorted when displayed as 16:9 on a widescreen monitor. Monitors have settings to set display ratio, please refer to your monitor's user manual.

INFORMATION: For information about connecting touch screens, please use the below link.

Touch Screen Interface

6.6. Connecting Keyboard & Mouse

Standard USB Keyboard & Mouse can be connected to MASSO, both wired and wireless devices are supported.

INFORMATION: MASSO G3 has 4 USB Type A ports and MASSO G2 has 2 USB Type A ports. If more USB ports are required then a USB HUB can also be connected. All ports are USB2. MASSO Does not support USB Type C

INFORMATION: MASSO supports English (QWERTY) and German (QWERTZ) keyboards. Select your keyboard type under General Settings.

CAUTION: Avoid using unbranded Keyboard and Mouse as they are known to cause issues.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logitech

6.7. Loading software onto MASSO Touch

Regular updates are released to add more features to the units.

The software upgrade process can be easily performed on-site by following the instructions below:

Each software version is complete and and does not require previous software versions to be installed.

This process is the same whether you are installing a new MASSO or updating software.

Always make a backup of your settings and save a copy of the printable file to check your settings are correct after updating.

INFORMATION: The latest software updates are available from your my Workshop portal.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Load software on your MASSO Touch - MASSO Top Tip 6

Information: Avoid using unbranded USB Flash drives as these are known to give issues with software install and upgrades

Information: Always make a backup of your settings before upgrading your software.

- Ensure you are using the right software install instructions for your controller. These are for MASSO Touch.
- Ensure your Flash drive is formatted to Fat32
- Ensure that your flash drive is using MBR as GPT is not supported.
- Create a folder called MASSO on the flash drive and copy the software file downloaded from MY WORKSHOP
- Back up your current setting and save the printable file.
- On powering the **MASSO Touch** and immediately tap the screen repeatedly until the MASSO software load screen appears. If the software load screen does not appear re-power MASSO and start again.
- Select the desired software from the list in the software load screen and press the enter key on your keyboard.
- After the software has finished loading press the Escape button on screen and your MASSO will restart with your new software.
- Use your printable file to check your settings after updating.

6.8. Loading Software to MASSO-G3

Regular updates are released to add more features to the units.

The software upgrade process can be easily performed on-site by following the instructions below:

Each software version is complete and and does not require previous software versions to be installed.

This process is the same whether you are installing a new MASSO or updating software.

Always make a backup of your settings and save a copy of the printable file to check your settings are correct after updating.

INFORMATION: The latest software updates are available from your [my Workshop] portal.

MASSO 101 - Loading Software on MASSO G3 CNC Controllers

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Information: Avoid using unbranded USB Flash drives as these are known to give issues with software install and upgrades

Information: Always make a backup of your settings before upgrading your software.

- Ensure you are using the right software install instructions for you controller. These are for MASSO G3.
- Ensure your Flash drive is formatted to Fat32
- Ensure that your flash drive is using MBR as GPT is not supported.
- Create a folder called MASSO on the flash drive and copy the software file downloaded from MY WORKSHOP
- Back up your current setting and save the printable file.
- Power on the **MASSO G3** and immediately press the F1 key repeatedly until the MASSO software load screen appears. If the software load screen does not appear re-power MASSO and start again.
- Select the desired software from the list in the software load screen using the up/down arrow keys and press the enter key on your keyboard.
- After the software has finished loading press the ESC key and your MASSO will restart with your new software.
- Use your printable file to check your settings after updating.

6.9. Loading Software to MASSO-G2

Regular updates are released to add more features to the units.

The software upgrade process can be easily performed on-site by following the instructions below:

Each software version is complete and and does not require previous software versions to be installed.

This process is the same whether you are installing a new MASSO or updating software.

Always make a backup of your settingsBack up your current setting on MASSO and take screen prints to allow easy checking of settings after the update is complete.

INFORMATION: The latest software updates are available from your my Workshop portal.

Information: Avoid using unbranded USB Flash drives as these are known to give issues with software install and upgrades

WARNING: Check that while copying file to your flash drive ensure the file name is not renamed.

The example below is for controller with serial number **5A-660**

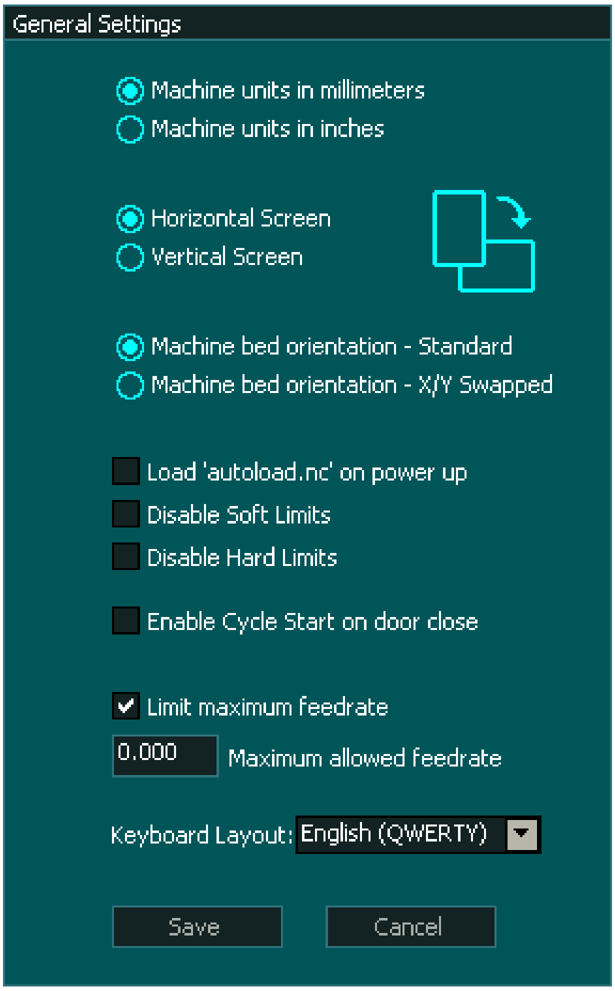
- Ensure you are using the right software install instructions for you controller. These are for MASSO G2
- Check that the file name matches the serial number of the controller.
- Back up your current setting on MASSO and take screen prints to allow easy checking of settings after the update is complete.
- Connect a USB flash drive to your PC/MAC and **make sure it's been formatted in FAT or FAT32** format.
- Ensure that your flash drive is using MBR as GPT is not supported.
- Extract the files from the Zip file downloaded from MY WORKSHOP **"00000660.HTG"** and **Data1.HTG** files and copy them to the root directory of your USB flash drive.
- Plug the Flash drive into the port labeled with a picture of a Flash Drive
- **NOTE:** Make sure that there is nothing connected on the PlayStation connector on the MASSO
- Insert the USB flash drive into the controller's USB flash drive connector and DO NOT connect a USB hub.
- Power up the controller and a progress bar will be displayed on the screen showing the upgrade status.
- Once the progress bar shows 100%, the upgrade process is finished, please power cycle the unit.
- Do not remove the flash drive from MASSO as the Data1.htg file is loaded after the first power cycle.

- Check your settings using the screen prints to make sure nothing has changed.

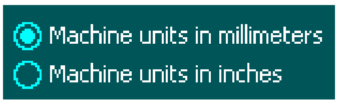
6.10. MASSO Settings

Read other subtopics below:

6.10.1. General settings



Machine units

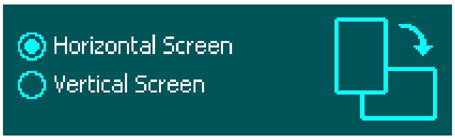


- This is where you define the native units for your machine.
- If you prefer to have your machine work in metric select 

- If you prefer to have your machine work in metric select 

- You can switch between metric and imperial using Gcodes G20 & G21 in your Gcode file if needed though it is best to output your Gcode file in the native unit of measurement of your machine regardless of whether the CAD file is metric or imperial.

Horizontal / Vertical Screen



- This rotates the screen 90 degrees so that the monitor can be used in either Horizontal or Vertical mode.
- The Default mode for MASSO Touch is Vertical mode
- Vertical mode is designed to be used with a touch screen and includes a keyboard in the lower part of the screen
- The Default mode for MASSO G3 is Horizontal mode
- Horizontal mode is designed for a screen without touch screen.
- For additional information on the different Graphical layouts please see this page Graphical interface
- MASSO Touch can be used in either mode but since horizontal mode does not include a keyboard an external keyboard must be used.
- Touch screen functionality is available in both screen modes.

INFORMATION: If you have set your MASSO Touch into Horizontal mode for a look or by mistake and want to change back, you can plug in an external Keyboard into the external USB port on MASSO Touch and enter your Admin Password. After this you can set it back to Vertical mode and restart MASSO.

Machine Bed orientation

- The machine bed orientation setting in the F1 General Settings screen allow the user to swap the X & Y axis display on the MASSO screen.
- This is for people who choose to set their machine up with the Y axis moving left and right and the X axis moving backwards and forwards.
- It is a non standard set up and should be avoided if possible but for those who wish to set their machine like this, selecting the Machine Bed Orientation to swapped will rotate what you see on the screen to march what you see on the table.
- Please note that this does not swap the physical X & Y axis on the machine and cannot be used to rotate a toolpath.

Autoload on Power Up

- If this option is ticked MASSO will look for a file called **autoload.nc** on the root directory of your flash drive when MASSO is powered up or the flash drive is inserted and if it locates this file it will automatically load it ready to run.

Disable Softlimits

- Putting a tick in this box will disable soft limits while machining.
- Please note that soft limits are still active while jogging even when disabled.
- For additional information on soft limts please see this page Soft Limts

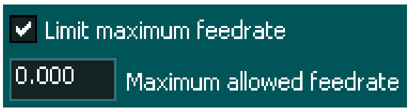
Disable Hard Limits

- Putting a tick in this box will disable hard limits.
- The Homing sensors on MASSO act as machine limits after homing is complete.
- If this box is unticked after homing a triggered homing sensor will cause a Hard Limit alarm
- If this box is ticked after homing a triggered homing sensor is ignored.
- Hard limits trigger when a homing sensor changed to High
- For additional information on hard limts please see this page Hard Limts

Enable Cycle Start on Door Close

- This setting determines how opening the machine door behaves when the door is closed.
- If this box is unticked, after closing the door the Cycle Start button must be pressed to continue machining
- If this box is ticked, after closing the door the machine will automatically resume machining.
- For more information on the Door input please see this page Door Input

Limit Maximum Feedrate



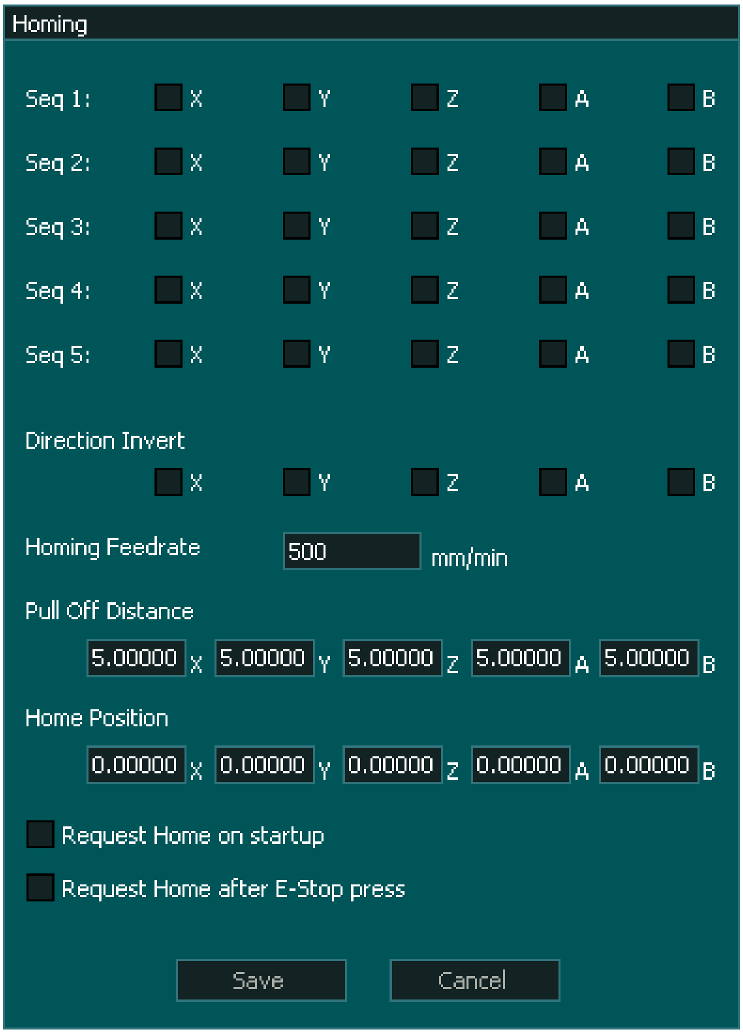
- This setting allows the user to set a maximum feed rate while machining.
- No axis is allowed to exceed the maximum allowed feed rate specified.
- You will not see the Maximum allowed feedrate box is not visible until the Limit maximum feedrate box is ticked. 

- The biggest use of this feature is running third party provided Gcode which is too fast for your machine.
- WARNING: Do not set the feed rate to 0 when using this feature as this will stop G1,G2 & G2 moves.

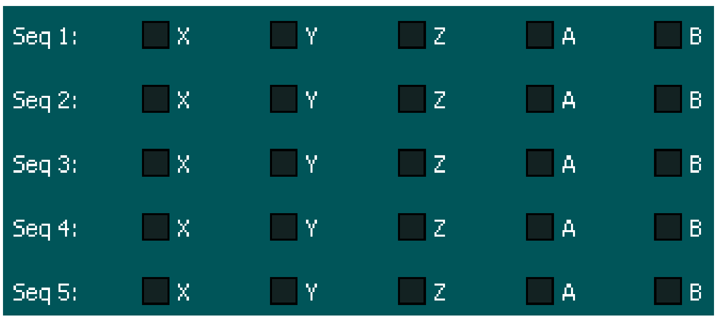
Keyboard Layout

- Users may choose between QWERTY and QWERTZ keyboard layouts by selecting from the pull down menu
- Default is the standard English keyboard.

6.10.2. Homing Settings



SEQ 1-5



- This is where you define the order in which your axis will be homed.
- All axis in the same sequence are homed simultaneously
- Sequences are done in numerical order.
- For additional information on setting up homing please see this page Homing
- Axis that are slaved will be grayed out and cannot be selected. 

Direction invert

- This setting changes the direction that the axis uses when seeking the Homing sensor.
- For additional information on setting up homing please see this page Homing

Homing Feedrate

- This setting determines how fast the axis will move when seeking for the Homing sensor.
- For additional information on setting up homing please see this page Homing

Pull Off Distance

- The pull off distance is how far the axis will move away from the homing sensor trigger point.
- For additional information on setting up homing please see this page Homing

Home Position

- The Home position setting is the Machine coordinate that is given to the final axis position at the end of Homing
- For additional information on setting up homing please see this page Homing

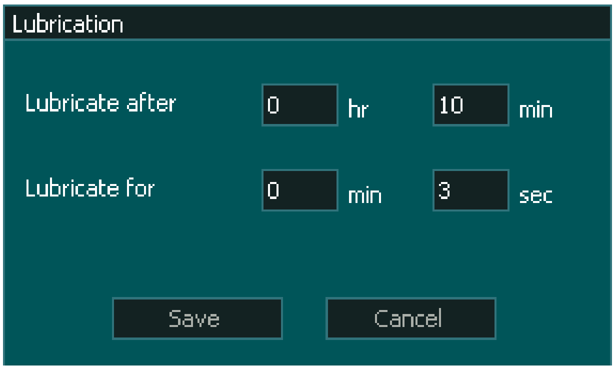
Request Home on Startup

- This setting will force MASSO to be homed on power up before machining can be started.
- It is advised that this option be used.
- If left unticked the Homing option will not show on the F2 or F3 screen when MASSO is turned on.

Request Home after E-Stop press

- Ticking this option will force the machine to be homed after the EStop button is pressed.
- Pressing the Estop button usually leads to a loss of position and it is advised that this option be ticked.

6.10.3. Lubrication Settings



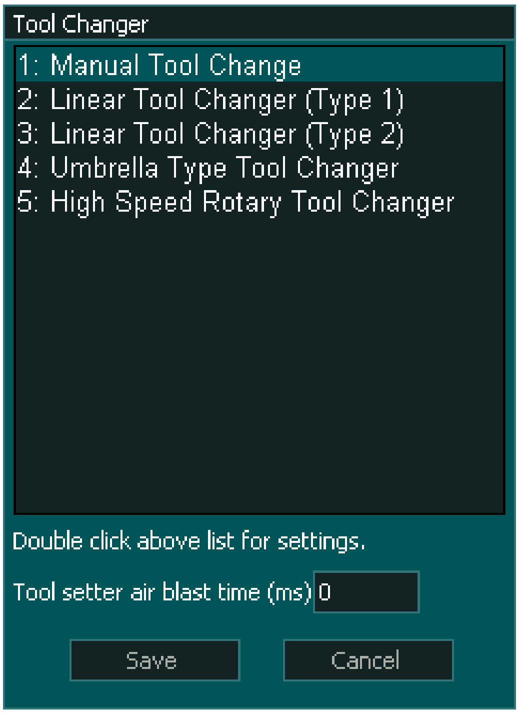
Lubricate after

- This determines the runtime between automatic lubrication.
- For additional information on lubrication please see: Lubrication

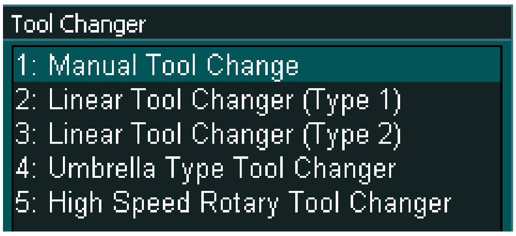
Lubricate for

- This is the time that the lubrication output will be set high for the Auto lubrication cycle.
- For additional information on lubrication please see: Lubrication

6.10.4. Tool Changer Settings



Tool Changer

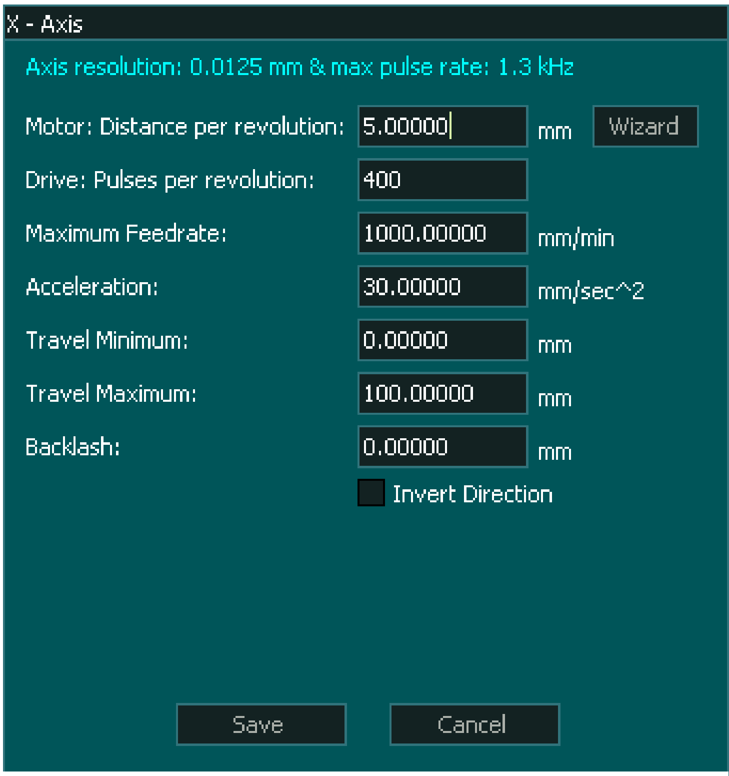


- Select the tool changer type that suits your machine.
- Some tools changers can have other options when double clicked that determine how the tool changer behaves.
- If double clicking a tool changer does not open a new settings window, there are no additional settings for that changer.
- For information on the various tool changer types and their settings please see the appropriate tool changer documentation
- Mill Tool changers
- Lathe Tool changers

Tool setter air blast time(ms)

- This setting determines how long the tool setter air blast output is set high.
- This is used to give a blast or air over the tool setter to clear it of swarf before the tool is measured.
- The time is measure in milliseconds
- The operation of the air blast is automatic and will occur after the new tool is picked up and before the new tool is measured.

6.10.5. Axis Settings



X,Y,Z, A & B axis

- This settings page is where you enter the properties of your motor and machine drive train.
- The A & B axis have additional settings.

Axis Resolution

- This is not a setting but a calculation based on the Distance per revolution and Pulses per revolution
- This is how far the axis will move with a single step and is the smallest incremental distance possible for the axis.

Distance per revolution

- How far your axis travels in one revolution of the motor.
- This takes into account the entire drive train including gear box ratios.

Pulses per revolution

- How many steps it will take for your motor to complete 1 revolution.
- This is based on your motor and driver settings.

Maximum feedrate

- Defines your axis rapid speed.

Acceleration setting

- Determines how quickly your axis accelerates to your chosen feed rate.
- IT also determines how quickly an axis will decelerate.

Travel Minimum

- This value determines the extent of travel for the axis in the negative direction.
- This value must be a lower numeric value than the Travel Maximum

Travel Maximum

- This value determines the extent of travel for the axis in the positive direction.
- This value must be a higher numeric value than the Travel Minimum

Backlash

- Enter your axis backlash.
- This value cannot exceed 10mm or 0.3937”

Invert Direction

- If your axis travels in the wrong direction, put a check in this box to reverse it.

A & B axis

- The A & B axis have additional settings for Angular and slave settings.

Angular Axis

- The A & B axis can be set as for rotary axis
- Setting the axis to angular changes the moves to angular instead of linear.
- Movements are in degrees
- The Motor distance is automatically set to 360 degrees and cannot be changed.
- Calibration is done through calculation and not by using the wizard.
- For additional information on setting up a rotary axis please see; Rotary axis

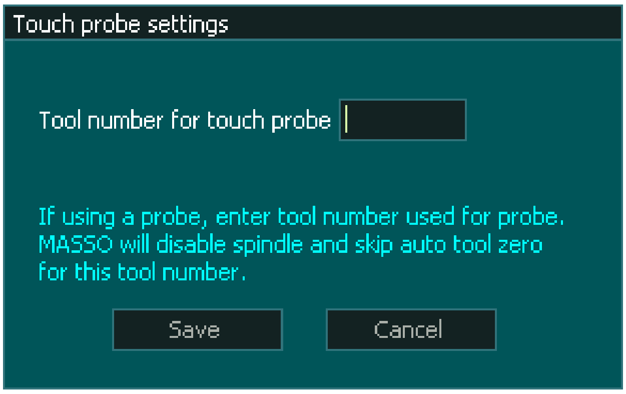
Slave axis

- This setting is used for software slaving the the A axis to the X axis or the B axis to the Y
- Software slaving is used for axis auto squaring.
- For additional information on homing please see; Homing

Wizard

- This button is for axis calibration.
- For additional information on axis calibration please see; Axis Calibration Wizard

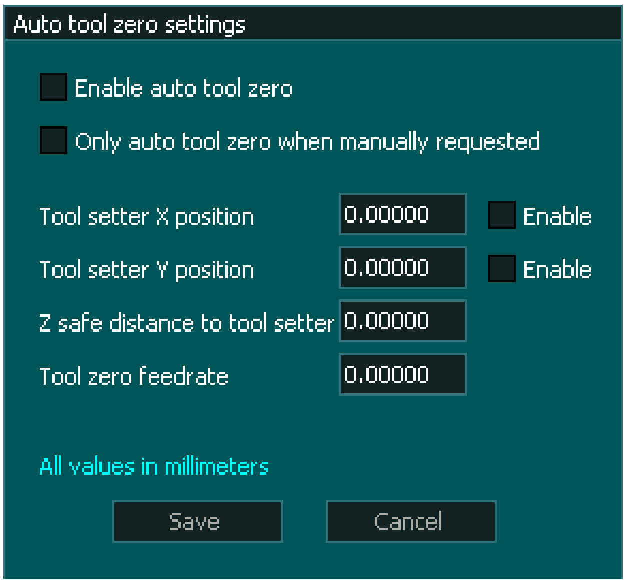
6.10.6. Touch probe settings



Tool number for touch probe

- This setting defines the touch probe tool number and can be any number of your choosing from 1 to 100
- The tool number assigned here will disable the spindle and the Auto Tool zero from measuring the tool lengthe when this tool is loaded.
- For additional information please see: >> Touch Probe

6.10.7. Auto Tool Zero Settings



Enable auto tool zero

- This enables the auto tool zero function used for measuring tool length during the homing routine and between tool changes.
- Without a tool setter installed each tool change will require it's own separate Gcode file as the tool setter is an intergral part of changing tool in MASSO for both manual and Auto tool changers.
- For additional information on Auto tool zero please see: >> Auto Tool Zero

Only auto tool zero when manually requested

- This setting is used for those who have auto tool changers or tools installed in tool holders such that the tool length is fixed.
- When ticked this prevents the tool in the spindle being measured during homing and on tool changes and MASSO uses the tool length entered in the F4 tool table to set the tool height for each tool when change in a Gcode program.
- When this option is selected tools must be measured using the Auto tool zero option if the tool editing

page in the F4 page. Each tool only needs to be measured when initially installed in it's holder or is replaced.
- For additional information on Auto tool zero please see: >> [Auto Tool Zero]

Tool setter X & Y position

- This setting defines the machine coordinate of the Tool setter on the table.
- If the enable is not selected the spindle will not move that axis to the specified coordinate
- The tool setter must be located within the soft limits of the table.
- For additional information on Auto tool zero please see: >> [Auto Tool Zero]

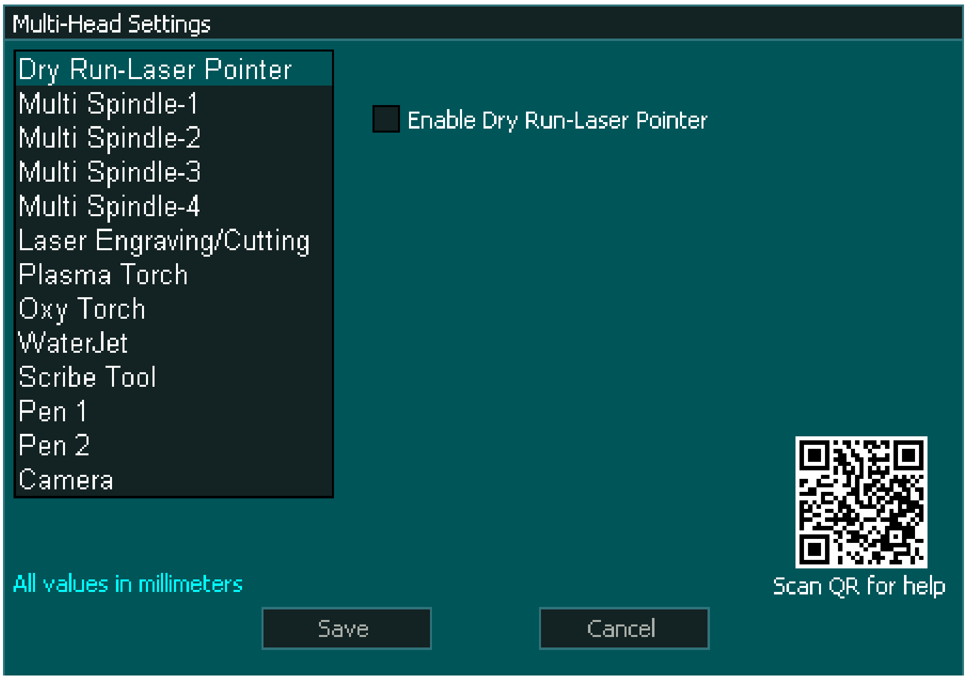
Z safe distance to tool setter

- This defines the machine coordinate that the Z axis ca rapid down to before it starts probing the tool length
- This is useful on long Z axis
- For additional information on Auto tool zero please see: >> [Auto Tool Zero]

Tool zero feedrate

- This defines the feed rate that the spindle will probe down to the tool setter.
- For additional information on Auto tool zero please see: >> [Auto Tool Zero]

6.10.8. Multi-Head Settings



Multi-Head

MASSO G3 & MASSO Touch allow the user to have multiple heads attached to their machine and each head has it's own parameters to define some functions and offsets from other heads.

Each tool is assigned a tool number and changing between head is as simple as changing tool.

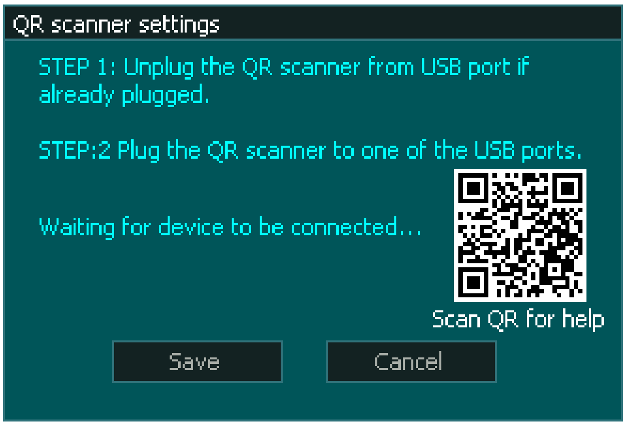
With the exception of the main spindle all tools 0 & 101 to 118 are disabled and need to be enable before they can be used

- Dry Run Laser Pointer **Tool Number 0**
- Main spindle **Tool Numbers 1-100**
- Laser engraver / cutter **Tool Number 111**
- Multi spindles 1 - 4 **Tool Numbers101 - 104**
- Plasma Torch **Tool Number 112**
- Oxy Torch **Tool Number 113**
- Water Jet **Tool Number 114**
- Scribe Tool **Tool Number 115**
- Pen 1 & 2 **Tools Number 116 & 117**

- Camera **Tool Number 118**

For information on the various Multi-Heads please see; >> Multi-Head

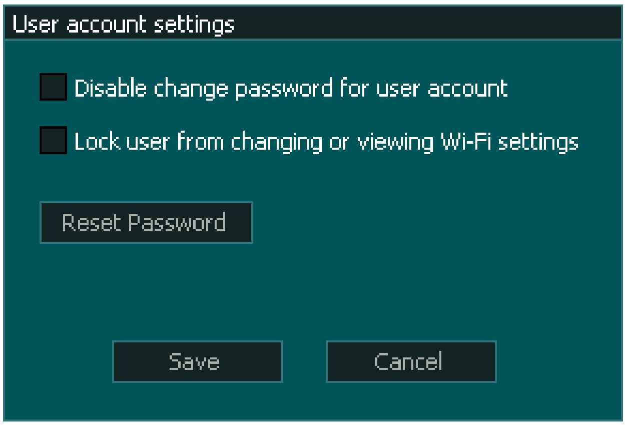
6.10.9. QR Scanner Settings



QR scanner settings

- This page is where you pair your QR scanner to MASSO.
- The procedure to pair and use the QR scanned can be found here: >> QR scanner Pairing
- The procedure to pair and use the QR scanned can be found here: >> QR scanner use

6.10.10. User Account Settings



Disable change password for user account

- Prevents the user from changing the user login password

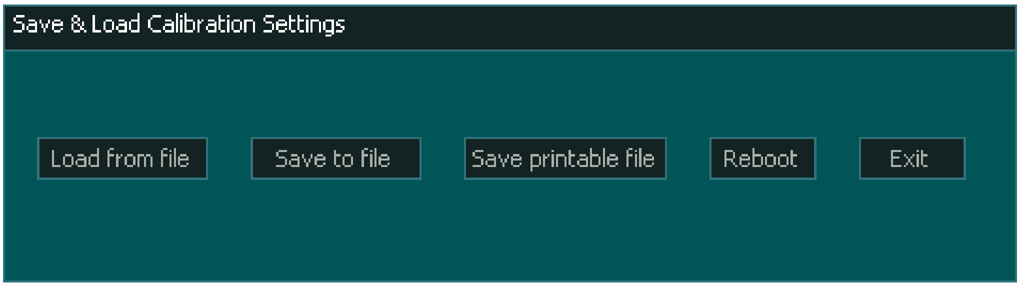
Lock User from changing or viewing Wi-Fi settings

- Prevent the user from entering the Wi-Fi settings page

Reset Password

- Resets the User password back to the default of **HTG**

6.10.11. Load and Save Calibration Settings



Load from file

- Saves MASSO settings from your flash drive
- The settings file must be located on the Flash Drive under the MASSO/Machine Settings folder.

For additional information please see:>> Load and save settings

Save to file

- Saves all calibration and setup settings will be saved to **MASSO_Settings.htg** and tool table **MASSO_Tools.htg** on to the USB Flash drive.
- For additional information please see:>> Load and save settings

Save printable file

- Saves your settings as a txt file to your Flash Drive under the MASSO/Machine Settings folder which can be read and shared with others
- For additional information please see:>> Printable settings File

Reboot

- Reboots your MASSO. Usually used after loading a new settings file

6.11. Admin and User Passwords

By default the system password is set to **"HTG"** (in capital letters) for both **Admin** and **User logins**.

> **INFORMATION:** When the controller is powered up, Caps Key is enabled by default, as of v3.49 for G2 and v4.00 for G3 Caps key is not enabled.

MASSO 101 - User & Admin Passwords

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

> **INFORMATION:** If want to lock Masso to prevent unauthorized use, Press **CTRL + L** and you will be prompted to re-enter the User and Admin Passwords.

Changing the User or Admin Password

- To change the User or Admin password Click on the Change Password in the Login box.
- Enter the current password and press enter. Default Password is "**HTG**"
-

- Enter the new password up to 5 characters long in the New Password box. (Passwords are case sensitive)
- Enter the new password again into the Confirm Password box
- Press Ok

Removing User login

To remove the user login leave the New Password and Confirm Password boxes blank and press Ok.

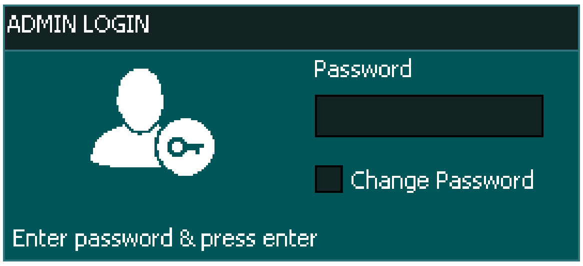
When you next start Masso the user password login box will not be presented.

Removing Admin Login Password

It is not possible to remove the Admin Login.

The Admin Password can be set a blank just like the user password but it will not remove the login.

When you set the Admin login to blank, select the Password box press the Enter Key to login.



Resetting Passwords

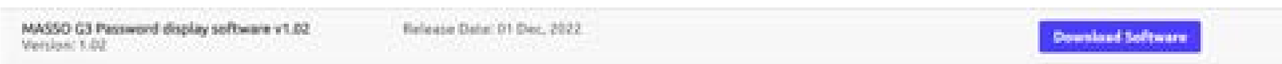
Should you lose or forget your passwords you need to download the Password reset or Password display file for your MASSO.

This can be downloaded from the myWORKSHOP portal

> Before performing a password reset ensure that you have both the Password reset or Display file and a copy of your MASSO software. Mill, Plasma or Lathe.

G3 Password Display Process

Log into myWORKSHOP and download the Password Display software and a copy of the software you are currently running on MASSO if you do not already have it.

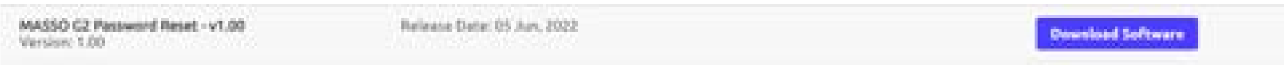


- Copy the Password Display software into the MASSO directory of your flash drive along with the current software version you are running on your MASSO.
- Restart MASSO and immediately press the F1 key multiple times or tap the screen of MASSO Touch until the software load screen appears
- Select the Password Display Software v1.02 and install.
- Press ESC once the install process is complete.
- This will display both your User and Admin Passwords on screen.
- Note these down as you will need these to log in later.
- Restart MASSO pressing the F1 key multiple times until the software load screen appears

- Select the MASSO software you are running on your MASSO and install.
- Press ESC once the install process is complete.
- MASSO will start and you can now login using the passwords you noted down from earlier.

G2 Reset Process

Log into myWORKSHOP and download the Password Reset software and a copy of the MASSO software you are currently running on MASSO if you do not already have it.



- Copy the Password reset software into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading. This will reset both your User and Admin Passwords to default "**HTG**"
- Copy the MASSO software files into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading and restart MASSO.
- You can now login using the default password. "**HTG**"

> Resetting the Password does not change the configuration settings of Masso.

6.12. Wiring and Calibration

> Now the axis and spindle drives can be wired to MASSO, followed by calibration. Please use the below links:

[Axis Servo/Stepper Examples]

[Spindle VFD Examples]

6.13. QR Scanner

> **INFORMATION:** This function is only available for MASSO G3 and MASSO Touch in version 5.0 or higher.

> **INFORMATION:** This feature requires the use of MASSO Link version 2.1 or higher

What it Does

The MASSO QR Scanner feature allows the user to scan a QR code which will then automatically load the file into memory ready for the user to run the program.

This feature requires the use of MASSO Link version 2.1.02 or higher which is used to create the QR code.

The user can also create their own QR codes using the MASSO protocol.

Scanner Requirements

- The scanner must be a USB scanner.
- The scanner must be capable of scanning QR codes
- The scanner must be set up to simulate a USB HID-KBW. In this mode the the reading module in the scanner will become a virtual keyboard to output data to the host.
- The scanner needs to be set to send a CR (carriage return) at the end of the scanned code.

Many barcode scanners come with a user manual that include a set of series of barcodes that can be used to program the barcode scanner itself.

Not all barcode scanners are designed to read QR codes and will read 1D codes only. These are the single line codes found on product packaging and will not work with the MASSO QR codes.

Wireless Barcode scanners with a USB receiver can be used with MASSO as long as they comply with the above requirements.

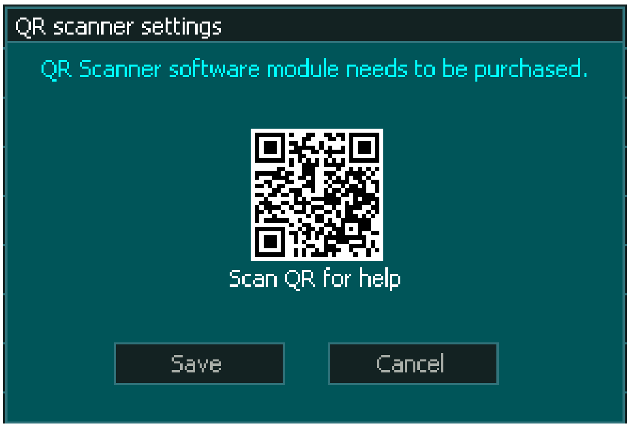
Bluetooth scanners will not work with MASSO so if purchasing a wireless scanner ensure that it is not Bluetooth as they can look similar.

Setting up your scanner

The QR Scanner feature is an additional addon feature that needs to be purchased separately.

If you see the message displayed below you need to purchase the QR Scanner addon module and load the new software from your myWorkshop portal.

This addon is available from the MASSO online store.

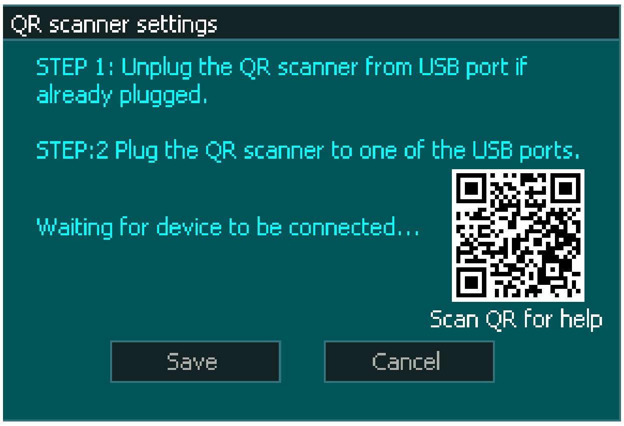


Installing your QR Scanner

- If you do not have a spare USB port available on your MASSO G3 or MASSO Touch you can connect a USB hub to one of the USB ports and use this to connect your scanner. An unpowered USB3.0 hub will work fine for this purpose however do not plug your Flash Drive into the USB hub as it needs its own USB port.

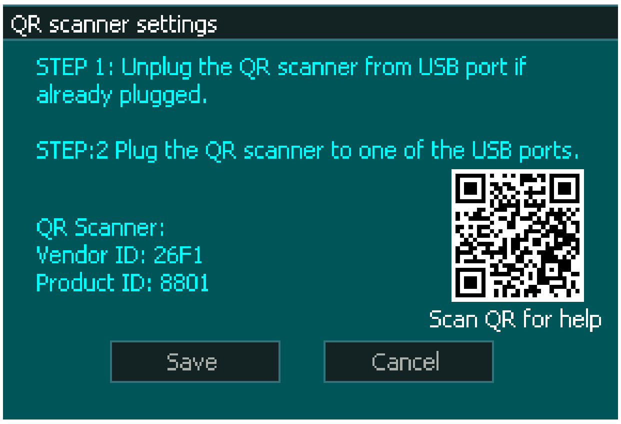
Step 1 - Do not plug your QR Scanner into MASSO yet. If you have already plugged it in unplug it before you start.

Step 2 - In the F1 Screen select QR Scanner and the following screen will be displayed.



Step 3 - Plug in your QR Scanner. You will see the Vendor ID and Product ID displayed.

This indicates the scanner has been detected and identified.

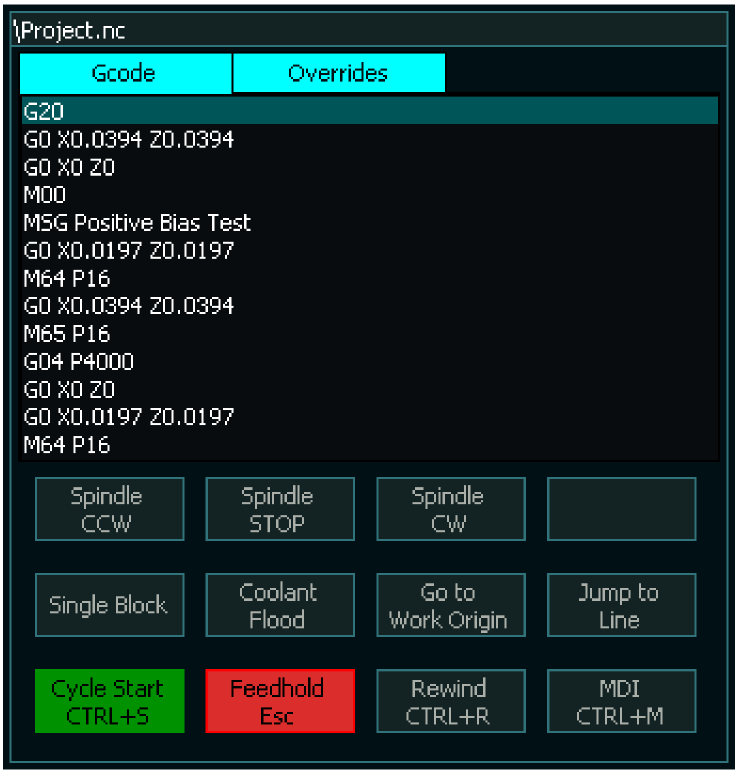


Step 4 Press Save and the QR Scanner install is complete.

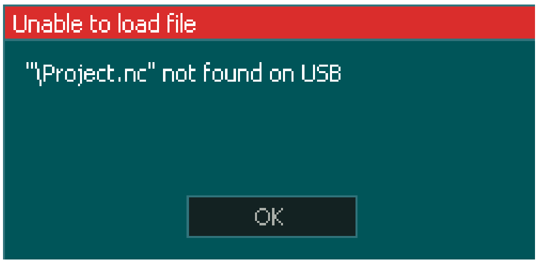
Troubleshooting

If the QR scanner does not work as expected

- Put a Gcode file onto your flash drive and name it project.nc
- Go to the F2 page on MASSO and Scan the QR code below. The file should load into MASSO ready to run as shown.

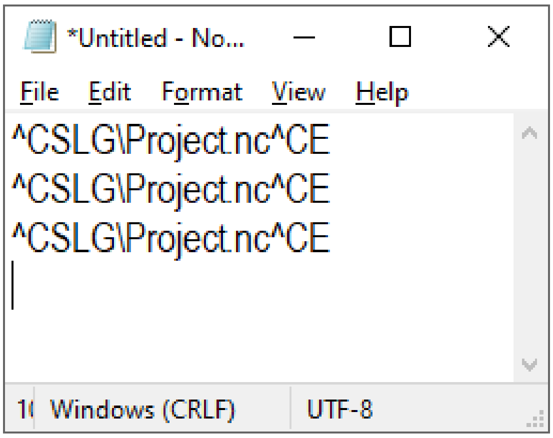


- If you see the following message it means that the file is not present on the Flash drive or you have it in the wrong folder on the Flash Drive. For this test the file needs to be in the root directory.



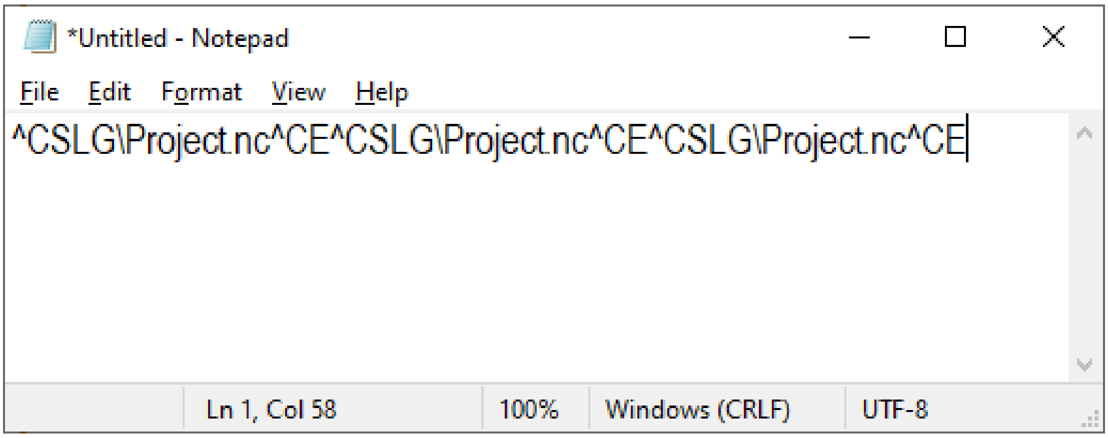
- If you do not see either of these messages when you scan the QR code please confirm that the scanner is set up as a USB HID-KBW virtual keyboard and is set to output a carriage return at the end of the scan.

- You can test your QR scanner on a PC. Plug the scanner into a USB port on your computer and open your text editor of choice. Notepad works well in Windows. Scan the QR code 3 times and you will should see the following on your screen.



This indicates the scanner is reading the code and has carriage return turned on.

If you see the following then carriage return is not turned on and the scanner is not set up properly.



If the test in notepad is correct you can also use MDI to test the scanner but it will not show a carriage return like notepad.

Plug the scanner into MASSO and open MDI.

For this test the scanner must not be paired with MASSO so that it will act as a keyboard as far as MASSO is concerned.

If you have already set the scanner up in MASSO you can go to the QR scanner page, unplug your mouse and plug it back in and hit save.

This will make MASSO think the mouse is the scanner and allow the scanner to work in the MDI test.

Scan the test code and you will see ^CSLG\Project.nc^CE enter in the MDI line

Press Run between each scan to clear the line and try again.

Each time it will print ^CSLG\Project.nc^CE

If it does then MASSO is reading the code correctly and you can pair the QR scanner with MASSO.

Creating QR Codes with MASSO Link

The easiest way to create QR codes is to use MASSO Link v2.1.02 or higher. It has a built in QR code generator built in

See here for more information.

Quick Start Guide to using MASSO QR Scanner

See the link below for more information

Quick start guide to using your QR scanner

Creating your own QR codes

Syntax

^CS - Code Start

LG - Load Gcode

\ - root folder followed by the directory path and Gcode file name

^CE - Code End

Example ^CSLG\My Project files\Widget.nc^CE

QR Code Formatting

A correctly formatted QR code can be broken up into several parts

^CSLG\My Project files\Widget.nc^CE

?

The Codes can be broken up as follows

^CS LG \My Project files\ Widget.nc ^CE

- **^CS** - is the start of a QR code instruction.
- **LG** - tells MASSO what it should do with the follow information, in this case load the Gcode file ready to run
- \ - This is the start of the directory where the Gcode file will be found. \ means the root directory and may be followed by folder names which terminate with \
- **My Project files**\ means the Gcode file will be found in a folder called "My Project files" located in the root directory of the Flash drive.
- Multiple levels of directories can be used if required. eg **My Project files\Personal**\
- **Widget.nc** - This is the file mane you want to load.
- **^CE** - End of QR command

6.14. Current Software Versions

Masso G3

Mill, Plasma, Oxy, Waterjet & Lathe v5.06 (Release Date: 27 October 2023)

Beta release v5.100b currently available for testing (Release Date: 20 October 2023)

MASSO Touch

Mill, Plasma, Oxy, Waterjet & Lathe v5.06 (Release Date: 27 October 2023)

Beta release v5.100b currently available for testing (Release Date: 20 October 2023)

Masso G2

Mill, Plasma & Lathe v3.51 (Release Date: 15 June 2022)

Masso Link

Version 2.10 (Release Date: 1 July, 2021) for MASSO G2, MASSO G3 & MASSO Touch

Click here to download MASSO Link software

Version 2.11 (Release Date 17 November 2021) for MASSO G3 & MASSO Touch when using QR scanner

Click here to download MASSO Link software

INFORMATION: The latest version of your software is available on your myWorkshop portal

INFORMATION: For more information on using your myWorkshop portal please see here: Using myWorkshop

7. Machining with MASSO

Read other subtopics below:

7.1. Loading Software to MASSO-G3

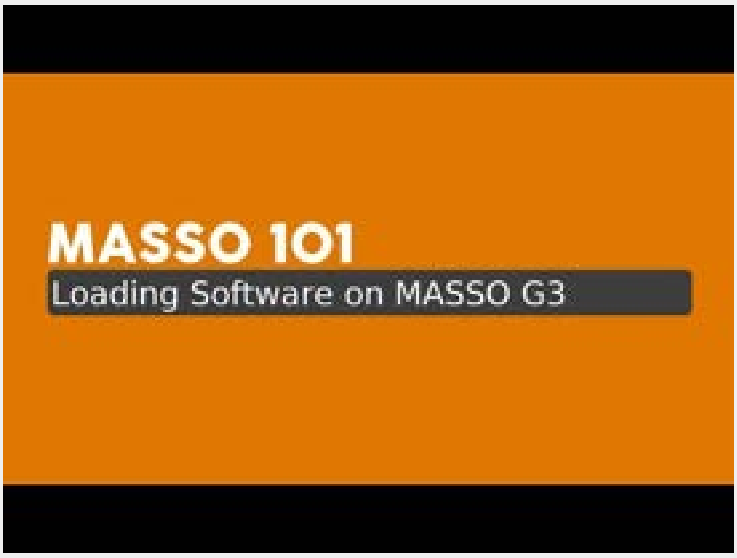
Regular updates are released to add more features to the units.

The software upgrade process can be easily performed on-site by following the instructions below:

The installation of new software and the software upgrade process are the same.

Avoid using unbranded USB Flash drives as these are known to give issues with software install and upgrades

INFORMATION: The latest software updates are available from your my Workshop portal.



Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

MASSO 101 - Loading Software on MASSO G3 CNC Controllers

Information: Summary of install and upgrade process

- Before upgrading to new software, make a backup of your settings. >> Backup your settings

- Ensure your Flash drive is formatted to Fat32 and uses MBR as GPT is not supported
- Create a folder called MASSO on the flash drive and copy the software file emailed to you into this folder.
- If you have a MASSO G3, on powering the MASSO G3, immediately press the F1 key repeatedly until the MASSO software load screen appears. If the software load screen does not appear re-power MASSO and start again.
- If you have a MASSO Touch, on powering the MASSO Touch, tap the screen repeatedly until the MASSO software load screen appears. If the software load screen does not appear re-power MASSO and start again.
- Keep pressing the keyboard F1 key or keep tapping the MASSO Touch screen on power-up and do not wait for the screen to show any messages.
- Select the desired software from the list in the software load screen using the up/down arrow keys and press the enter key on your keyboard.
- After the software has finished loading press the ESC key and your MASSO will restart with your new software.

7.2. Loading Software to MASSO-G2

Regular updates are released to add more features to the units. Custom software's are also released for special client requirements. The software up-gradation process can be easily performed on site by following the instructions below:

The latest software version is available for download through your myWorkshop portal.

For the current version please see here: current-software-version

Information: Avoid using unbranded USB Flash drives as these are known to give issues with software install and upgrades

Information: It is advisable to make a backup of your settings before upgrading your software.

NOTE: For the below example the controller serial number will be **5A-660**

WARNING: Check that while copying file from email the file name is not renamed and is exactly the file name you downloaded. example "**00000660.HTG"**

Summary of the install process

- Check that the file name matches the serial number of the controller.
- Connect a USB FLASH drive to your PC/MAC and **make sure it's been formatted in FAT or FAT32** format and must use MBR as GPT is not supported.
- Copy all the files received in the software update email including **"00000660.HTG"** and **Data1.HTG** file to the root directory of the USB FLASH drive.
- When copying the files to the USB flash drive, please make sure that your email software does not download the files as ZIP file.
- Power off the controller.
- **NOTE:** Make sure that there is nothing connected on the PlayStation connector on the MASSO
- Insert the USB FLASH drive into the controller's USB flash drive connector and DO NOT connect a USB hub.
- Power up the controller and a progress bar will be displayed on the screen showing the upgrade status.
- Once the progress bar shows 100%, the upgrade process is finished, please power cycle the unit.

7.3. Admin and User Passwords

By default the system password is set to **"HTG"** (in capital letters) for both **Admin** and **User logins**.

> **INFORMATION:** When the controller is powerd up, Caps Key is enabled by default, as of v3.49 for G2 and v4.00 for G3 Caps key is not enabled.

MASSO 101 - User & Admin Passwords

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]()

> **INFORMATION:** If want to lock Masso to prevent unauthorized use, Press **CTRL + L** and you will be prompted to re-enter the User and Admin Passwords.

Changing the User or Admin Password

- To change the User or Admin password Click on the Change Password in the Login box.
- Enter the current password and press enter. Default Password is "**HTG**"
-

- Enter the new password up to 5 characters long in the New Password box. (Passwords are case sensitive)
- Enter the new password again into the Confirm Password box
- Press Ok
- 

Removing User login

To remove the user login leave the New Password and Confirm Password boxes blank and press Ok.

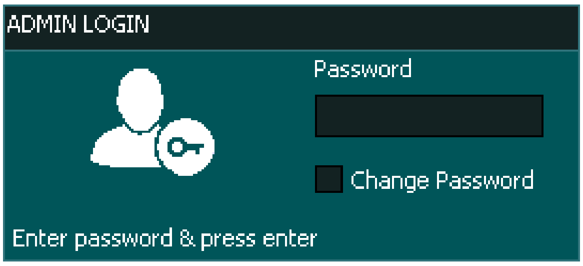
When you next start Masso the user password login box will not be presented.

Removing Admin Login Password

It is not possible to remove the Admin Login.

The Admin Password can be set a blank just like the user password but it will not remove the login.

When you set the Admin login to blank, select the Password box press the Enter Key to login.



Resetting Passwords

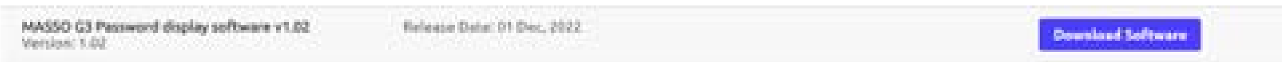
Should you lose or forget your passwords you need to download the Password reset or Password display file for your MASSO.

This can be downloaded from the myWORKSHOP portal

> Before performing a password reset ensure that you have both the Password reset or Display file and a copy of your MASSO software. Mill, Plasma or Lathe.

G3 Password Display Process

Log into myWORKSHOP and download the Password Display software and a copy of the software you are currently running on MASSO if you do not already have it.

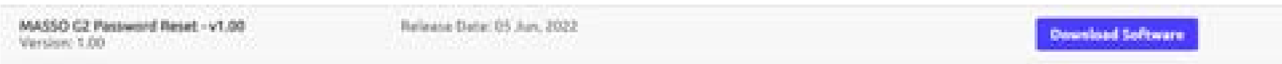


- Copy the Password Display software into the MASSO directory of your flash drive along with the current software version you are running on your MASSO.
- Restart MASSO and immediately press the F1 key multiple times or tap the screen of MASSO Touch until the software load screen appears
- Select the Password Display Software v1.02 and install.
- Press ESC once the install process is complete.
- This will display both your User and Admin Passwords on screen.

- Note these down as you will need these to log in later.
- Restart MASSO pressing the F1 key multiple times until the software load screen appears
- Select the MASSO software you are running on your MASSO and install.
- Press ESC once the install process is complete.
- MASSO will start and you can now login using the passwords you noted down from earlier.

G2 Reset Process

Log into myWORKSHOP and download the Password Reset software and a copy of the MASSO software you are currently running on MASSO if you do not already have it.



- Copy the Password reset software into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading. This will reset both your User and Admin Passwords to default "**HTG**"
- Copy the MASSO software files into the Root directory of your flash drive.
- Restart MASSO and the software will automatically load.
- Wait for the software to complete loading and restart MASSO.
- You can now login using the default password. "**HTG**"

> Resetting the Password does not change the configuration settings of Masso.

7.4. Graphical Interface

Read other subtopics below:

7.4.1. Graphical Interface MASSO G3

This page describes the User interface of MASSO G3 and MASSO Touch running version 4 and 5 software

The user interface is divided into 6 screens from **F1** to **F6**

INFORMATION: The interface can be set as either Horizontal or Vertical by selecting the desired option under F1 General Settings. The Vertical interface is primarily designed for MASSO touch though can be used with any G3 with a suitable touchscreen monitor.

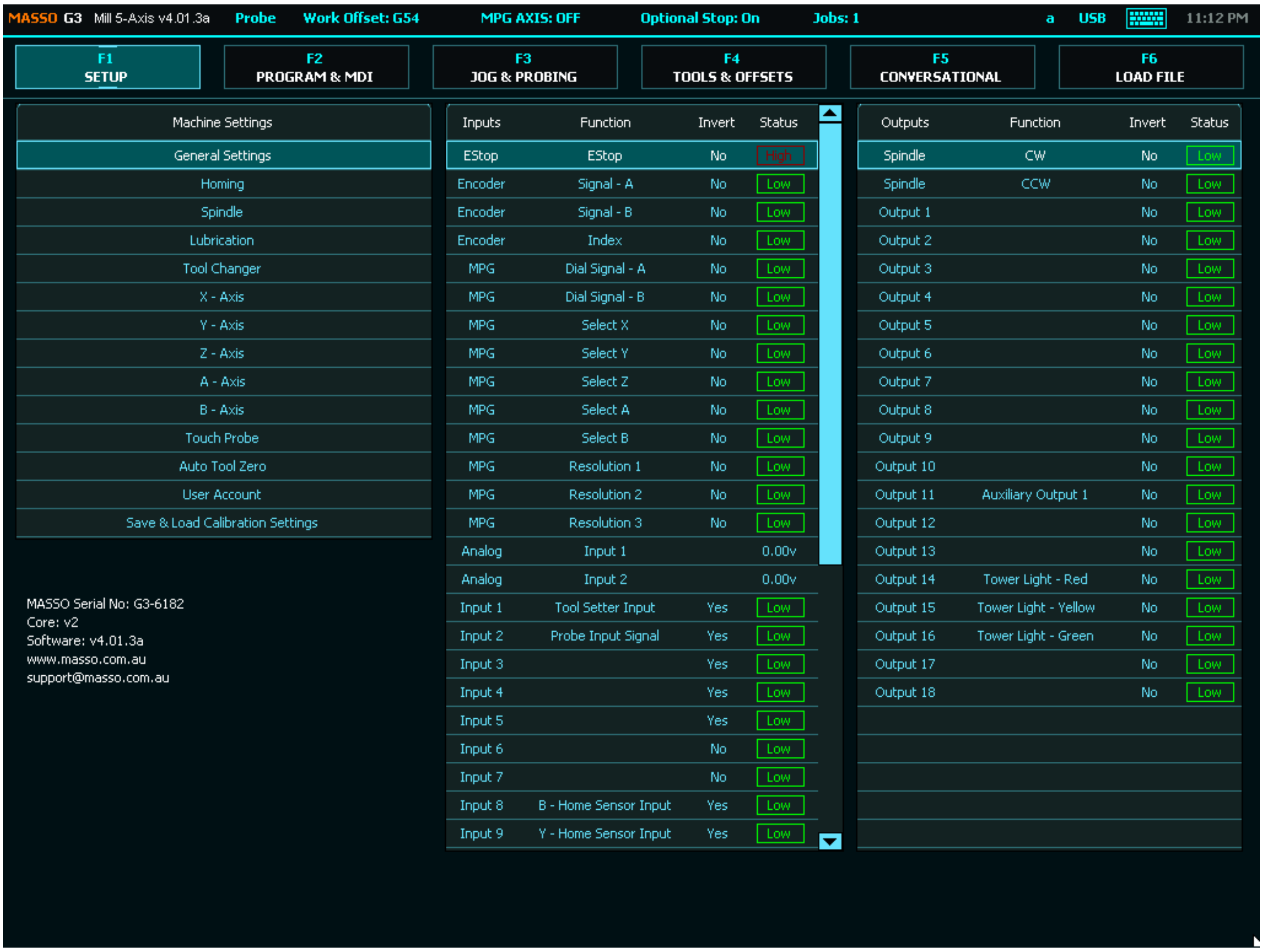
INFORMATION: You can navigate between the screens by pressing keys F1 - F6 or by clicking the buttons at the bottom of the screen.

Horizontal Format

F1 Screen

This screen allows you to configure your MASSO settings.

- When you enter this screen you will be prompted for the Admin Password. Default Password is "HTG"
- If you do not enter the password you will enter read only mode where you will not be able to make changes. Use **CTRL+L** if you want to reenter the password.



F2 Screen

This is the Run screen where you run your GCode files and monitor progress.

- When you enter this screen you will be prompted for the User Password. Default Password is "HTG". The user password can be changed or removed.
- Use **CTRL+L** to lock the Screen and prevent unauthorized use.
- The empty box next to the Spindle CW is where you can enter your spindle speed. Type the desired speed into the box and press enter.
- Click on Wi-Fi at the top of the screen to enter the Wi-Fi configuration page. If Wi-Fi is Orange it is connected.
- Click the Axis Zero buttons to zero out an Axis DRO
- Click on the DRO value to manually enter a new value
- Click Optional Stop at the top of the screen to toggle between on and off.

F3 Screen

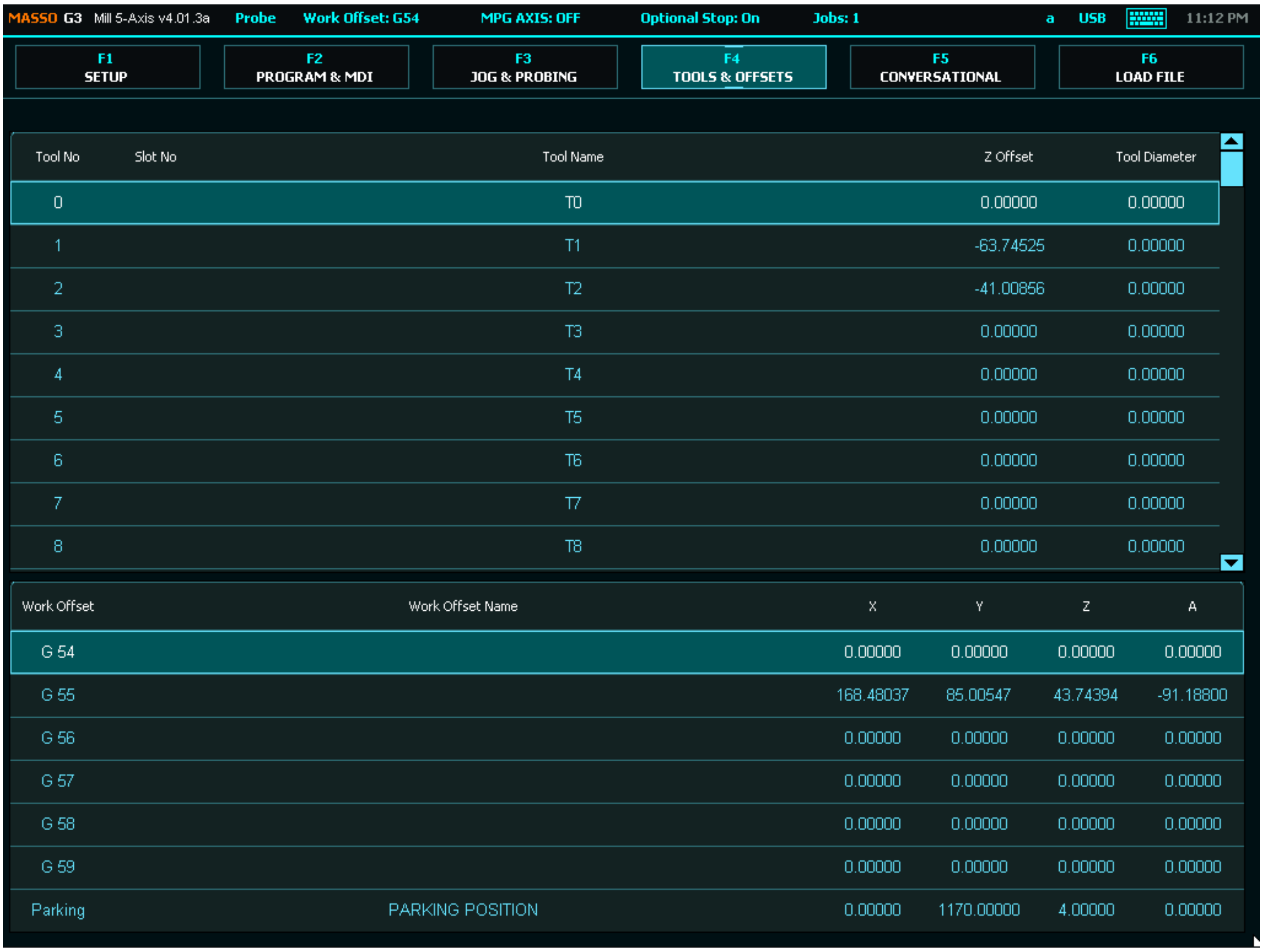
This is the Jog Screen. From this screen you can Home and Jog your machine.

- You can access MASSO probing functions by pressing the probing button on screen.
- Press the Home Button for 3 seconds to home the machine
- Jog and using the Axis + & - Buttons
- Select continuous or step jog mode as well as step distance
- Use the Slider to set continuous jog speed.
- Click the Axis Zero buttons to zero out an Axis DRO

F4 Screen

Tool Table, work offset screen and Park location.

- This is where tool data is stored for each tool including it's name, Z offset and Tool Diameter.
- Work offsets G54 to G59 are stored in the Work offset table. These values are automatically stored when you zero your axis and you can also manually change them if needed.
- Double Click on a tool to change it's parameters as required
- The Parking location coordinates are stored here.
- Tools 111 to 118 cannot be edited in the F4 screen. To edit these tools go to the F1 Mulit-Head page

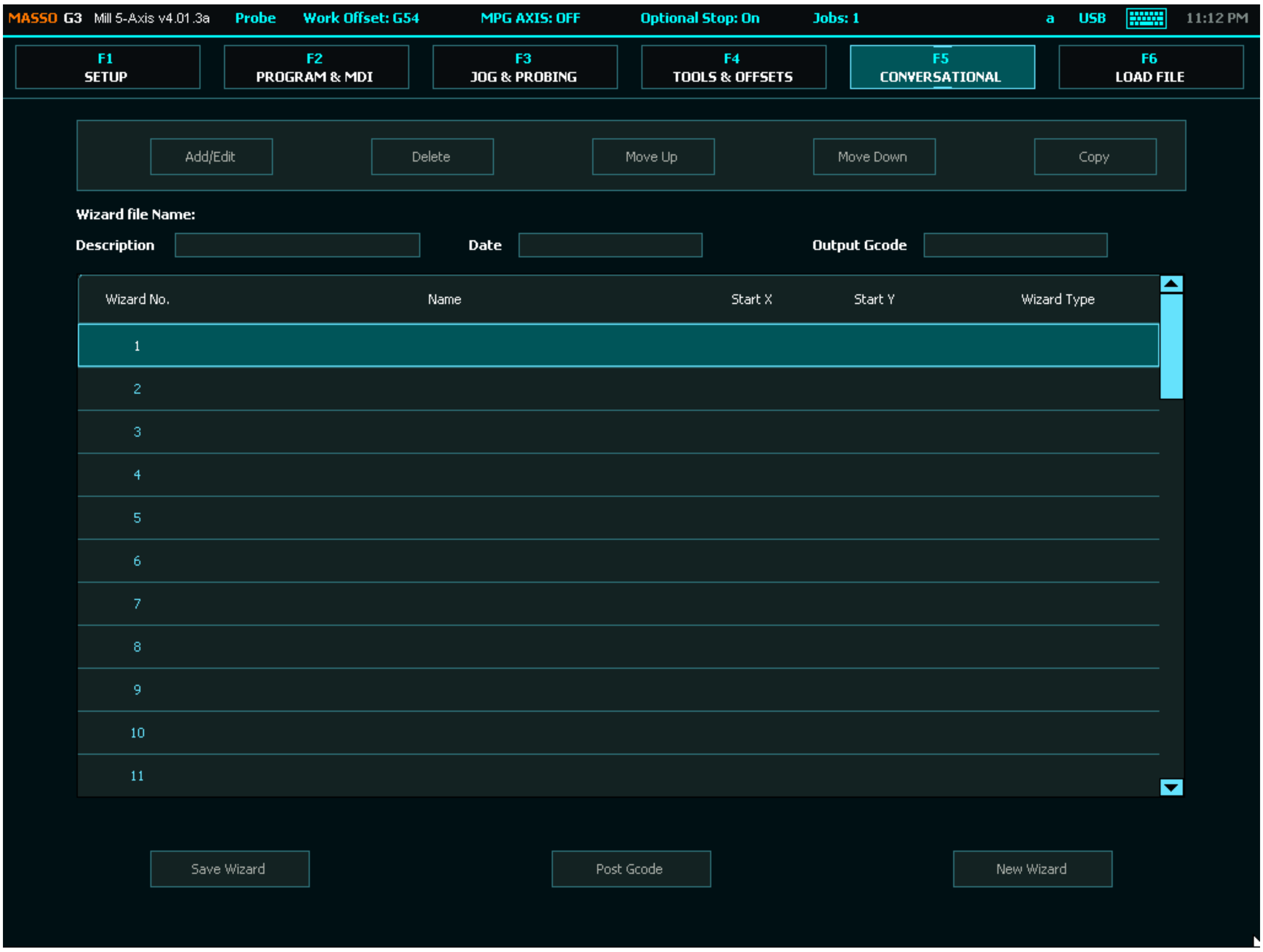


F5 Screen

Masso have built in wizards that will allow you to create basic Gcode files.

The wizards are intended for the most basic of jobs and CAM software is recommended.

Additional information on the available wizards



F6 Screen

This screen is where you will select files from your USB Flash drive and load them into MASSO.

- Double click the file you wish to load or select the file or press the **Load** key
- Once the file loaded it will draw the toolpaths onto the screen for you to view.
- If you do not wish to wait for the screen print to load or wish to cancel the selected file from loading press the Escape key
- To Delete a file select and press **Delete**
- To create a new File Press **New**
- To edit a file select and Press **Edit**

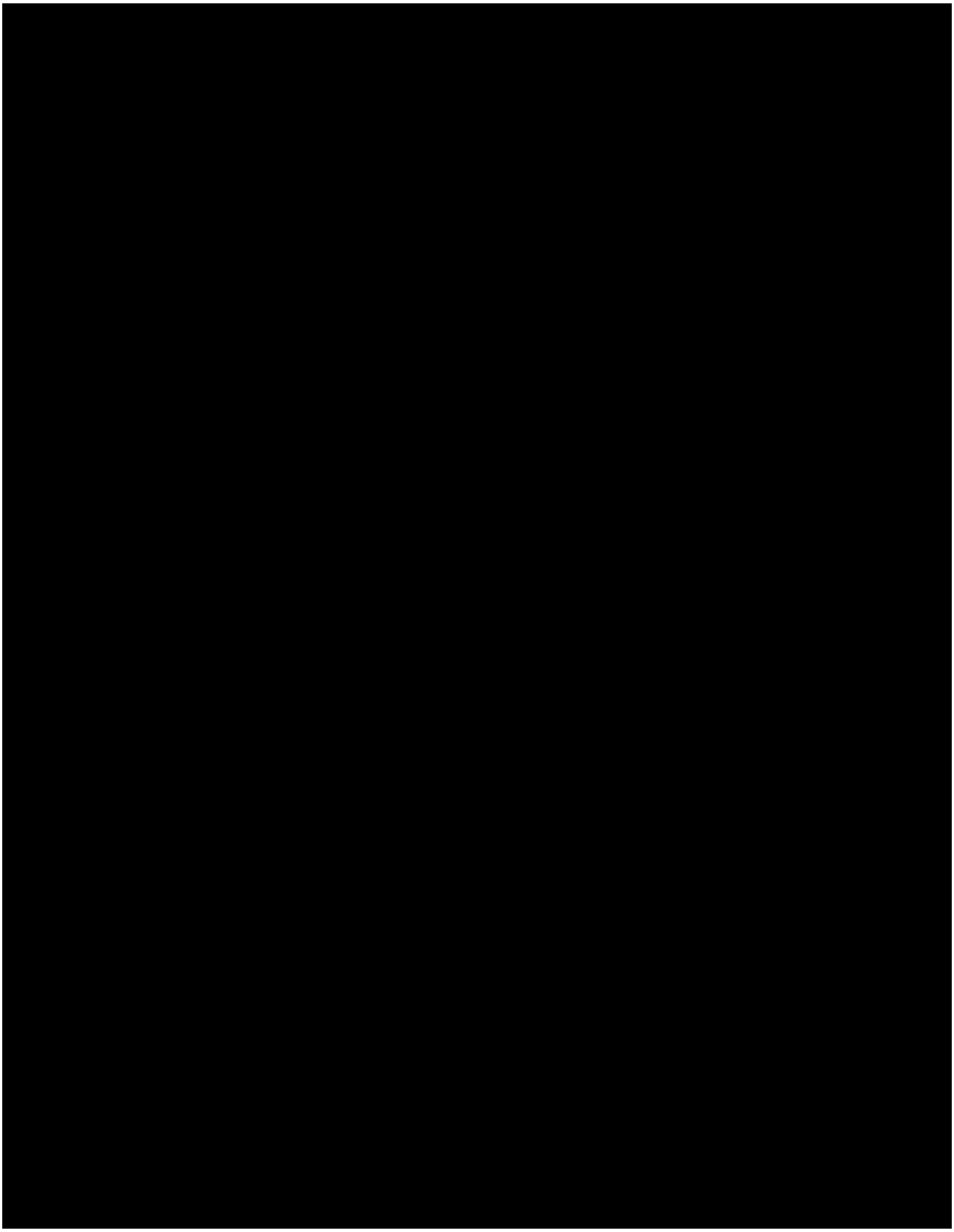
Vertical Touch Screen Format

INFORMATION: The Vertical interface is primarily designed for MASSO touch though can be used with any G3 with a suitable touchscreen monitor. It includes an on screen keyboard which is permanently dispalyed.

F1 Screen

This screen allows you to configure your Masso settings.

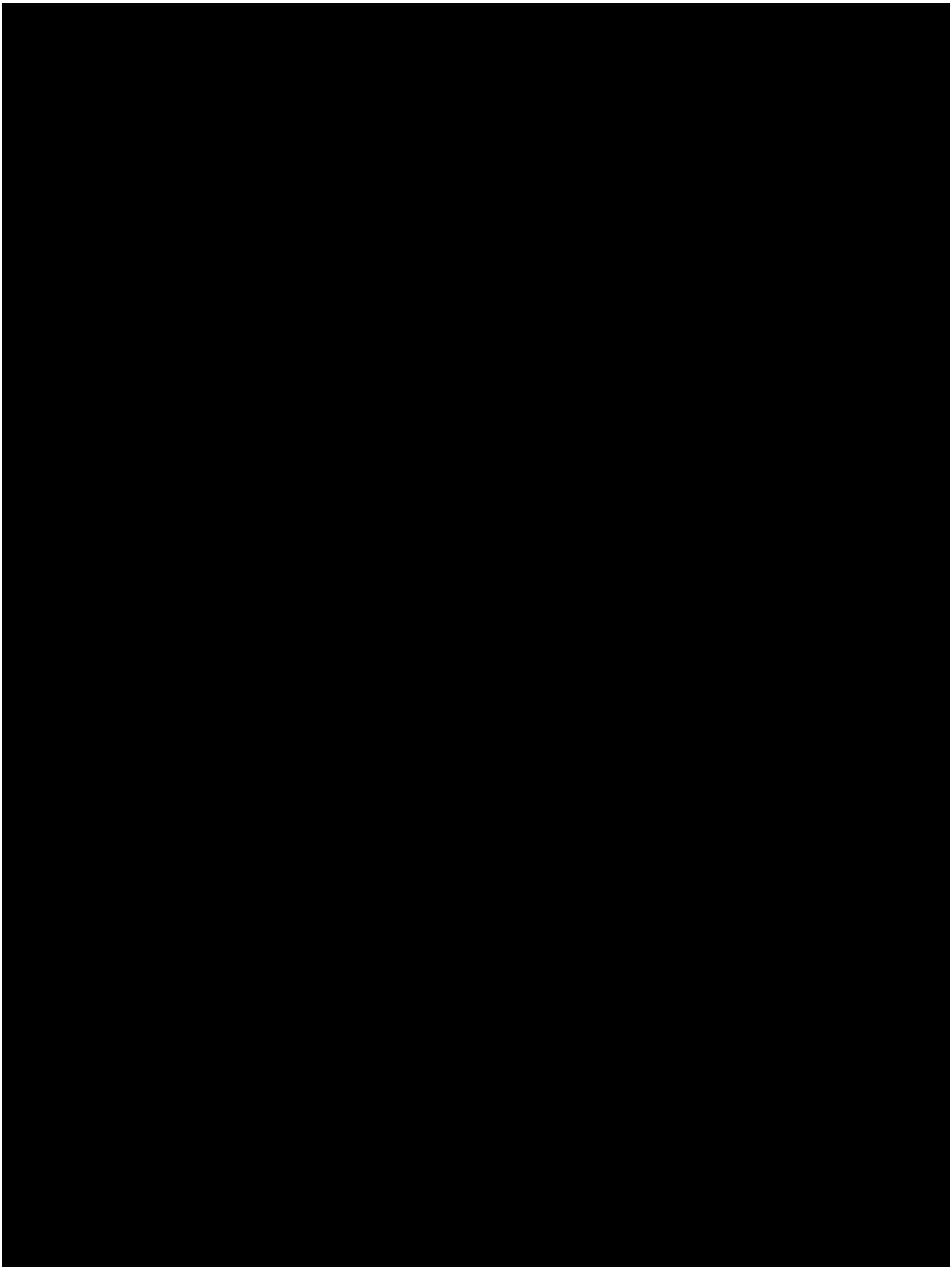
- When you enter this screen you will be prompted for the Admin Password. Default Password is "HTG"
- If you do not enter the password you will enter read only mode where you will not be able to make changes. Use **CTRL+L** if you want to reenter the password.



F2 Screen

This is the Run screen where you run your GCode files and monitor progress.

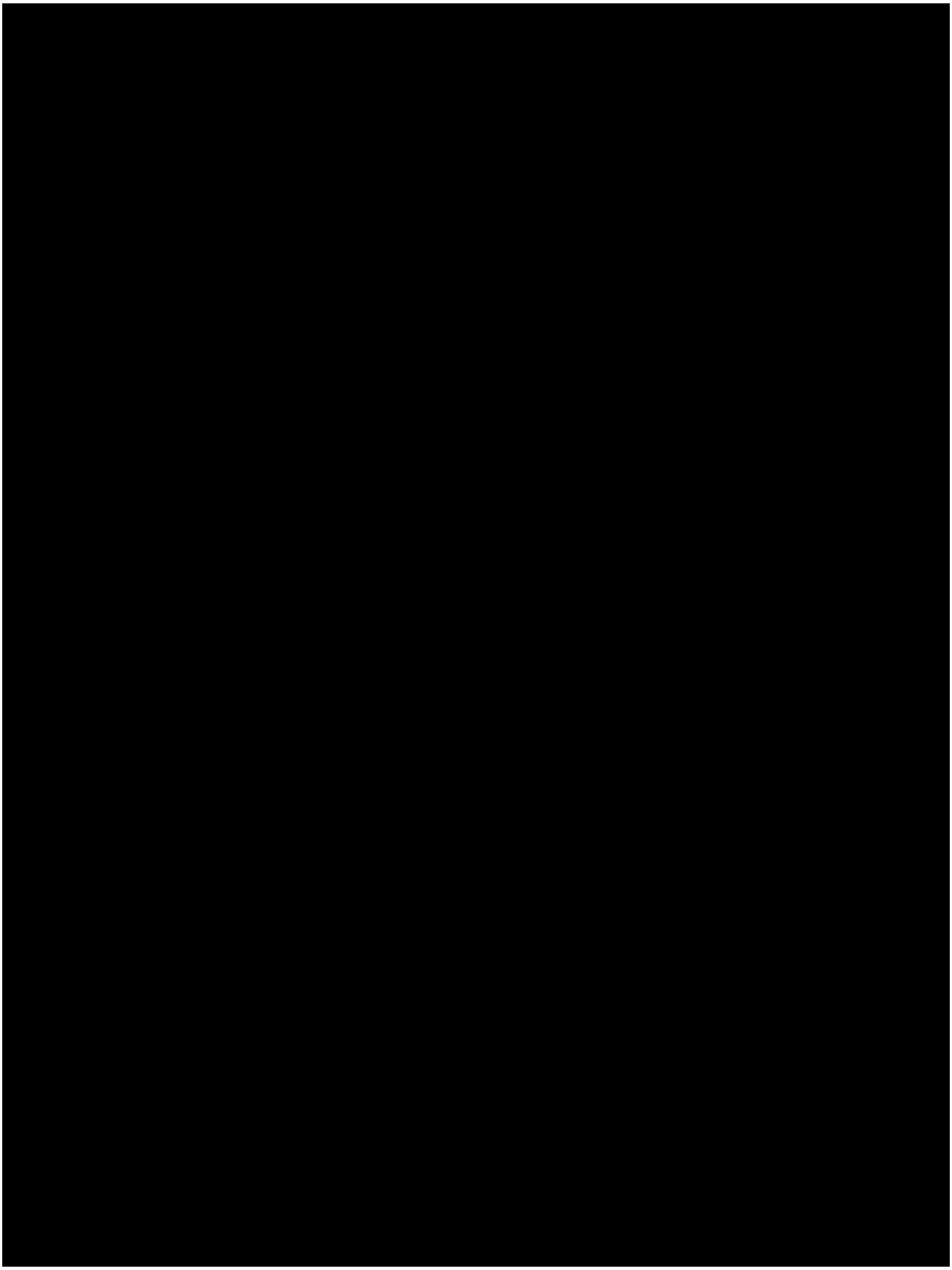
- When you enter this screen you will be prompted for the User Password. Default Password is "HTG". The user password can be changed or removed.
- **Use CTRL+L** to lock the Screen and prevent unauthorized use.
- The empty box next to the Spindle CW is where you can enter your spindle speed. Type the desired speed into the box and press enter.
- Click on Wi-Fi at the top of the screen to enter the Wi-Fi configuration page. If Wi-Fi is Orange it is connected.
- Click the Axis Zero buttons to zero out an Axis DRO
- Click on the DRO value to manually enter a new value
- Click Optional Stop at the top of the screen to toggle between on and off.



F3 Screen

This is the Jog Screen. From this screen you can Home and Jog your machine.

- You can access MASSO probing functions by pressing the probing button on screen.
- Press the Home Button for 3 seconds to home the machine
- Jog and using the Axis + & - Buttons
- Select continuous or step jog mode as well as step distance
- Use the Slider to set continuous jog speed.
- Click the Axis Zero buttons to zero out an Axis DRO



F4 Screen

Tool Table, work offset screen and Park location.

- This is where tool data is stored for each tool including it's name, Z offset and Tool Diameter.
- Work offsets G54 to G59 are stored in the Work offset table. These values are automatically stored when you zero your axis and you can also manually change them if needed.
- Double Click on a tool to change it's parameters as required
- The Parking location coordinates are stored here.
- Tools 111 to 118 cannot be edited in the F4 screen. To edit these tools go to the F1 Mulit-Head page

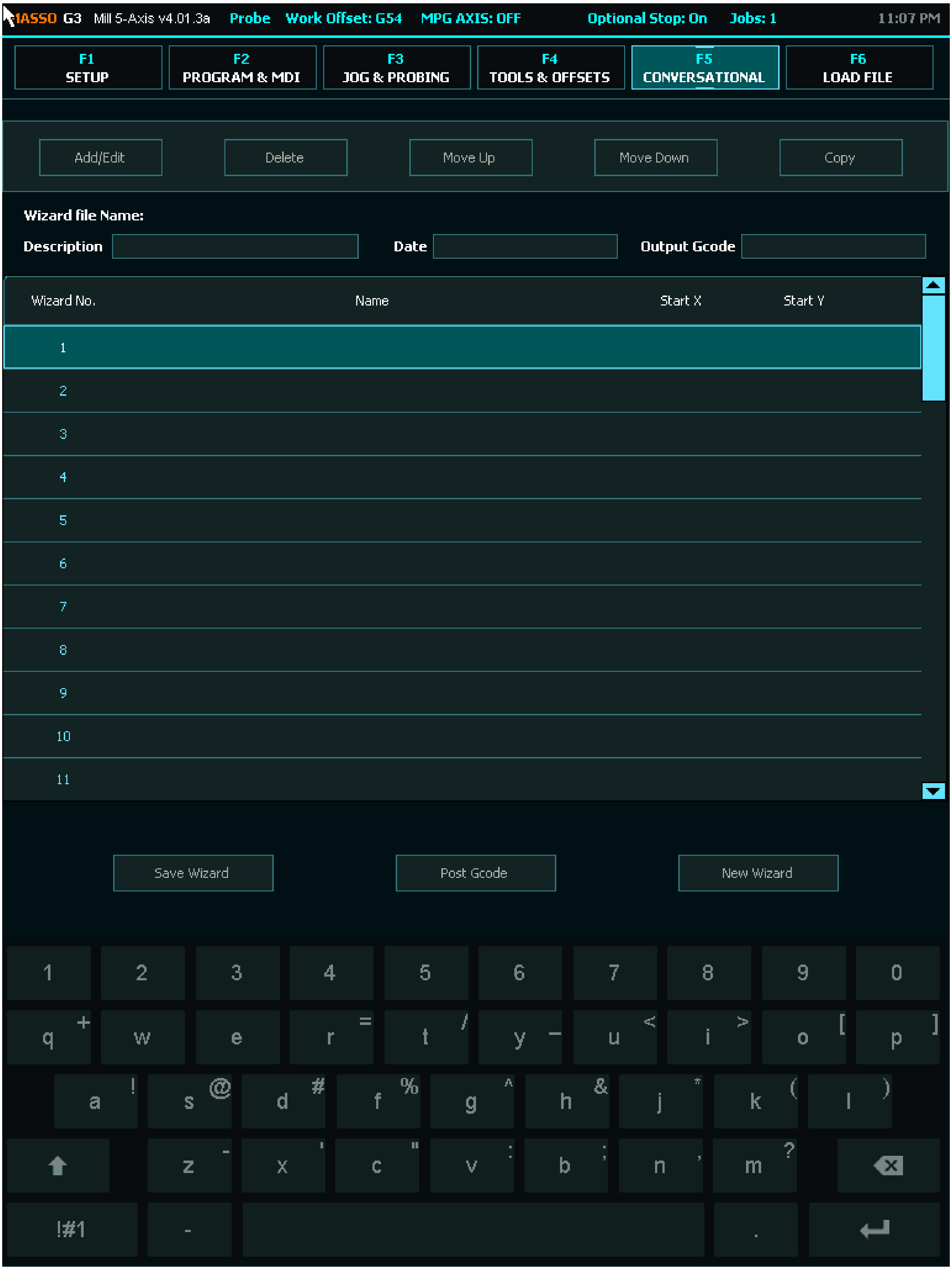

MASSO G3 Mill 5-Axis v4.01.3a Probe Work Offset: G54 MPG AXIS: OFF Optional Stop: On Jobs: 1 11:08 PM
F1 SETUP
F2 PROGRAM & MDI
F3 JOG & PROBING
F4 TOOLS & OFFSETS
F5 CONVERSATIONAL
F6 LOAD FILE
Tool No Slot No Tool Name Z Offset Tool Diameter
0 T0 0.00000 0.00000
1 T1 -63.74525 0.00000
2 T2 -41.00856 0.00000
3 T3 0.00000 0.00000
4 T4 0.00000 0.00000
5 T5 0.00000 0.00000
6 T6 0.00000 0.00000
7 T7 0.00000 0.00000
8 T8 0.00000 0.00000
Work Offset Work Offset Name X Y Z A
G 54 0.00000 0.00000 0.00000 0.00000
G 55 168.48037 85.00547 43.74394 -91.18800
G 56 0.00000 0.00000 0.00000 0.00000
G 57 0.00000 0.00000 0.00000 0.00000
G 58 0.00000 0.00000 0.00000 0.00000
G 59 0.00000 0.00000 0.00000 0.00000
Parking PARKING POSITION 0.00000 1170.00000 4.00000 0.00000
1 2 3 4 5 6 7 8 9 0
q + w e r = t / y – u < i > o [p]
a ! s @ d # f % g ^ h & j * k (l)
z - x ' c " v : b ; n , m ?
!#1 - .

F5 Screen

Masso have built in wizards that will allow you to create basic Gcode files.

The wizards are intended for the most basic of jobs and CAM software is recommended.

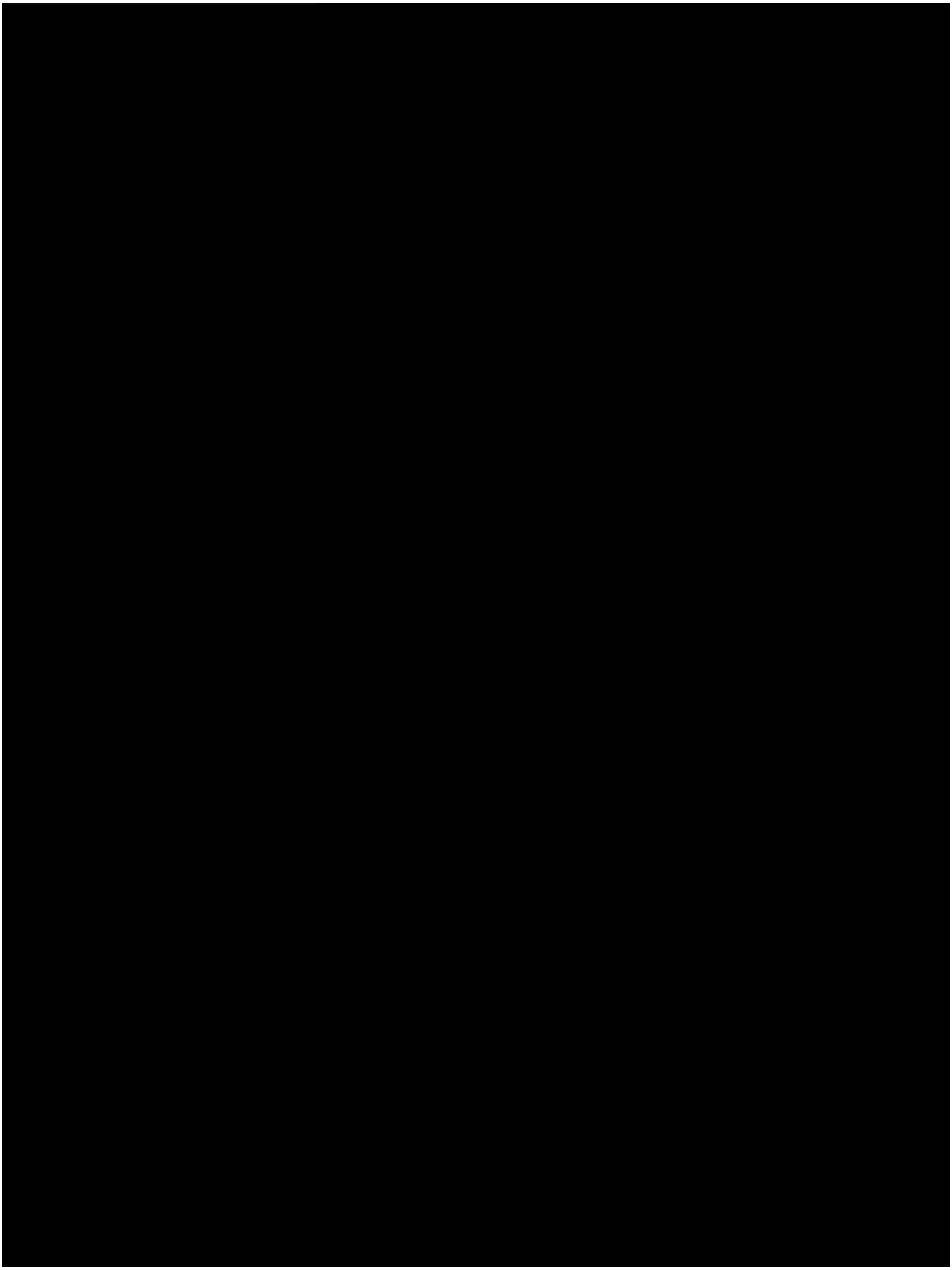
Additional information on the available wizards


MASSO G3 Mill 5-Axis v4.01.3a
Probe
Work Offset: G54
MPG AXIS: OFF
Optional Stop: On
Jobs: 1
11:07 PM
F1 SETUP
F2 PROGRAM & MDI
F3 JOG & PROBING
F4 TOOLS & OFFSETS
F5 CONVERSATIONAL
F6 LOAD FILE
Add/Edit
Delete
Move Up
Move Down
Copy
Wizard file Name:
Description
Date
Output Gcode
Wizard No.
Name
Start X
Start Y
1
2
3
4
5
6
7
8
9
10
11
Save Wizard
Post Gcode
New Wizard

F6 Screen

This screen is where you will select files from your USB Flash drive and load them into MASSO.

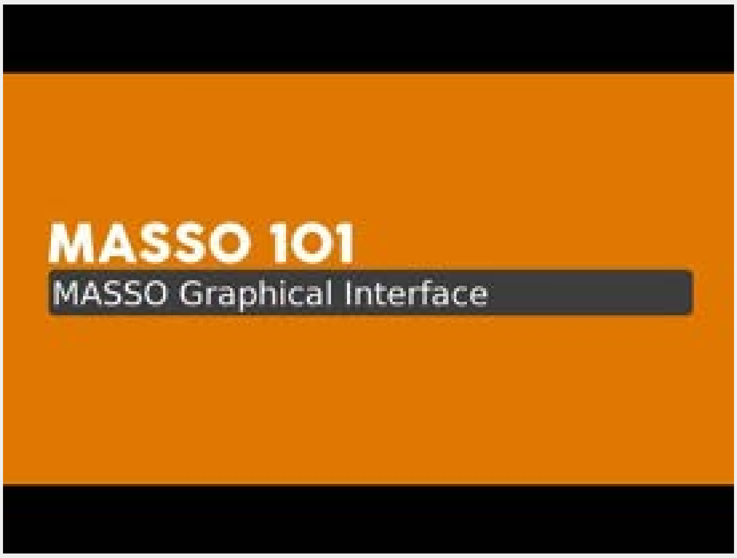
- Double click the file you wish to load or select the file or press the **Load** key
- Once the file loaded it will draw the toolpaths onto the screen for you to view.
- If you do not wish to wait for the screen print to load or wish to cancel the selected file from loading press the Escape key
- To Delete a file select and press **Delete**
- To create a new File Press **New**
- To edit a file select and Press **Edit**



7.4.2. Graphical Interface MASSO G2

This page describes the User interface of MASSO G2 and MASSO G3 running version 3 software

The user interface is divided into 6 screens from **F1** to **F6**, the below video explains each screen in detail.



MASSO 101 - MASSO Graphical Interface

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

INFORMATION: You can navigate between the screens by pressing keys F1 - F6 or by clicking the buttons at the bottom of the screen.

F1 Screen

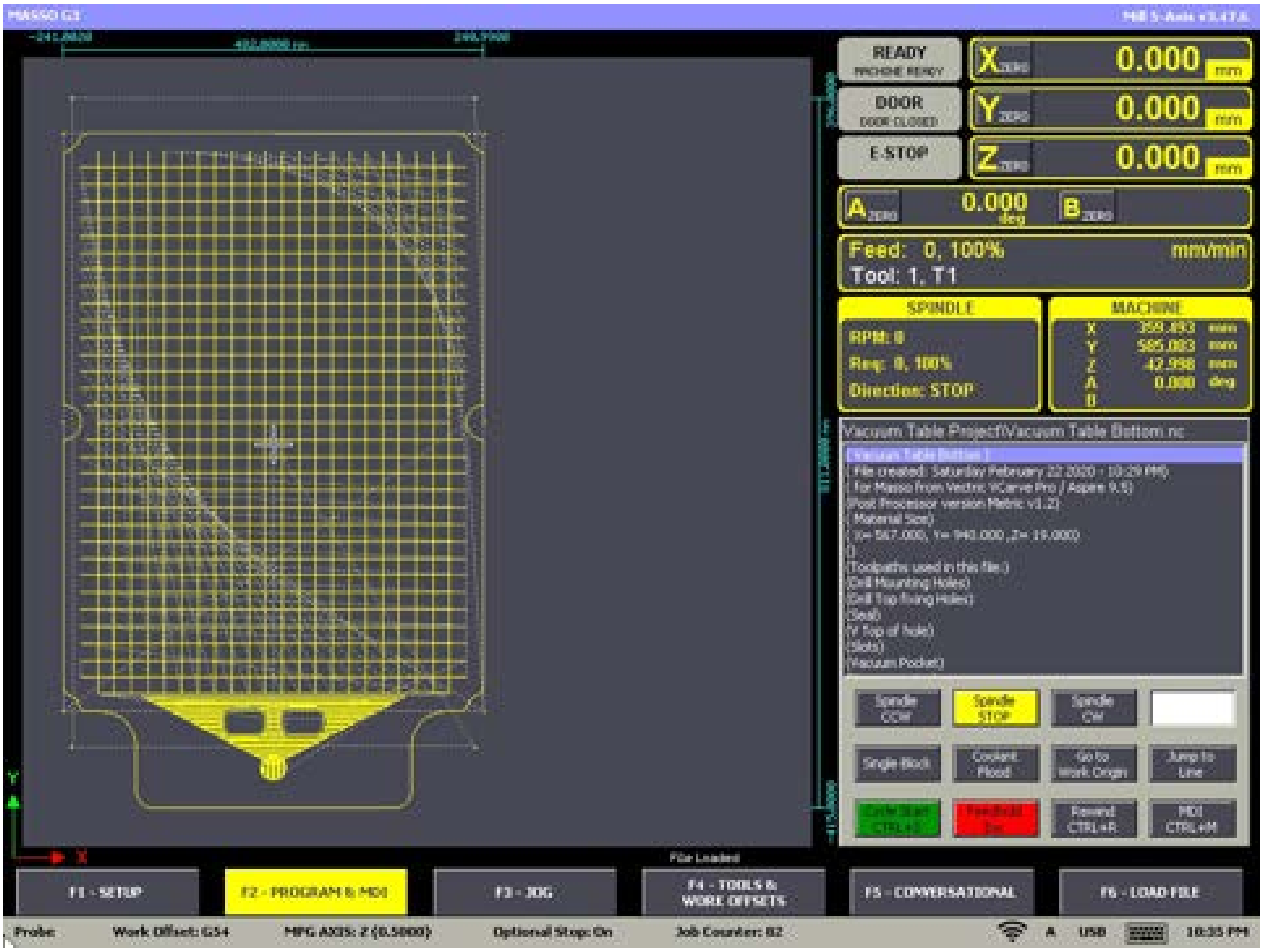
This screen allows you to configure your Masso settings.

- When you enter this screen you will be prompted for the Admin Password. Default Password is "HTG"
- If you do not enter the password you will enter read only mode where you will not be able to make changes. Use **CTRL+L** if you want to reenter the password.

F2 Screen

This is the Run screen where you run your GCode files and monitor progress.

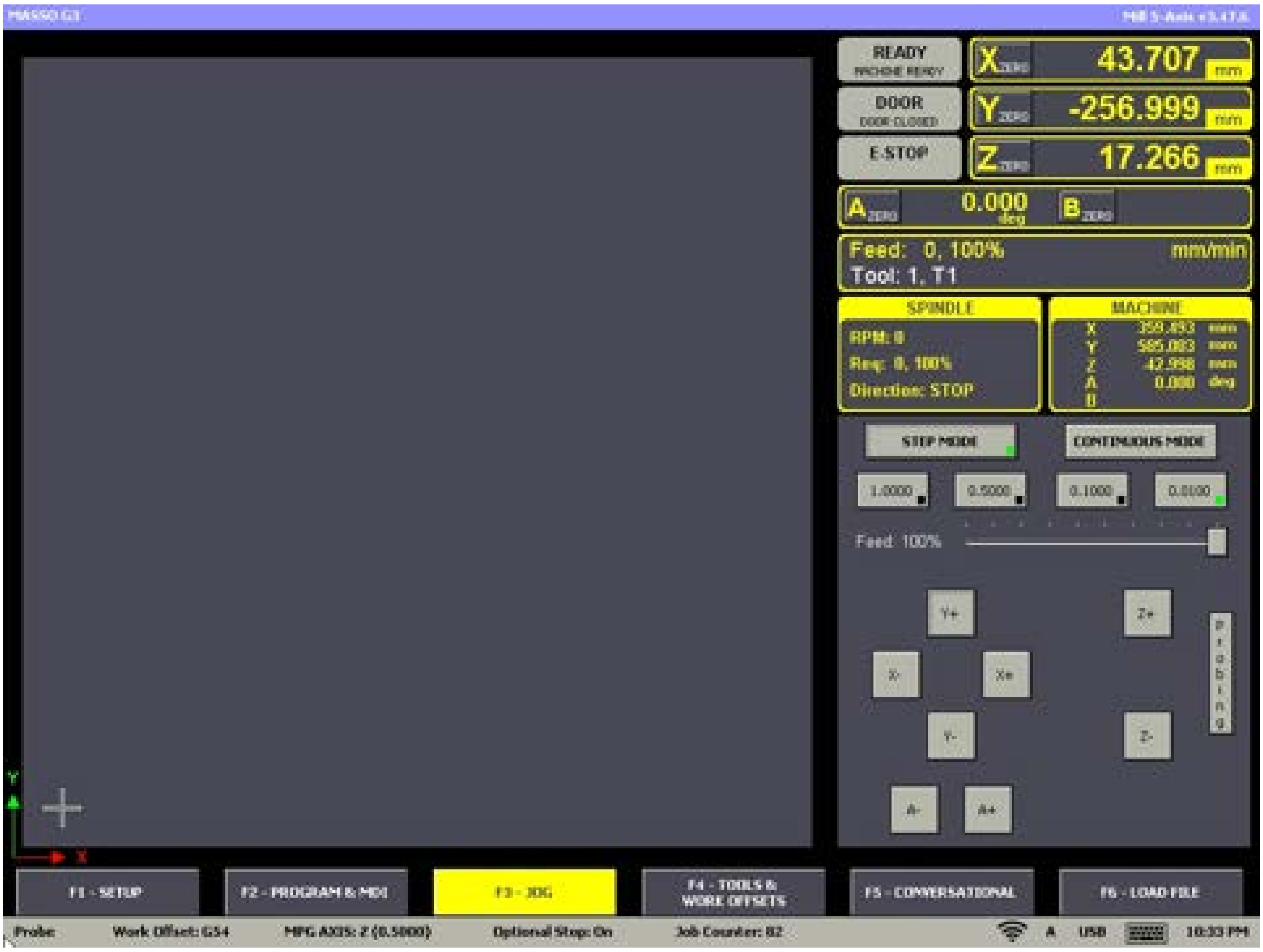
- When you enter this screen you will be prompted for the User Password. Default Password is "HTG". The user password can be changed or removed.
- **Use CTRL+L** to lock the Screen and prevent unauthorized use.
- The White box next to the Spindle CW is where you can enter your spindle speed. Type the desired speed into the box and press enter.
- Click on the WiFi symbol to enter the WiFi configuration page.
- Click the Axis Zero buttons to zero out an Axis DRO



F3 Screen

This is the Jog Screen. From this screen you can Home and Jog your machine.

- You can access MASSO probing functions by pressing the probing button on screen.
- Press the Home Button for 3 seconds to home the machine
- Jog and using the Axis + & - Buttons
- Select continuous or step jog mode as well as step distance
- Use the Slider to set continuous jog speed.
- Click the Axis Zero buttons to zero out an Axis DRO



F4 Screen

Tool Table, work offset screen and Park location.

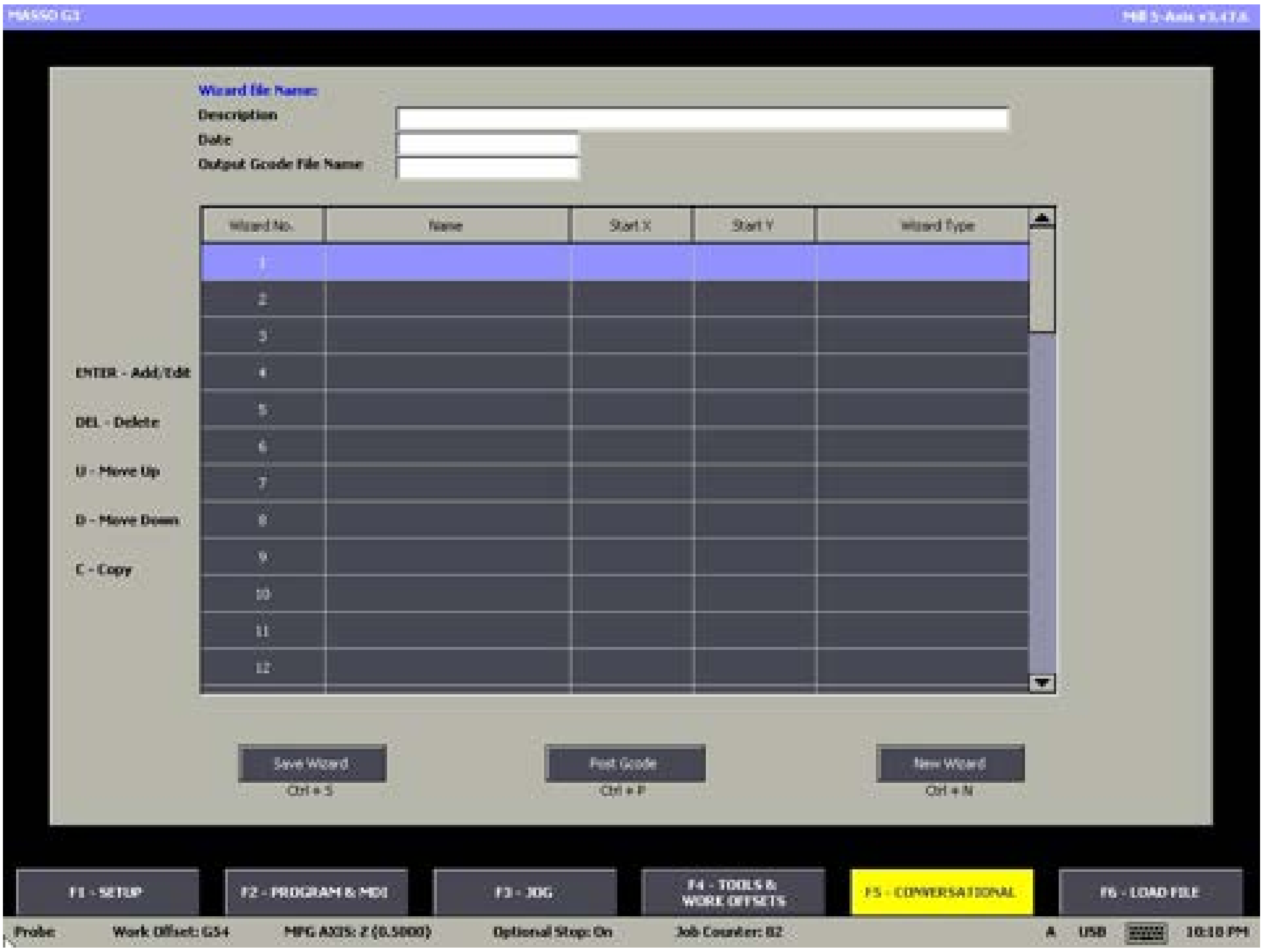
- This is where tool data is stored for each tool including it's name, Z offset and Tool Diameter.
- Work offsets G54 to G59 are stored in the Work offset table. These values are automatically stored when you zero your axis and you can also manually change them if needed.
- Double Click on a tool to change it's parameters as required
- The Parking location coordinates are stored here.

F5 Screen

Masso have built in wizards that will allow you to create basic Gcode files.

The wizards are intended for the most basic of jobs and CAM software is recommended.

Additional information on the available wizards



F6 Screen

This screen is where you will select files from your USB Flash drive and load them into MASSO.

- Double click the file you wish to load or select the file and press the load key
- Once the file loaded it will draw the toolpaths onto the screen for you to view.
- If you do not wish to wait for the screen print to load or wish to cancel the selected file from loading press the Escape key
- Right Click on a file name to see the file delete function


READY
DOOR
E-STOP
43.707
-256.999
17.266
0.000
Feed: 0, 100%
mm/min
Tool: 1, T1
SPINDLE
MACHINE
RPM: 0
Direction: STOP
Load File
Escape
F1 - SETUP
F2 - PROGRAM & MDI
F3 - JOG
F4 - TOOLS & WORK OFFSETS
F5 - CONVERSATIONAL
F6 - LOAD FILE

7.4.3. Controller Alarms

Estop alarm

An EStop alarm is given on startup of MASSO. Press and release the EStop button to test the EStop is working and this will cancel the alarm.

EStop also occurs if the EStop button is pressed on the machine.

Homing alarm

This alarm indicates that the machine has not been homed. To clear the alarm home the machine.

If you get a homing error alarm it means something has gone wrong while homing. Rehome the machine to clear

Door Alarm

This alarm indicates that the cabinet door is open. Close the door to clear the alarm.

You can set the machine to automatically stop and start when the door is opened or closed.

If you have a G2 you must assign an output as a door alarm even if you do not have a door. Setting this to logic low will remove the alarm

Soft Limit

The extremes of travel of each axis is defined in each axis settings page.

If you execute a move that will exceed the limit of travel a soft limit will alarm will display.

To cancel issue a valid move on the axis and the alarm will clear.

Hard Limit

These alarms are triggered by the homing sensors. If a mechanical fault occurs that causes the axis to trigger a hard limit the Hard Limit alarm will be displayed.

To clear the alarm find and clear the issue that caused the Hard limit alarm and Home the machine to clear the alarm.

Probing alarm

A Probing alarm occurs during a probing cycle where MASSO does not receive a signal from the probing sensor within the specified distance.

You will also get a probing alarm if the probe is already in the active state when a probing cycle is started.

To clear issue a new probing command with a valid distance ensuring the probe is not already in an active state.

Tool Error Alarm

This occurs if you try and load a tool not supported by MASSO. EG the tool number is greater that 118 on the G3 or MASSO Touch or Greater that 31 on the G2

Motor Alarm

When a Stepper or Servo drive goes into an alarm condition the Drive can signal MASSO which will put the system into Feed hold and stop the spindle.

The Motor alarm indication will be displayed on the screen. you drive must be capable of providing the required signal and they be connected to MASSO.

To clear the alarm first clear the fault with the drive and home the machine to clear Alarm indication on MASSO.

Lubricant Low alarm

If you have a lubricant vessel that has an alarm output you can connect it to MASSO and a Lubrication alarm will display on MASSO.

Top up your lubricant vessel and the alarm will automatically clear.

Air Pressure Low Alarm

When the Air pressure drops below the sensor trigger point the Air Pressure Low alarm input changes to High and the Air Pressure Alarm is displayed on screen.

To reset the alarm the alarm input needs to return to low and the machine homed.

Use Jump to line to resume machining.

Spindle Alarm

This input monitors the Spindle alarm output from the VFD and will signal an alarm condition if the input changes to High.

MASSO will enter Feed hold and Spindle alarm will be displayed.

To clear and reset the alarm you must Home the machine

Spindle Coolant Pulses Alarm

This input monitors the coolant flow sensor and requires 1 pulse every 10 seconds when the spindle is running.

If no pulse is received in 10 seconds the MASSO will enter Feed hold and Spindle Coolant alarm will be displayed.

To clear and reset the alarm you must Home the machine

Spindle Coolant Flow Alarm

This input monitors the coolant flow sensor and will signal an alarm condition if the input changes to High for 10 seconds or more when the spindle is running.

MASSO will enter Feed hold and Spindle Coolant alarm will be displayed.

To clear and reset the alarm you must Home the machine

7.5. Touch Screen Interface

- As per special user requests to add touch screen support with MASSO, from software **version 3.35** MASSO Touch Screen Interface USB was added.
- **NOTE: Not all touch screens with USB HID interface are supported, please see the list of supported screens below and test your touch screen.**
- Capacitive Touch screens do not work with the MASSO. Look for ones that use 4 wire resistive touch screen
- Screen resolution 1024 x 768

Connecting the Touch Screen

- Plug the VGA cable into MASSO VGA port
- Plug the USB cable provided with the touch screen monitor into one of the spare USB ports on MASSO. If you have a G2 you may require a USB hub.
- No configuration is required to make the touchscreen work. If the touch screen does not work when plugged in then it is not compatible

Please use our forum topic for touch screen support: touch-screen-interface

WARNING: Monitor internal touch screen interface hardware used by manufactures can change without warning and are outside the control of MASSO. This will cause a monitor that previously worked to no longer be compatible. It is highly recommended that if you are purchasing a new MASSO and require a touch screen now or in the future that you purchase the MASSO Touch which comes with a touch screen.

List of touch screens that users have tested that work with MASSO:

- **Cocar** monitor 15? 150S
- **iChawk** screen, Model: K120TC-DUV2
- **iChawk** monitor 19" Model: ZK190TC-592R
- **iChawk** monitor 15" Model: ZB150TC-59R
- **iChawk** ZB190TC-591R
- **Eyoyo** ZXD15 SKU:A1210AG
- **Yashiteng** YJ150QR-1 15" monitor 1024 x 768 Resistance Touch screen (VGA HDMI USB version) Please note there are over 10 different versions of this monitor, only 1 has been tested.

Screens reported by users that do not work with MASSO:

- **EIO TouchSystems**, Model: ET1739L-8CWA-3-NPB-G
- **ELO Touch Solutions** Model ET2740L, P/N E220828
- **ELO**, Model: ET1537L-7CWA-1-G
- **ASUS**, Model: VT168N
- **ASUS,** Model: VT229H
- **Kodak** Model: KD15V700 15"
- **DELL** Model: E157FPTe
- **Medion** Model: MD20165
- **HP Compaq** Model: L5009tm Part No. ELO E476049
- **EYOYO** Model: EM15T
- **Planar** Model: PXL2430MW
- **Planar Helium** Model: PCT2235
- **Viewsonic** Model: TD2421
- **iiyama Prolite** T2253MTS-B1
- **ZHIXIANDA**
- **Angel POS** 15 Inch Pro Capacitive LED Backlit Multi-Touch Monitor

The following screens used to work with MASSO but users have since reported that the internal touch interface has changed in the current models and they no longer work.

- **Eyoyo** 15? LCD Touch Screen Monitor, **Touch Type:** Four-wire resistive touch.
- **Eyoyo** 15? LCD Touch Screen Monitor with HDMI P/N 1901W **Touch Type:** Four-wire resistive touch.
- **Beetronics** 15TS5 Monitor.

7.6. Keyboard and Key Shortcuts

NOTE: Most of the functions can now be accessed easily with mouse but will still require some keyboard shortcuts as below:

MASSO Touch users who use the on screen keyboard will not be able to use the Short cuts below as these are for use on and external Keyboard.

The Shortcuts below accessed by the External keyboard are all accessible directly from the MASSO Touch screen either on the F2 or F3 or F6 screens

Operation	Key Combination	Valid in Screen
Lock System	CTRL + L	All Screens
Home Machine	CTRL + ALT + Home key	F2 & F3
Move to Parking Position	CTRL + ALT + P	F2 & F3
Cycle Start	CTRL + S	F2
Cycle Stop	Escape	F2
Restart Program	CTRL + R	F2
Jump to G-Code line	CTRL + J	F2
Jog Step Size	1,2,3 or 4	F3 *(MASSO G3 Only)*
X – Rapid	SHIFT+ Left or Right arrow key	F3
Y – Rapid	SHIFT + Up or Down arrow key	F3
Z – Rapid	SHIFT + "U" or "D" keys	F3
X – Jog	Left or Right arrow key	F3
Y – Jog	Up or Down arrow key	F3
Z – Jog	"U" or "D" keys	F3
Feed Override	select "F11"	F2 & F3
Spindle Override	select "F12"	F2
Override Increase	"+" *(You can also use MPG)*	F2 & F3
Override Decrease	"-" *(You can also use MPG)*	F2 & F3
Optional Stop On/Off	CTRL + O	All Screens
Open MDI Window	CTRL + M	F2 & F3
Create New Gcode File	CTRL + N	F2
Edit Gcode File	CTRL + E	F2
Set X-Axis to zero	CTRL + X	F3
Set Y-Axis to zero	CTRL + Y	F3
Set Z-Axis to zero	CTRL + Z	F3
Screen Print	Print Screen Key	All Screens
Screen Print	CTRL +P	All Screens

Read other subtopics below:

7.6.1. Setting Time & Date

MASSO has a built in real time clock and to set system time, a special command in the MDI window can be given in this format **Time:HH:MM**. Please see the below video for full instructions.

> **INFORMATION:** If the MASSO controller is connected to a PC via WiFi and using the MASSO Link software on the PC then the time is automatically synced with the PC time. You can find more information about MASSO WiFi connectivity and **MASSO Link** software [>>>CLICK HERE<<<]

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

MASSO 101 - Setting Time

To manually reset the Time on MASSO G3 & MASSO Touch

- Go to the **F2 - Program & MDI** screen.
- Press **CTRL + M** or click the MDI button to open the **MDI** Window.
- Type **Time:HH:MM** and press the **Run** button

To manually reset the Time on MASSO G2

- Go to the **F2 - Program & MDI** screen.
- Press **CTRL + M** or click the MDI button to open the **MDI** Window.
- Type **Time:HH:MM** and press **Enter.**

Setting the Date on G2 , MASSO G3 & MASSO Touch

- To set the Date connect your MASSO via MASSO Link to your computer and MASSO Link will automatically sync with the PC Date and Time.
- To connect your MASSO to MASSO Link please [>>>CLICK HERE<<<]

When entering the time you must use 24 hour clock to specify PM. If it is afternoon add 12 hours to the current time, for example 3:20pm is 15:20 in 24hr clock.

7.6.2. Homing the machine

Homing the machine is one of the most important parts of a CNC. Without homing the machine, no CNC machine can be used to its full potential and can result in crashing of the machine as the controller does not know the position of the axis on power up.

> **INFORMATION:** Its a good idea to set to enable ***"Request Home on startup"*** and ***"Request Home after E-Stop press"*** option in "***Homing settings"*** window. This will blink a homing request alarm on the screen to tell the user to home the machine before use and wont let the user run and gcode without homing the machine.

Steps to home the machine

- Homing is available in the F2 & F3 screens
- To home the machine, first make sure that no alarms such as E-Stop are flashing on the screen.
- Next check that its safe to run the homing cycle on the machine and the tool, work piece or clamps will not be hit. If you need to move the axis to a safe position before homing, jogging from the F3 screen or MPG is allowed.
- Once you are ready to home the machine, press **CTRL+ALT+HOME** key on the keyboard or Double click the **HOME** button at the top of the F2 or F3 screen if you are using a mouse or Double tap the button if using a touch screen..
- You can also assign one of the inputs on Masso as a Home Button Input and connect a button to it to home the machine.
- If the on screen Homing button indication does not show up when you start MASSO it is because **Request Homing on Start up** or **Request Home after E-Stop press** is not selected in the F1 Homing screen.
- The Homing button will display on screen at any time it is mandatory to home the machine.

> **INFORMATION:** If the homing button position is showing 
>
> or 
>
> u can Double click or Double Tap the button to Home the machine at any time.

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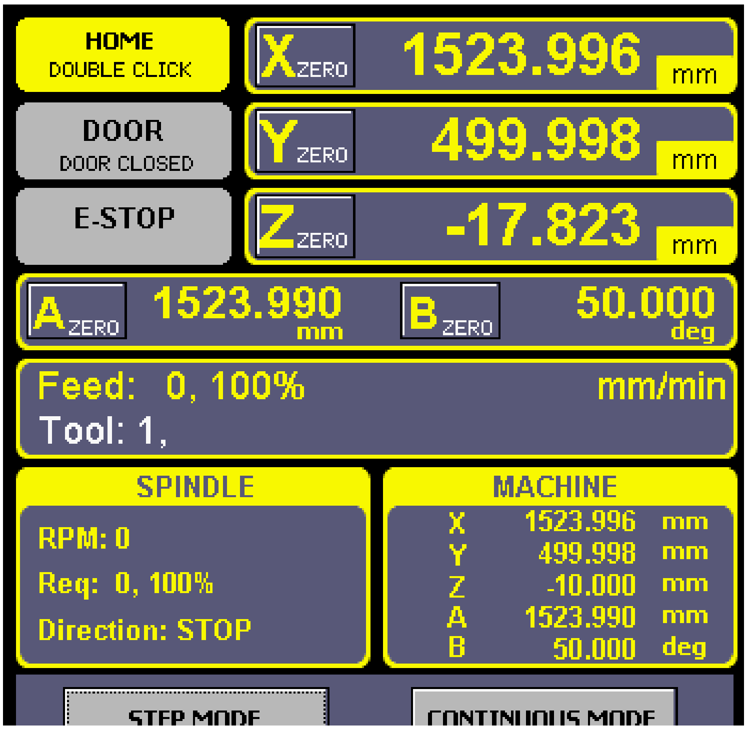

HOME
DOUBLE CLICK
X ZERO
1523.996
mm
DOOR
DOOR CLOSED
Y ZERO
499.998
mm
E-STOP
Z ZERO
-17.823
mm
A ZERO
1523.990
mm
B ZERO
50.000
deg
Feed: 0, 100%
mm/min
Tool: 1,
SPINDLE
RPM: 0
Req: 0, 100%
Direction: STOP
MACHINE
X 1523.996 mm
Y 499.998 mm
Z -10.000 mm
A 1523.990 mm
B 50.000 deg

7.6.3. Jogging

Press **F3** to goto **“F3 – Jog**/**Rapid”** screen.

Jogging allows only one axis to move at a time in all jogging methods.

There are 4 methods available to the user for Jogging around the table

1. Keyboard
2. MPG
3. Touch screen jog keys
4. External Jog inputs

Jogging speed is determined buy the Jog feed rate setting in the F3 screen and affects all jogging methods except for the MPG Pendant which is controlled by the speed at which the MPG is turned.

Keyboard

Jog Step Size	1,2,3 or 4	F3	*(MASSO G3 Only)*
X – Rapid	SHIFT+ Left or Right arrow key	F3	
Y – Rapid	SHIFT + Up or Down arrow key	F3	
Z – Rapid	SHIFT + "U" or "D" keys	F3	
X – Jog	Left or Right arrow key	F3	
Y – Jog	Up or Down arrow key	F3	
Z – Jog	"U" or "D" keys	F3	
Feed Override	select "F11"	F2 & F3	
Spindle Override	select "F12"	F2	
Override Increase	"+" *(You can also use MPG)*	F2 & F3	
Override Decrease	"-" *(You can also use MPG)*	F2 & F3	

Rapid is the same as continuous motion and the speed of the motion is determined by the Jog feed rate slider on the MASSO F3 screen.

MASSO Pendant

The user can select which of the 5 axis they wish to move by using the axis selection knob on the pendant

The resolution can be selected by using the resolution selection knob on the Pendant

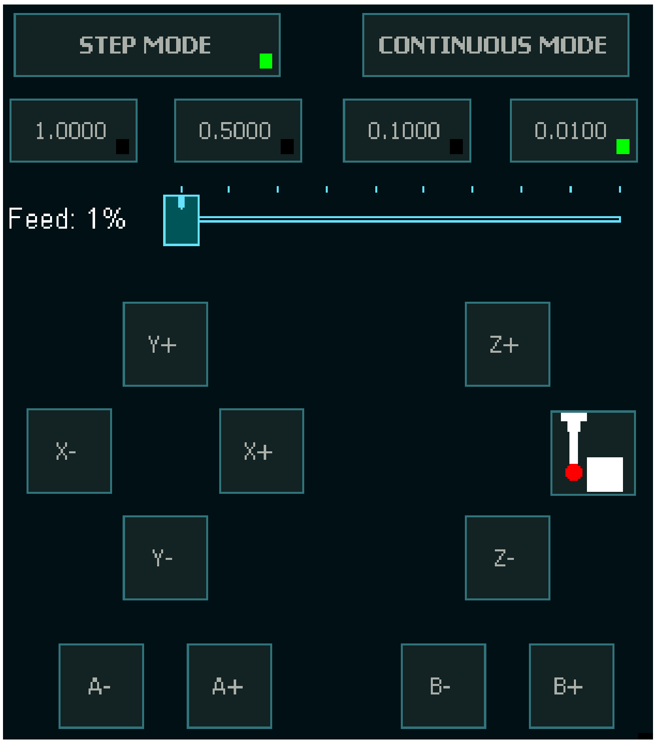
The resolution selected will depend on whether the user is using Metric or imperial and can be seen in the table below.

Resolution	Metric	Imperial
x1	0.01mm	0.0005”
x10	0.1mm	0.001”
x100	0.5mm	0.01”

Speed of movement is determined by the speed of the MPG rotation and can be used for single steps as well as continuous motion.

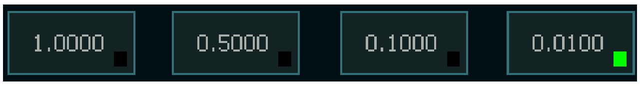
Touch screen jog Keys

These can be used with a touch screen or with a mouse.



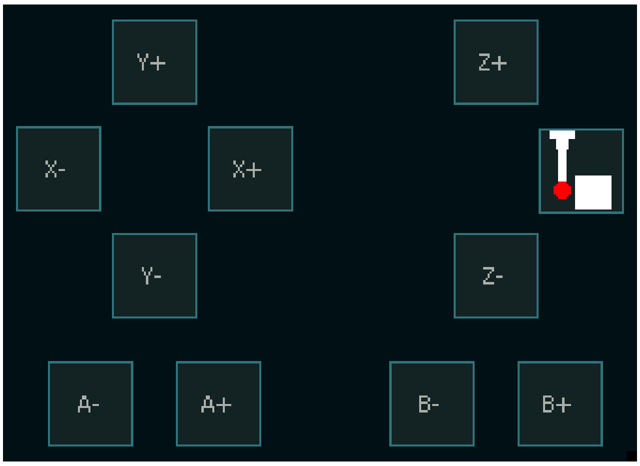
The user can determine between Step mode and Continuous mode.

In step mode the axis will make a single step determined by selected step size selected as shown by the Green indicatior.



In continuous mode the axis will move until the button is released at the rate specified by the Feed Rate slider.

The user moves the Axis by pressing the on screen buttons if using a touch screen or by using a mouse to press the desired axis



External Jog inputs

External buttons can be connected to inputs in MASSO and the inputs assigned to jog axis.

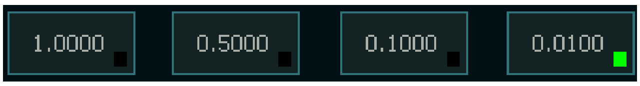
Up to 10 inputs and buttons can be used to select all of the jog directions and input and one button is required for Rapid / Continuous jogging

- Jog/Rapid A+ & A- Inputs
- Jog/Rapid B+ & B- Inputs
- Jog/Rapid X+ & X- Inputs
- Jog/Rapid Y+ & Y- Inputs
- Jog/Rapid Z+ & Z- Inputs
- Jog/Rapid Mode Input (This input changes the jog/rapid axis inputs above from single step to continuous mode while the input is high.)

When a Jog input is pressed the selected will move a single input.

If the Rapid Jog input is pressed as well the axis will move at rapid / continuous speed as determined by the rate specified by the Feed Rate slider in the F3 screen

The single step distance for an axis is determined by selected step size selected in the F3 screen as shown by the Green indicatior.



Read other subtopics below:

7.6.3.1) Jogback

7.6.3.1. Jogback

What is Jog back?

Jog back is a feature that allows the user to move spindle or other head out of the way to either examine the part you are cutting or to examine the cutter.

Jog back is active after you load a Gcode file or when you are in feed hold and is automatic.

- When you jog your machine MASSO remembers where the axes were when you started the jog sequence and when you press Cycle Start to continue machining it will walk your axis back one at a time to your previous position.
- Only the axes that were moved were moved will Jog back. For example if you only move the X & Z then only those axes will Jog back.
- One axis moves on each press of the Cycle Start button so if you move 3 axes then 3 presses of the Cycle Start button is required to return you to your start position.
- Axis Jog back in the following order. X, Y, A, B, Z
- If you are in Feed hold the machine will jog back one axis at a time with each press of the Cycle Start and once in position will resume machining on the next Cycle Start.

Cancel Jog Back

Jog back is cancelled when

- A Gcode file is loaded
- The Rewind button is pressed.
- **Any new jogging moves made after you load a Gcode file or press Rewind are subject to Jog back**

7.6.4. Feed rate override

Feed rate override

Feed rate override function allows the feed rate to be changed during machining. The range is from 20 to 100% of the specified feed rate and the current feed rate percentage is shown on the screen.

Information: This feature is available on the F2 & F3 Screens.

Information: The current Beta software version allows a Feed Rate override of 20 to 150%

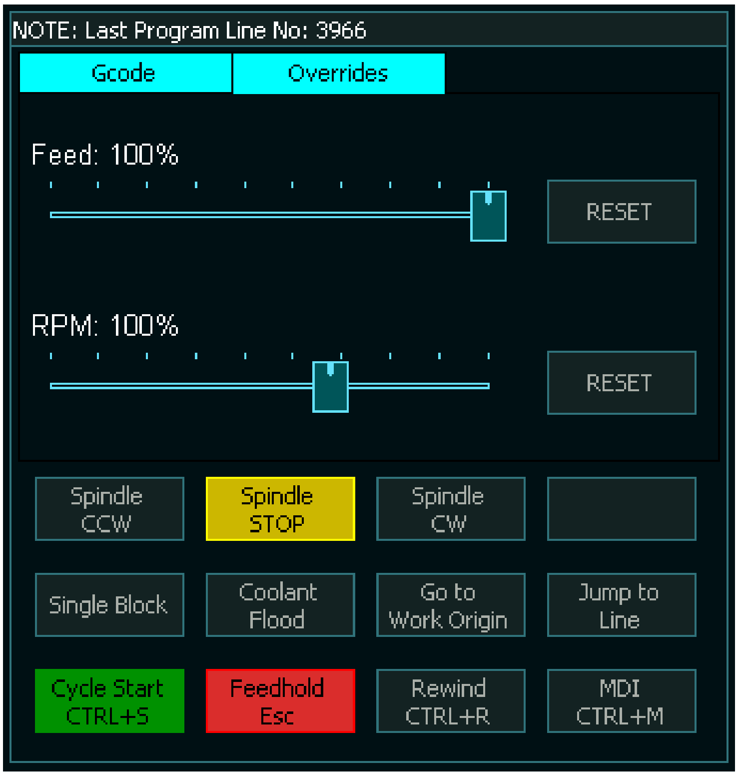
How to use

- Press the F11 Key on the keyboard
- Use the **+** & **-** keys on your keyboard to change the feed rate.
- You can also use the Pendant to change the feed rate by rotating the MPG dial in either the **+** or **-** direction to increase or decrease the feed rate.

Feed rate Override set at 100%

MASSO G3 and MASSO Touch

- In addition to the methods above the MASSO G3 and MASSO Touch has an Overrides tab in the Gcode window
- The Feed override slider that can be used to change the feed rate between 20% & 100%.
- Moving the slider will adjust the feed rate in real time while you are machining.
- The Reset button will reset Feed to 100%


NOTE: Last Program Line No: 3966
Gcode
Overrides
Feed: 100%
RESET
RPM: 100%
RESET
Spindle CCW
Spindle STOP
Spindle CW
Single Block
Coolant Flood
Go to Work Origin
Jump to Line
Cycle Start CTRL+S
Feedhold Esc
Rewind CTRL+R
MDI CTRL+M

7.6.5. Spindle RPM Override

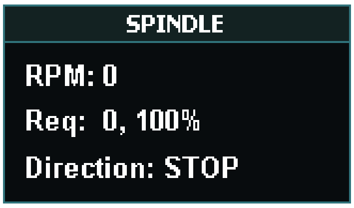
Spindle RPM Override

Information: This feature is available on the F2 & F3 Screens.

Information: Speed override ranges from 10% to 150% of the specified spindle speed.

How to use

- Press the F12 Key on the keyboard
- Use the **+** & **-** keys on your keyboard to change the spindle RPM.
- You can also use the Pendant to change the speed by rotating the MPG dial in either the **+** or **-** direction to increase or decrease the spindle RPM.

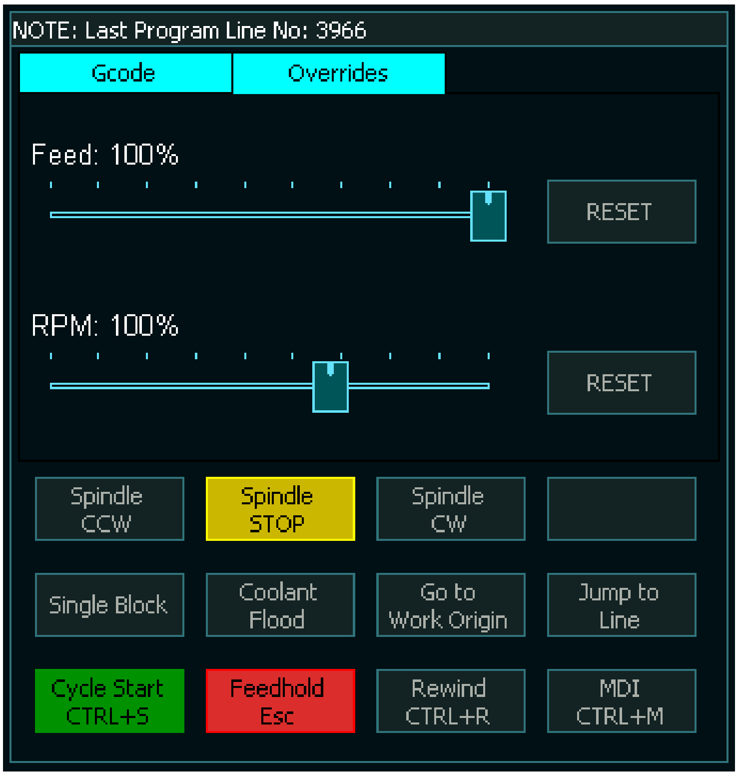


RPM Override set at 100%

INFORMATION: The following feature is available in version 4.02.34b and higher

MASSO G3 and MASSO Touch

- In addition to the methods above the MASSO G3 and MASSO Touch has an Overrides tab in the Gcode window
- The RPM override slider that can be used to change the Spindle speed between 10% & 150%.
- Moving the slider will adjust the spindle speed in real time while you are machining.
- The Reset button will reset RPM to 100%


NOTE: Last Program Line No: 3966
Gcode
Overrides
Feed: 100%
RESET
RPM: 100%
RESET
Spindle CCW
Spindle STOP
Spindle CW
Single Block
Coolant Flood
Go to Work Origin
Jump to Line
Cycle Start CTRL+S
Feedhold Esc
Rewind CTRL+R
MDI CTRL+M

7.6.6. MDI command

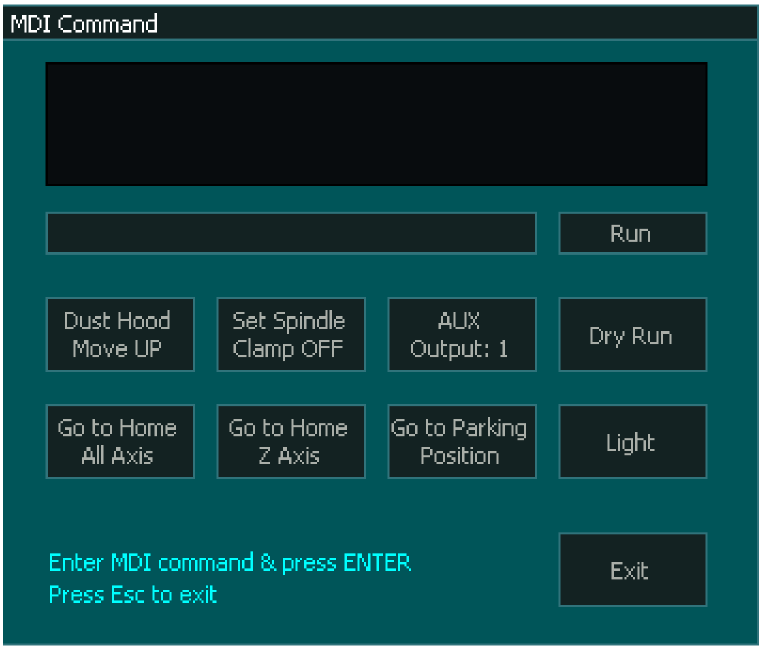
MDI window can be opened from **F2 - Program & MDI** screen using **CTRL+M** or by clicking on the MDI button towards the bottom left of the screen.

MDI window can be used to quickly run any gcode commands and the on-screen buttons can be used to control outputs or move the axis to the home position.

When using the touch screen keyboard the Enter button  is disabled and the Run Button 

in the MDI screen used to execute the Gcode command. This is to prevent the Enter button being pressed by mistake when using the delete button  as they re next to one another on the screen. This does not apply when using an external keyboard where pressing the Enter key will execute the Gcode command.

In MASSO G3 the up and down arrow key can be used the select and execute commands from history. The last 20 commands are saved in memory.



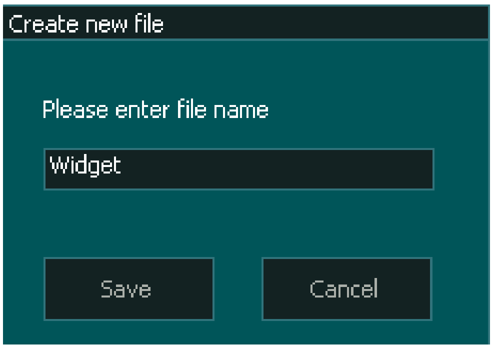
7.6.7. Creating New G-Code Files

Creating a new file can be done in one of two ways

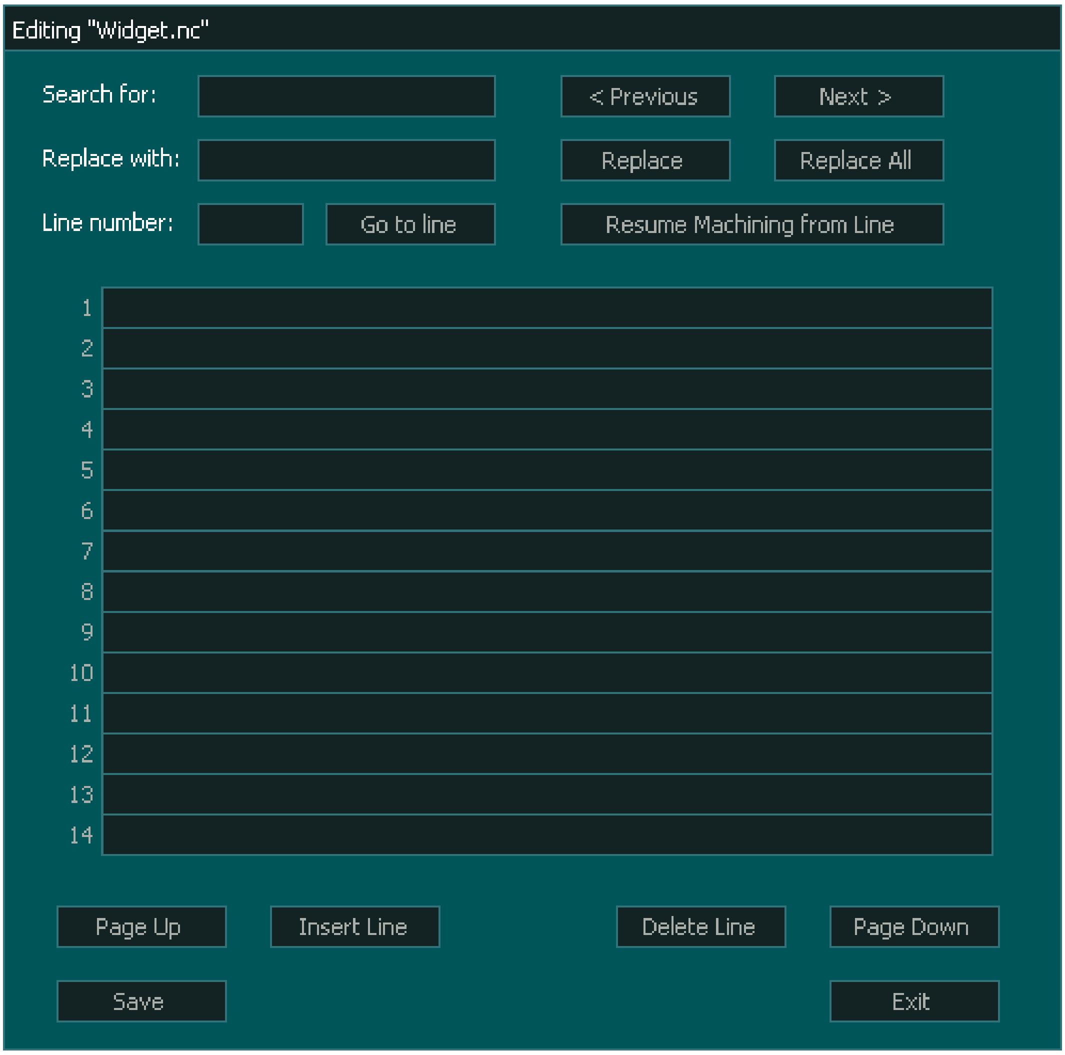
- Press the New button in the F6 screen 

or

- Press **F2** to go to the **F2 - Program & MDI** screen, press **CTRL + N** to open a new file name window.



- Enter the file name and press Save.
- There is no need to add the **.nc** to the filename as MASSO will automatically add this for you.
- The Editing window will open and you can write your new program.

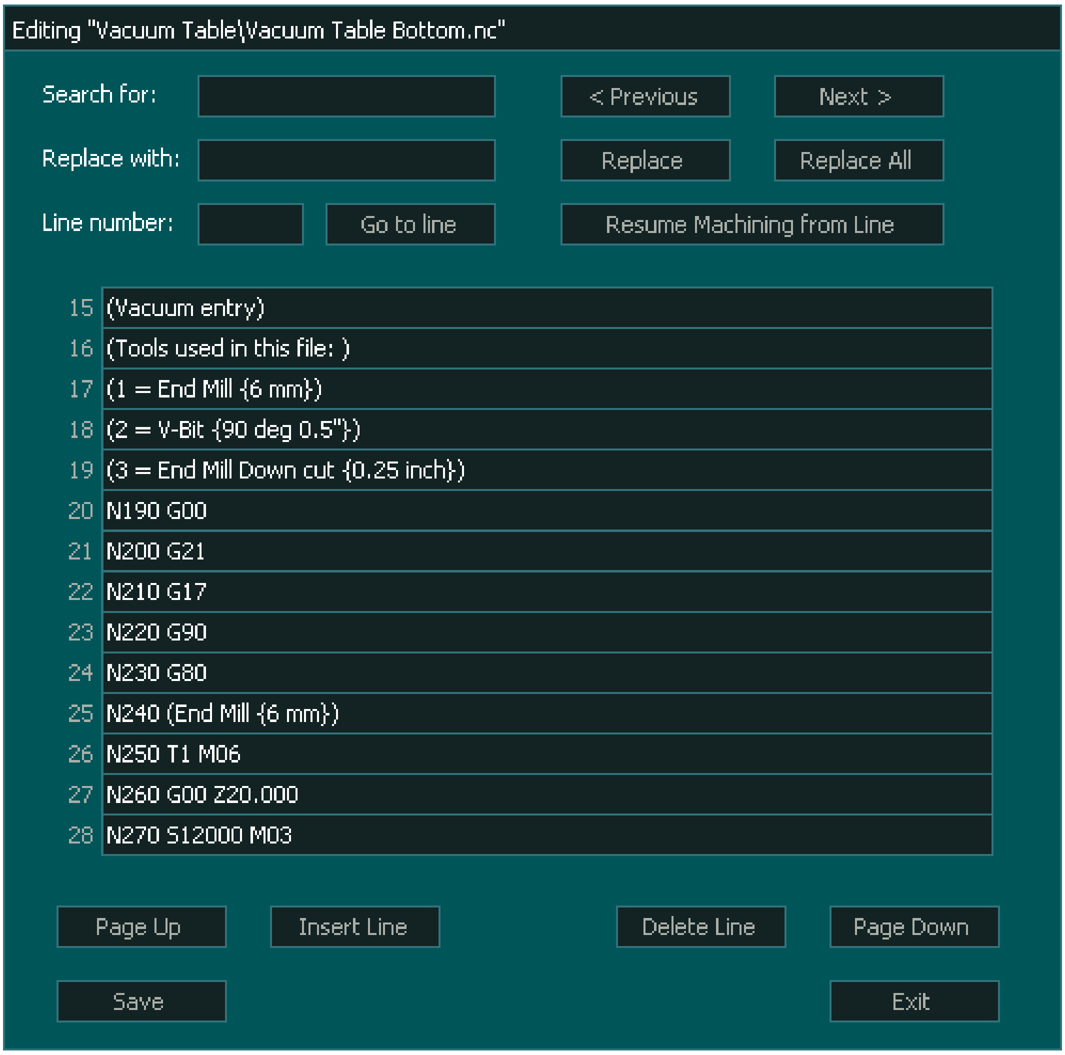

Editing "Widget.nc"
Search for:
< Previous
Next >
Replace with:
Replace
Replace All
Line number:
Go to line
Resume Machining from Line
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Page Up
Insert Line
Delete Line
Page Down
Save
Exit

7.6.8. Editing G-Code

INFORMATION: This editor is only available on MASSO G3 controllers running software v5 and above.

- Press the edit button on the F6 screen after loading the file. 

- Press **F2** to go to the **F2 - Program & MDI** screen
- Next press **CTRL + E** to open the edit file window



Screen button functions

Search for:

This allows you to search for specific text in the Gcode file.

It is also used for the Replace with: function

Enter your text into the search box

Looks for the previous appearance of the text specified in the Search box

Looks for the next appearance of the text specified in the Search box

Replace with:

This will replace the searched for text with the new text entered into the Replace with: box

Enter the text you want to replace into the Replace with box

Replaces the text located by the Search for: function with the text in the Replace with: box

Replaces all instances of the text in the Search for: box with the text in the Replace with: box

Line number:

This will look for a specific line of Gcode.

Enter the line number of the Gcode file you wish to go to

Press Go to Line to move to the line in the Line number box

Note: it is not looking for the N number used in Gcode as a line number you need to use the Search for: function instead.

INFORMATION: If you have made changes to the Gcode file please save them before pressing button as any unsaved changes will be lost.

Resume Machining from Line

This will automatically exit the editor and open Jump to line.

It will use the line number that the cursor was on in the editor and will automatically key the Start from line function.

To resume machining simply check the coordinates shown to ensure that they look right and press Run to proceed as usual.

Resume Machining from Line

INFORMATION: If you have made changes to the Gcode file please save them before pressing the Resume Machining from Line button as any unsaved changes will be lost.

Other Buttons

Page Up This moves up one page of Gcode.

Page Down This moves down one page of Gcode.

Insert Line This inserts a new line above the current selected line.

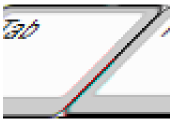
If your cursor is in the middle of the line of Gcode it will not split the line, just put an empty line above

Delete Line This deletes the current line with the cursor in it.

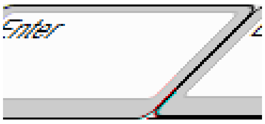
Save This saves the changes you have made to the Gcode file.

Exit This exits editing and reloads the Gcode file.

If you press Exit without saving the file first all changes will be lost and the original fill will be loaded.



The Tab key moves the cursor to the next line in the Gcode file.



The Enter key moves the cursor to the next line in the Gcode file.

7.6.9. Resetting Job Counter

MASSO has a built in job counter that increments everytime a gcode file runs. This counter can be used to see number of parts made in large production work.

To reset the job counter back to 0:

- Goto the **F2 - Program & MDI** screen.
- Press **CTRL + M** or click the MDI button to open the **MDI** Window.
- Type **RESET_JOB_COUNTER** and press Run

INFORMATION: The job counter can also be seen and reset remotely on a PC using the MASSO Link software.

INFORMATION: The job counter value in retained even after system power down. If the backup battery on the MASSO is removed, the job counter is reset to 0.

INFORMATION: For MASSO G2 model the job counter can count up to **4094** and for MASSO G3 model the job counter can count up to **4,294,967,295**.

7.7. Loading & Running G-Code

MASSO runs gcode files directly from the USB Flash drive. Please see the below video for instructions on how to load and run gcode files.

Files with extensions **.nc, .cnc, .tap, .wiz, .txt, .eia** are displayed in the **F6 - Load File** screen.

Gcode files as big as 4GB can be run on controller.

If you are loading a very large Gcode and do not want to wait for the toolpath preview to be displayed you can press the Escape button on screen or the ESC key on the keyboard to cancel the preview.

Gcode files can also be transferred wirelessly using WiFi connection and transferring files from PC using the MASSO Link software.

WARNING: After loading your Gcode file you must press the Rewind button before pressing Cycle Start to run your program.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Load and run a Gcode File - Masso Edition 11

7.8. Resuming Program or Jump to Line

INFORMATION: This feature is only available for mill and plasma software versions.

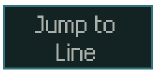
When machining complex jobs such as die molds or complex engraving jobs which can take a long time to machine, power failure or broken tool means that you need to start the entire gcode file from start. Restarting the gcode file from start is very time and resource consuming. To be able to effectively restart your machining process from where you left, MASSO has a **Resuming Program or Jump to Line** feature (from software v3.30).

- With this feature the current gcode line number is saved into a high speed internal memory and even if the machine is powered off while machining, MASSO will automatically store that last line number in memory.

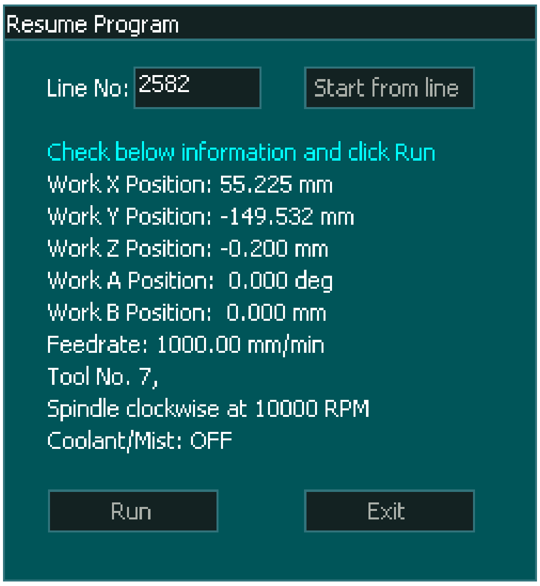
Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Jump to Line - Masso Edition 01

On power-up, a message is displayed on the gcode list with the last line number that was running

- After this please load the gcode file from the **F6-Load File** screen and go to **F2-Program & MDI** screen
- Press the Jump to line button 

 or use **CTRL+J** from an external keyboard to open the **Resuming Program** window
- The last line number will automatically be filled and depending on your program, please go back a few lines from the last running line so that the machining is resumed a few lines before it stopped.



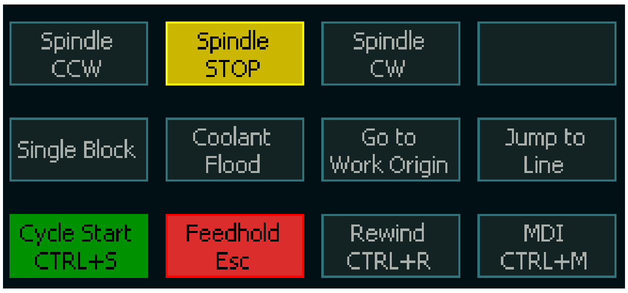
- Next click the **Start from line** button and MASSO will process the gcode file up to the line number entered by you. When done MASSO will calculate all the machining parameters from the gcode file as below:
- Calculate the X, Y, and Z-axis positions to resume machining.
- Cutting feedrate as per gcode.
- Tool Number.
- Spindle RPM and direction.
- Coolant/Mist status.
- Carefully check the information and click the **Run** button.
- Next, MASSO will resume the machining cycle as below:
- Move the Z axis up to the homing position.
- Change tool if a different tool is required.
- Sets the status of any output if used with M62 or M63 codes.
- Start spindle at the requested RPM and direction.
- Start Coolant/Mist as per gcode.
- Go to X & Y resume position.
- Move the Z axis down to the cutting position and start machining at the feedrate as per gcode file.

INFORMATION: When using Jump to line only one axis moves at a time and the Cycle Start button must be pressed between each X, Y, A, B & Z axis move when the axis is moving to the start position. Machining will automatically resume once the z axis has moved into position.

Jump to Line in Plasma software

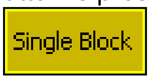
INFORMATION: When using the **Jump to line** in Plasma software MASSO will search backward in the Gcode file to locate the last M5 or M3 command depending on the software version being used and will be the starting line. If the line you have selected is an M5 command it will use that line. If there is no previous M5 or M3 command it will return to the start of the Gcode file. The use of Plasma Jump to line works the same as Mill software in its operation.

7.9. Single Block



The Single block button puts MASSO into a single step mode.

This is mostly used as a troubleshooting function to test Gcode one line at a time to establish where the problem may be occurring.

- When the **Single Block** button is pressed the button changes to yellow to indicate that the machine is in **Single Block** mode. 

- The machine will execute a single line of Gcode at a time.
- To step between lines the Cycles start button is pressed.
- To exit **Single Block** mode press the **Single Block** button again and it will toggle back to normal mode and the machine will start moving normally.
- Entering **Single Block** mode automatically sets the machine back to the start of the Gcode file.
- If you wish to test further into the program select **Single Block** mode and then use Jump to Line to select the line you wish to start testing from.

7.10. Wi-Fi Connectivity

MASSO comes with Wi-Fi hardware and software to easily connect your MASSO controller to a Wi-Fi network.

With the MASSO Link software, users can easily view the real-time status of your MASSO controller remotely, transfer gcode files to MASSO from your PC, get tool data from MASSO's memory and generate tools list document that can be used with CAM software.

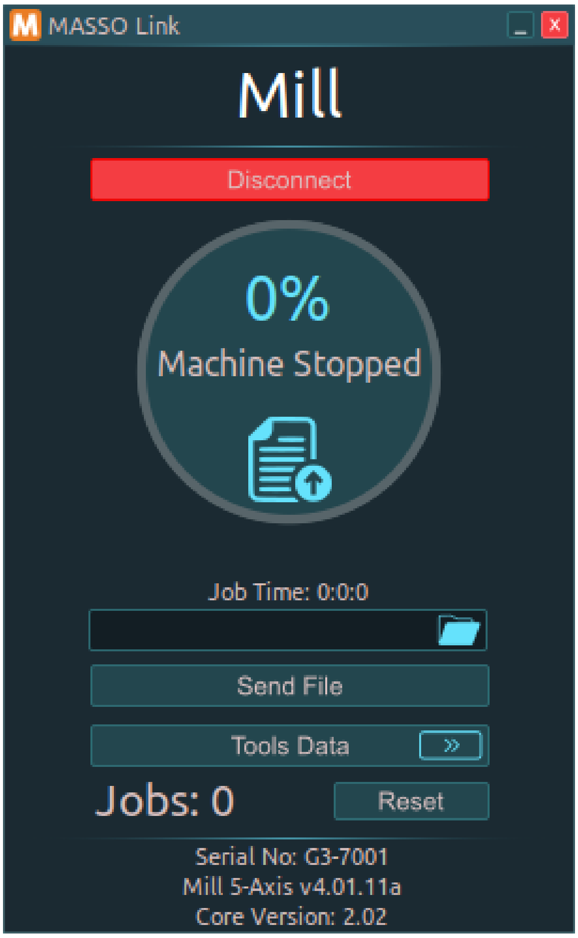
INFORMATION: MASSO Link software download link.

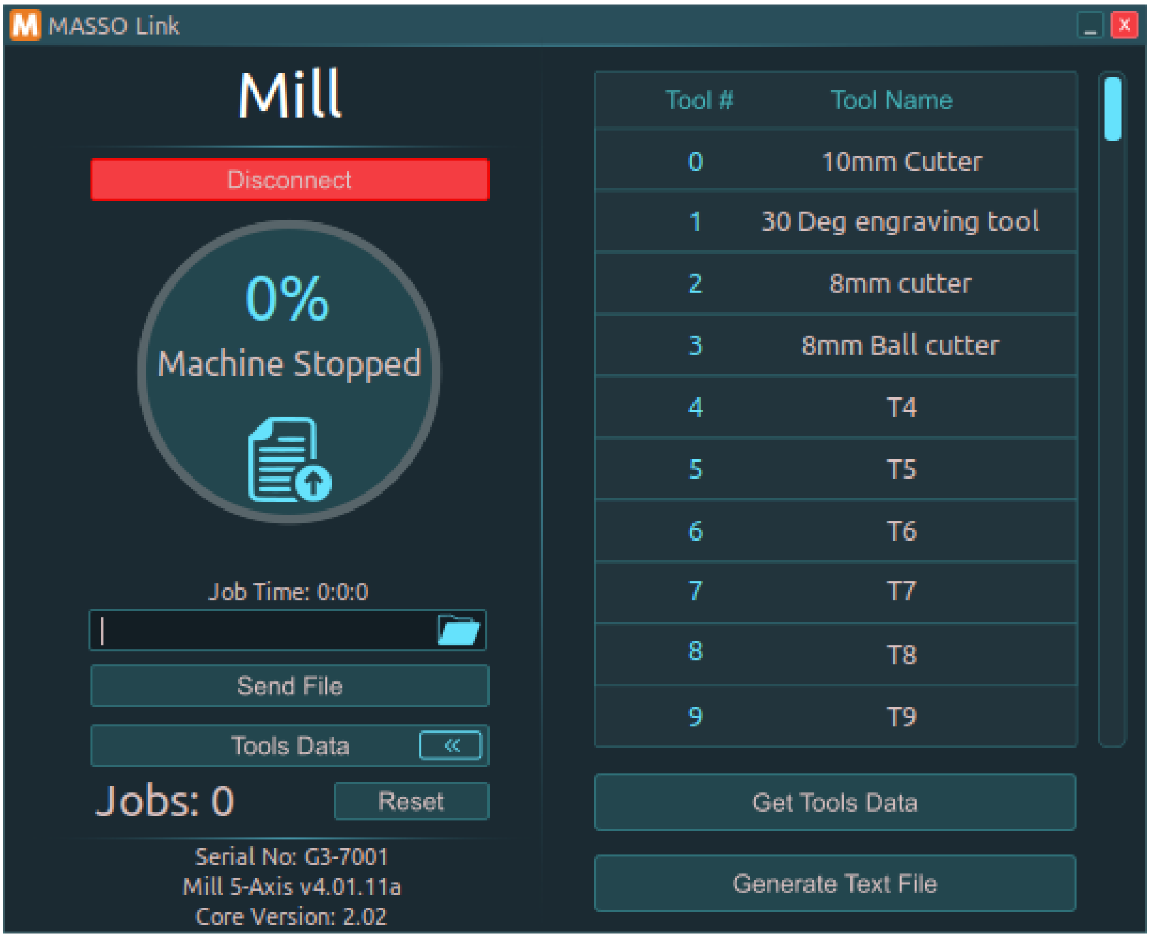
MASSO Link software is available for Windows, macOS, and Linux.

Running "MASSO Link" software on PC

INFORMATION: Masso link software uses UDP ports 11000 to 11050 for sending data and 65535 for receiving data.


MASSO Link
MASSO
Connected to My MASSO network
192
168
1
76
Connect
Machine name
Mill
Give a name of your machine for your reference.
Example: My Mill - Main Workshop
MASSO Documentation
MASSO Link
MASSO Link v2.0
Build: 28-01-2021


MASSO Link
Mill
Disconnect
0%
Machine Stopped
Job Time: 0:0:0
Send File
Tools Data
Jobs: 0
Reset
Serial No: G3-7001
Mill 5-Axis v4.01.11a
Core Version: 2.02



Creating your own Wi-Fi network

If a Wi-Fi network is not available, MASSO can be used to create a Wi-Fi network and a PC can be connected directly to MASSO via this Wi-Fi network. This feature is called **My MASSO Network**.

Tick the **Make "My MASSO Network"**, enter a network name (SSID) that you would like to call this network, and enter the security key. Click the **Enable** button.

At this stage, the Wi-Fi network will show up on your PC in the Wi-Fi networks list and you can connect to this network and use the **MASSO Link** software.

INFORMATION: The security key must be between 8 to 32 characters long.

Transferring gcode files to MASSO

INFORMATION: Please note that a USB Flash drive needs to be connected to MASSO to store these files.

- Once connected, gcode files with **.txt, .nc, .cnc, .tap, .eia** extensions can be dragged and dropped on to the **MASSO Link** software window.
- A folder name can be given and all the files sent to MASSO will be saved on the USB pen drive in this folder, else keeping this blank will save the files on the root folder of the USB pen drive.
- Click **Send File** to send the file to MASSO.

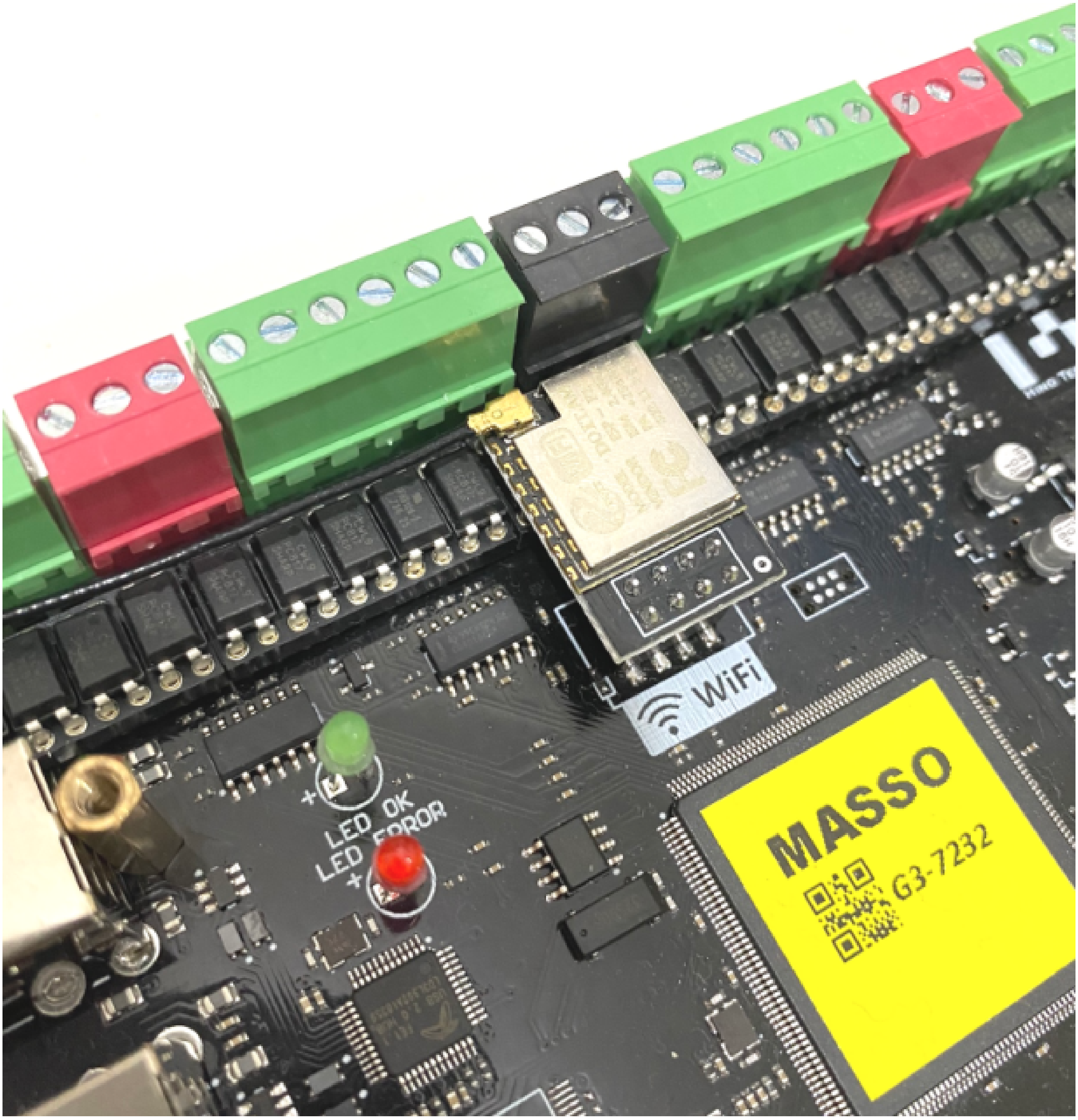
INFORMATION: File transfer speed is up to 2Mb per minute and is dependent on several factors including Wi-Fi Signal and flash drive write speed. A poor Wi-Fi signal may slow down the file transfer process by requiring data to be resent. A quality, branded USB2 or USB3 flash drive is recommended as modern flash drives will have higher internal write speeds. While the transfer rate may be slower than your flash drive write speed the data is not written to the drive until a block of data is received at which time it will write the data and request the next block. Slow write speeds within the flash drive will become a determining factor in overall transfer speed. A slow flash drive can half the transfer speed of a file doubling the amount of time it needs to send.

Installing the Wi-Fi module

The WiFi module is required to be plugged into MASSO's Wi-Fi connector before being able to use the WiFi functionality. The antenna cable and antenna must also be installed.

- Switch off the MASSO and remove the main label cover and slide out the label panel towards the left side.
- After installing the WiFi module the label panel can be installed back and MASSO powered up.

> **CAUTION:** Make sure to install the WiFi module in the correct direction as shown in the below photo.



Connecting to WiFi network

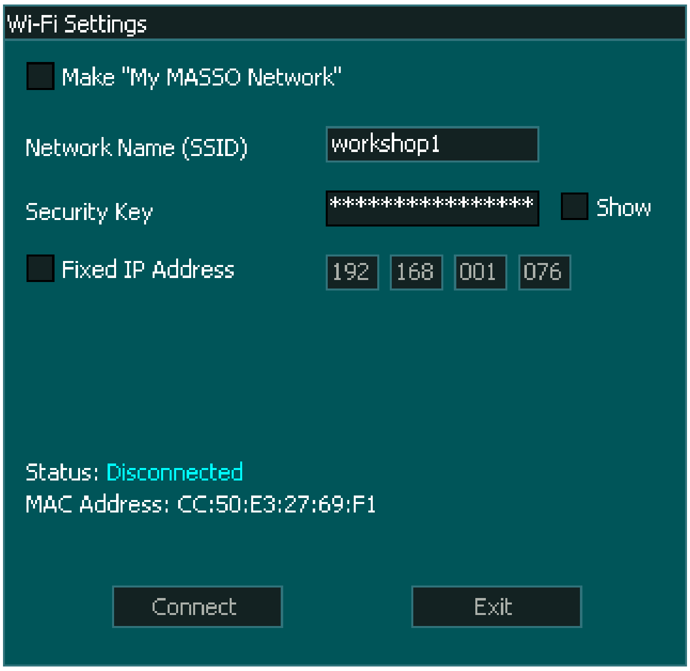
> **INFORMATION:** MASSO Wi-Fi module supports 2.4GHz frequency (IEEE 802.11 b/g/n).

In the **F2 - Program & MDI** screen, click the Wi-Fi icon.

Enter the name (SSID) and security key of the Wi-Fi network that you would like to connect to. If you would like to use dynamic IP as provided by your Wi-Fi network then leave the **Fixed IP Address** un-ticked and click the **Connect** button. Once connected the IP address provided by your Wi-Fi network is displayed.

> **INFORMATION:** It's a good idea to use the **Fixed IP Address** option as every time you connect to your Wi-Fi network, the IP address might be changed by the router. As the IP address is required by MASSO Link software, the new IP address needs to be updated on the PC to be able to connect to the MASSO. Using the **Fixed IP Address** solves this issue.

> **INFORMATION:** The maximum length of SSID is 30 characters and 60 characters for the security key.



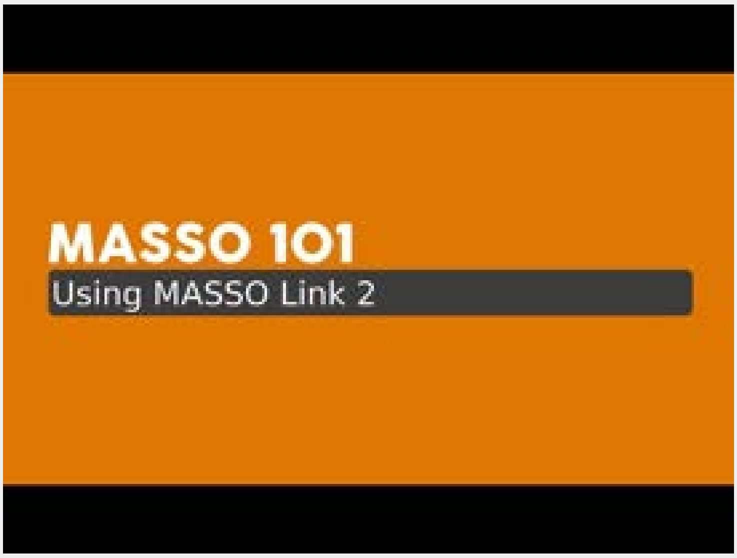
Troubleshooting

- Do not install MASSO Link into the "C:/Program files" directory as Windows permissions will cause issues when running MASSO Link. Instead create your own directory ad shown in the videos below and install it there.
- Firewall settings will prevent MASSO Link from connection to your MASSO
- AntiVirus software can have built in firewalls that override the Windows Firewall. IF you are having problems connections be sure to check your AntiVirus software.
- If you are connecting your MASSO to a managed wireless network you may need to contact your network administrator to allow access.
- If MASSO Link will not start and you have 2 monitors please turn one off monitor off and start MASSO Link. Reposition MASSO link on your Monitor and close. Turn on the 2nd monitor and restart MASSO Link. It should now open and work normally.

MASSO link on an existing Wi-Fi network

The Following video shows how to set up MASSO link on a PC however the method of setup and use is the same across all platforms.

Use this method if you have an existing Wi-Fi network.



Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

MASSO 101 - Using MASSO Link 2 on PC

Make my MASSO network

Use this if you method if you do not have an existing Wi-Fi network or you wish to use a direct point to point connection from MASSO to your PC

Install and using My MASSO Network with MASSO Link - Episode 27

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Read other subtopics below:

7.10.1) MASSO Link Software

7.10.2) MASSO Link - macOS Instructions

7.10.3) MASSO Link - Windows Instructions

7.10.4) Making QR Codes

7.10.1. MASSO Link Software

Click on the below operating system links of your choice to download MASSO Link software.

MASSO Link v2.11

Release date: 17 Nov 2021

Release Notes

1. Added support to map folder on the computer and generate QR codes to be scanned on the MASSO controller for loading gcode files.
2. Minor bug fixes and improvements.

> If upgrading from an earlier version of MASSO Link the old MASSO_Link.dat file must be deleted. An error message will be thrown if not done.

MASSO Link v2.10

Release date: 1 July 2021

> **INFORMATION: MASSO Link v2.10** requires **MASSO G3 v4.03** or higher or **MASSO G2 v3.50** or higher. Most of the features can still be used with older versions of MASSO controller software 4.01 and the current Beta versions as well.

macOS Version

Linux Version

Release Notes

1. Fixed windows scaling issue.
2. Improved graphics resolution.
3. Added support to send MASSO software update **.HTG** files to the controller.
4. Fixed bug where job run time was not displayed correctly in some situations.
5. Minor improvements and bug fixes.

MASSO Link v2.0

Release date: 28 January 2021

INFORMATION: MASSO Link v2.0 requires **MASSO G3 v4.01** or higher or **MASSO G2 v3.49** or higher.

Windows Version

macOS Version

Linux Version

Release Notes

1. The first cross-platform version released.
2. Supports running multiple copies of MASSO Link on a computer to monitor multiple machines at the same time.
3. Added option to remember the last position of the window so that next time MASSO Link opens at the same location.

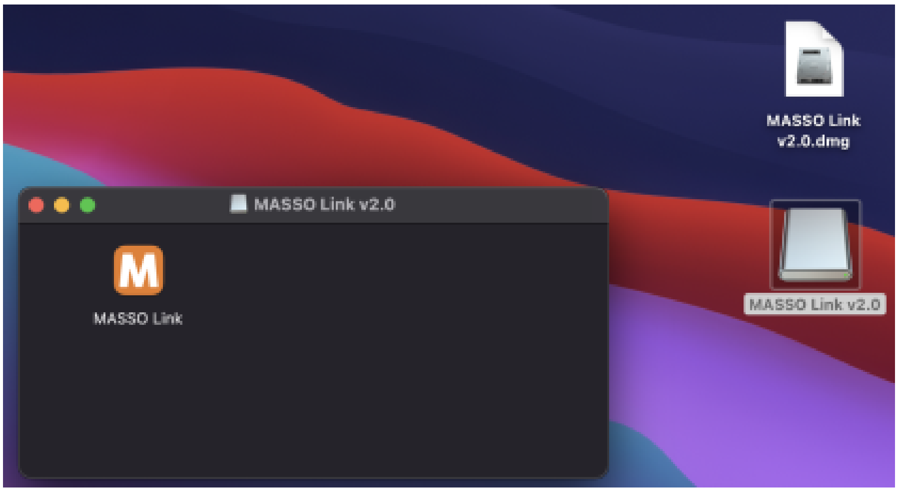
MASSO Link v1.6

This version is only available for Windows.

7.10.2. MASSO Link - macOS Instructions

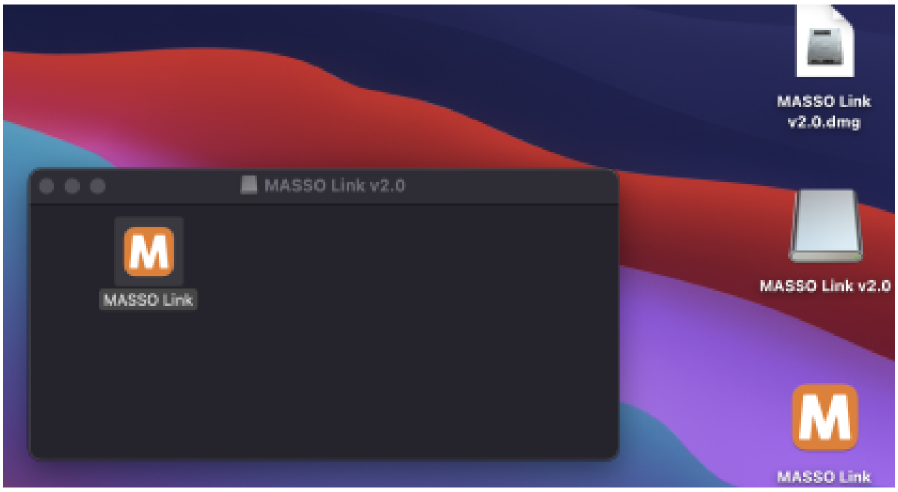
Running MASSO Link on your Apple computer

Step 1



After downloading the MASSO Link **.dmg** file, double click to mount the image.

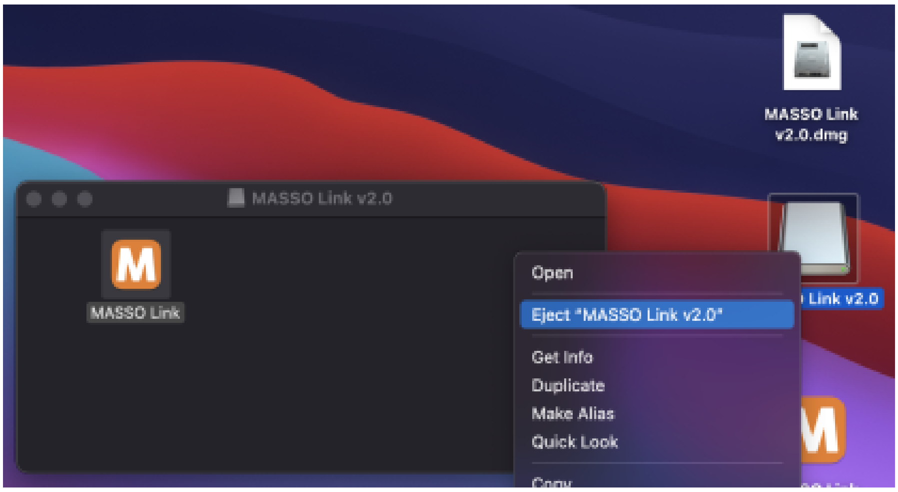
Step 2



Once the image has been mounted, drag and extract the MASSO Link software file on the desktop or in a folder.

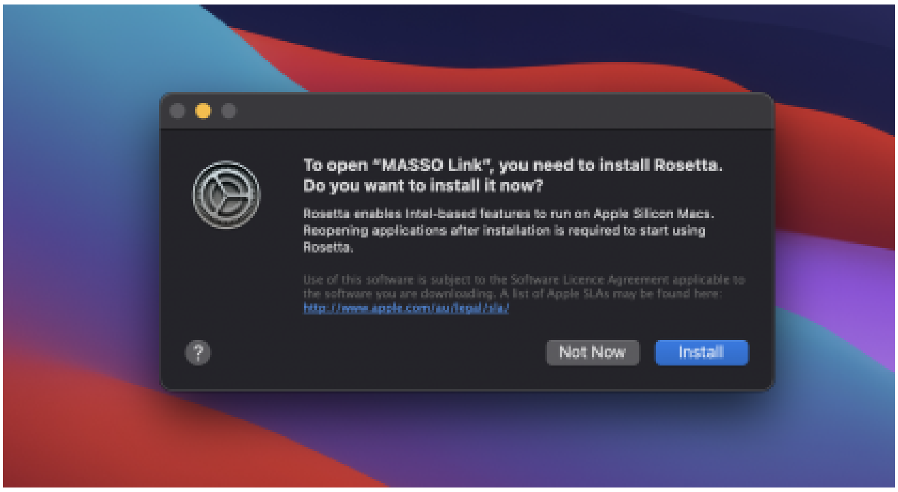
> **WARNING:** Do not run the MASSO Link file without extracting it from the image.

Step 3



Next right the image file and click **Eject**. At this stage, the dmg file can also be moved to the bin.

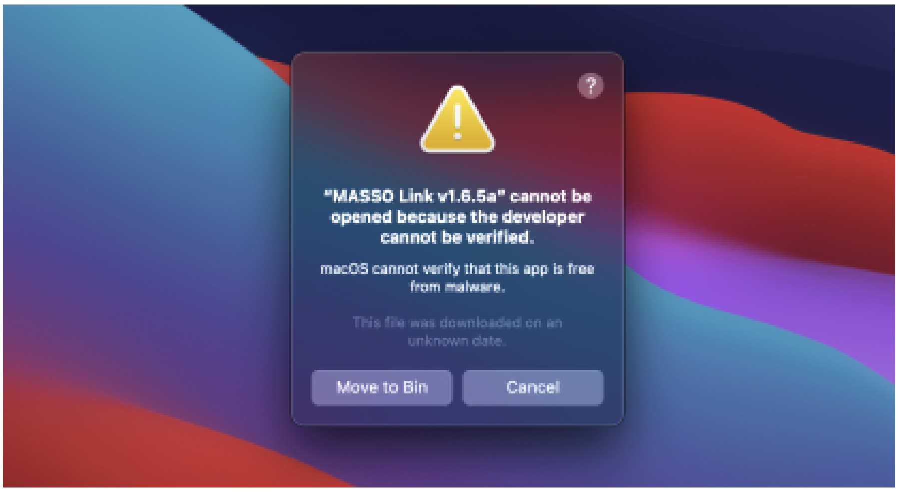
Step 4



Double click the MASSO Link icon.

INFORMATION: If you are using mac with the M1 chip and if Rosetta is not installed on your system then the above message will be displayed. Click **Install** to install Rosetta and once done, double click the MASSO Link icon.

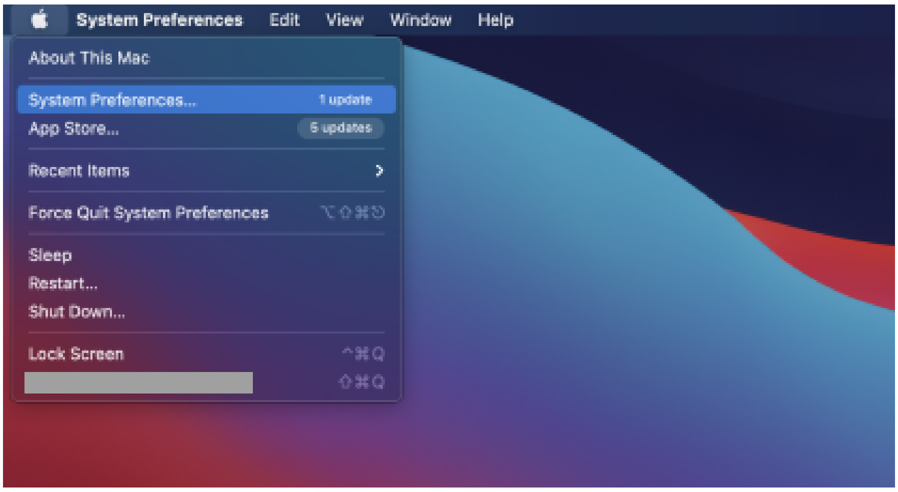
Step 5



On the first run, macOS will warn that the developer cannot be verified, click **Cancel**.

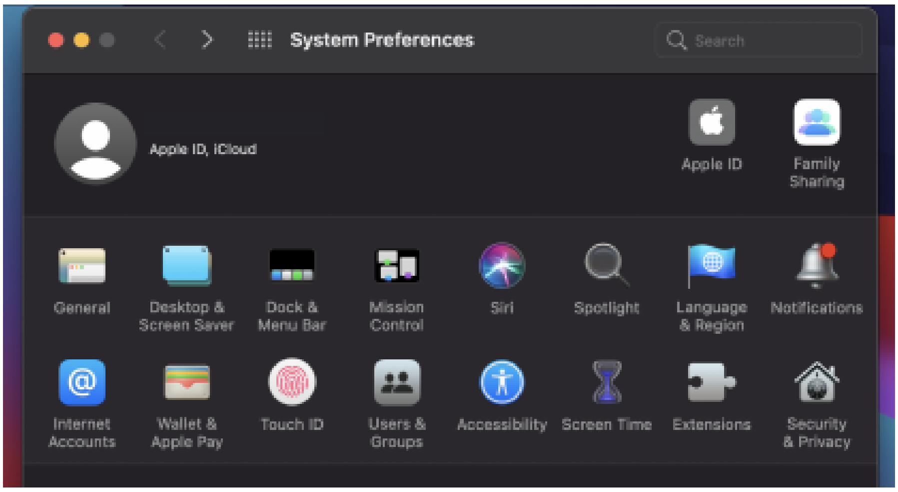
INFORMATION: You will need to follow the below steps once to allow MASSO Link to run on your mac.

Step 6



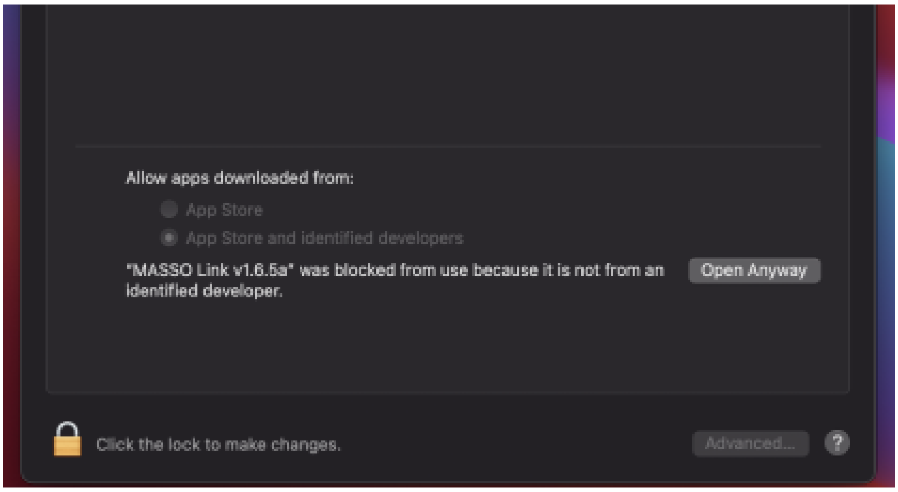
Go to the menu and click System Preferences.

Step 7



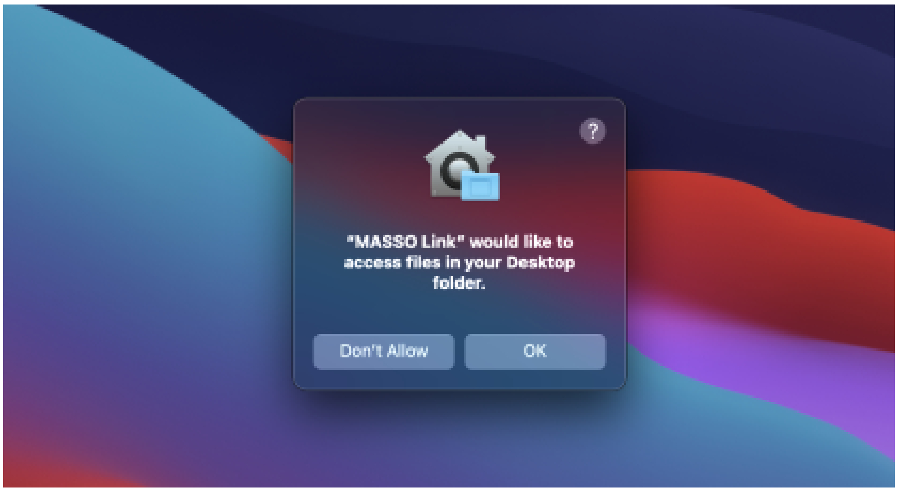
Double click and open **Security & Privacy**.

Step 8



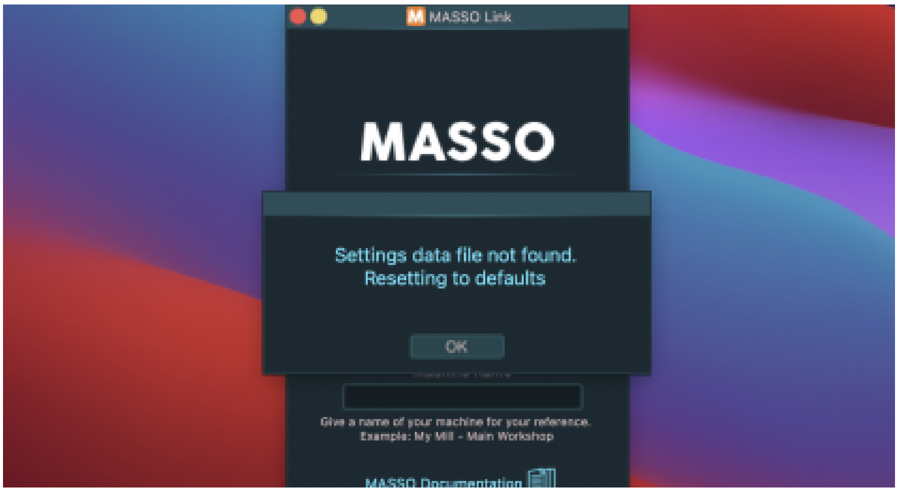
You will see the above message, click the **Open Anyway** button and close the window.

Step 9



Double click the MASSO Link icon, on first use you will see the above message, click the **OK** button.

Step 10



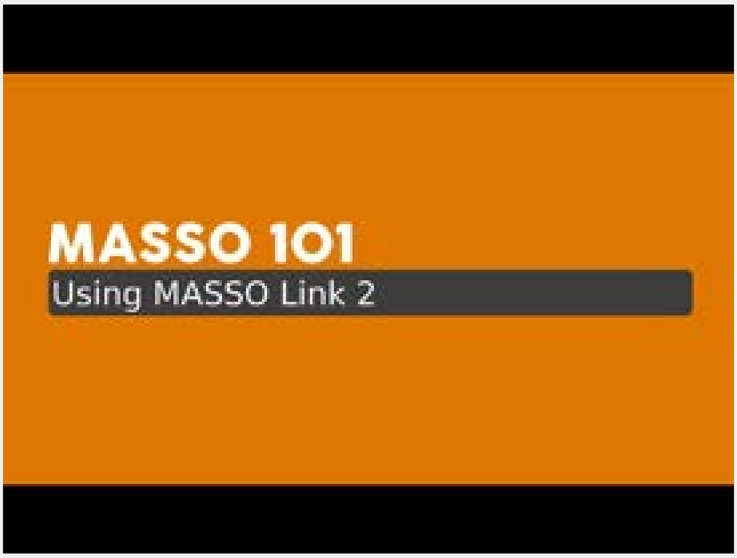
On first use, a settings file **MASSO_Settings.dat** will be created in the same folder and a message will be displayed. This settings file is used to store all the information such as machine name, IP address of MASSO and window position.

7.10.3. MASSO Link - Windows Instructions

MASSO link on an existing Wi-Fi network

The Following video shows how to set up MASSO link on a PC however the method of setup and use is the same across all platforms.

Use this method if you have an existing Wi-Fi network.

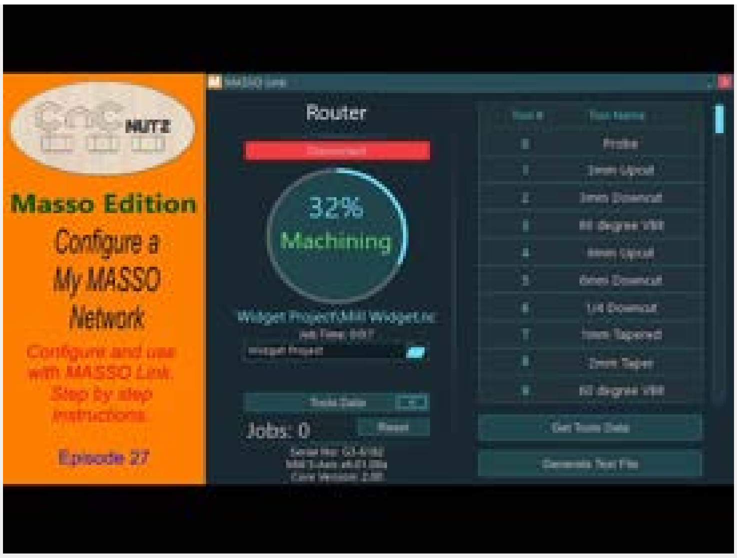


Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

MASSO 101 - Using MASSO Link 2 on PC

Make my MASSO network

Use this if you method if you do not have an existing Wi-Fi network or you wish to use a direct point to point connection from MASSO to your PC



Install and using My MASSO Network with MASSO Link - Episode 27

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

7.10.4. Making QR Codes

INFORMATION: This future requires MASSOLink v2.1.02 or greater.

From version 2.1.02 MASSO Link has the ability to generate QR Codes to use with MASSO the QR Scanner feature.

For information on how to install MASSO QR Scanner please follow the link below.

MASSO QR Scanner

Setting up MASSO Link QR code

Step 1 - Install MASSO Link as per the normal installation procedure.

For more information on Installing MASSO Link see here

Step 2 - Map your Gcode folder.

Click the symbol in the top left hand corner of the MASSO Link.

A window will open requesting that you drag and drop the folder that contains your Gcode file into the window.

After dropping the folder into the window you will see the following message telling you that the folder has been mapped.

The folder can be located anywhere on your PC.

Step 3 - Click OK.

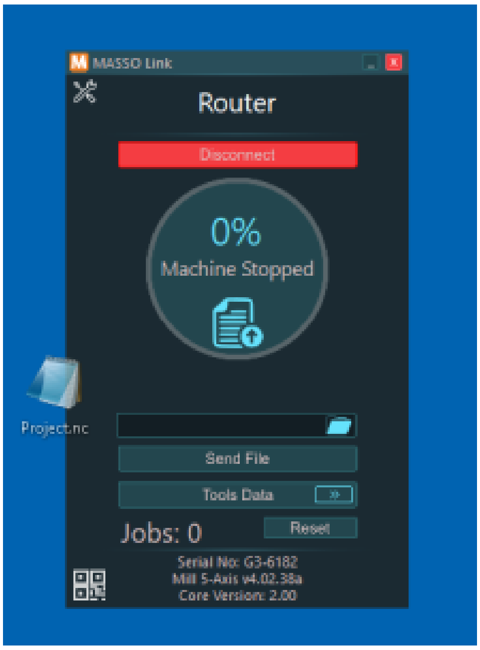
Your folder is now mapped and you can use any Gcode file within that folder to make a QR code.

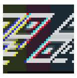
If your folder contains sub folders these are automatically mapped as well.

CAUTION: Do not map your Flash Drive to MASSO Link. Make a copy of your Flash Drive and it's folder structure in a folder on your PC and map that folder.

Creating a QR code

Step 1 - Drag and drop your Gcode file to the MASSO Link Window. The file name will display on screen.



Step 2- Press the  symbol at the bottom left of the MASSO Link window to generate the QR Code.

The QR Code Bitmap file will be put in the same folder as the GCode file and will start with the name of the same name.

Project.nc will generate a Gcode file called **Project - MASSO QR.bmp**

You can add the bitmap file to project documentation and job sheets to streamline your production process.

Flash Drive directory structure

It is critical that the Flash drive directory matches that of the Mapped folder or the QR code will not work.

Files in the Mapped folder will go into the root directory of your Flash Drive and subfolders will appear as folders. If the files are not in the correct folders MASSO will not be able to find them as the directory path is part of the QR code.

The easiest way to do this is to open the mapped folder and select all the files and sub folder in it and select copy.

eg Windows CTRL+A to select all and CTRL+C to copy all selected files.

Open your Flash Drive and paste all copied files into the root directory of the Flash Drive.

eg Windows CTRL+V to paste all copied files.

Troubleshooting

If you see this message it means that the file you have dragged to MASSO Link did not come from the mapped folder.

Solution: Move the file to your mapped folder and drag the file back in to MASSO Link. You can now create a QR Code for this file.

Using your MASSO QR Scanner.

More information on using your MASSO QR Scanner and QR Codes can be found >> here<<.

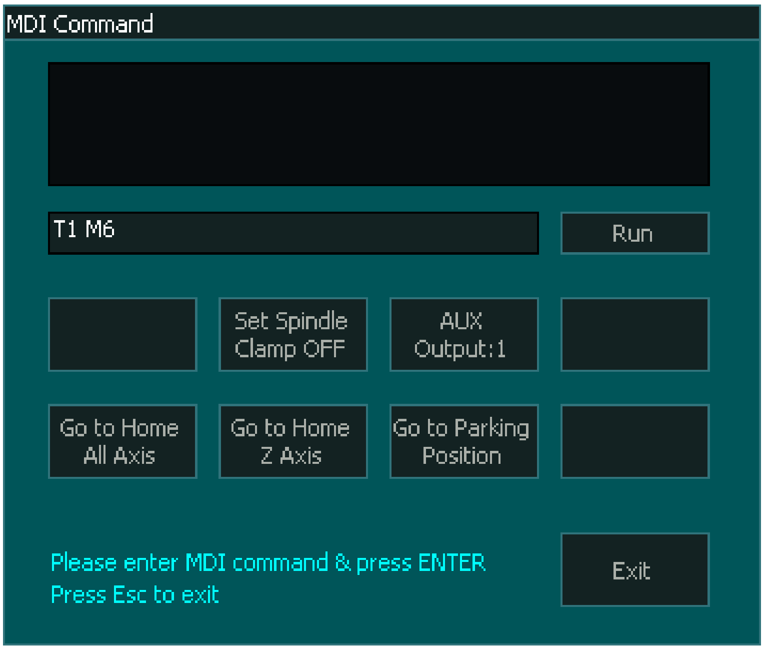
7.11. Calibrating Tools

Read other subtopics below:

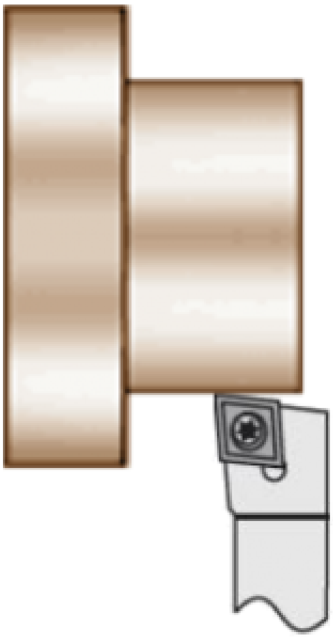
7.11.1. Lathe Tool Calibration Steps

INFORMATION: On a lathe machine X-axis work offsets are not used or available because changing the X offset would result in a change of workpiece diameter. For setting the X offset to calibrate each tool, please follow the below procedures.

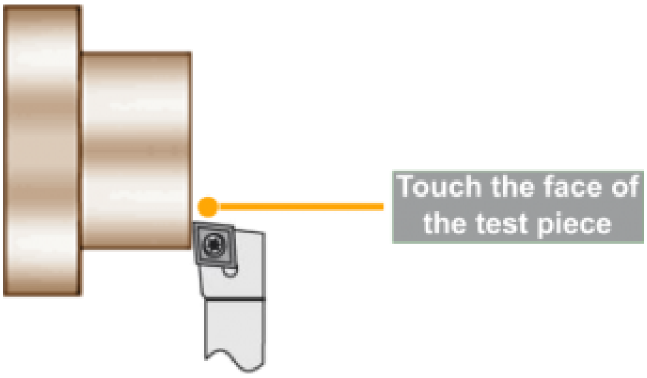
Step 1: Open the MDI window using the MDI button in F2 Screen or CTRL+M and load the tool you would like to calibrate, in this example we will be calibrating Tool No.1.



Step 2: Machine a small test piece or use an existing piece.

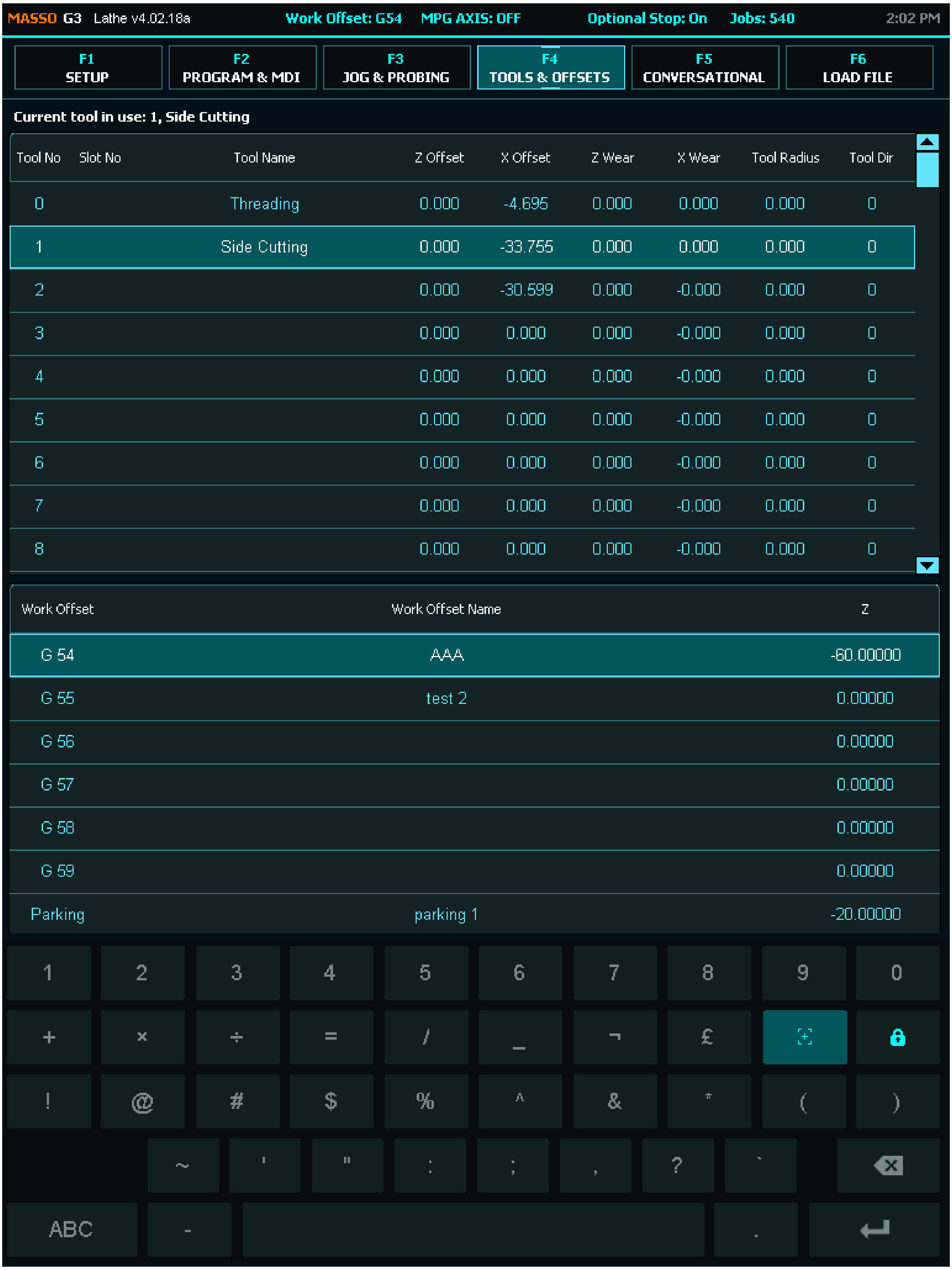


Step 3: Go to **F3 – Jog/Rapid** screen and touch the tool to the front face of the test piece.

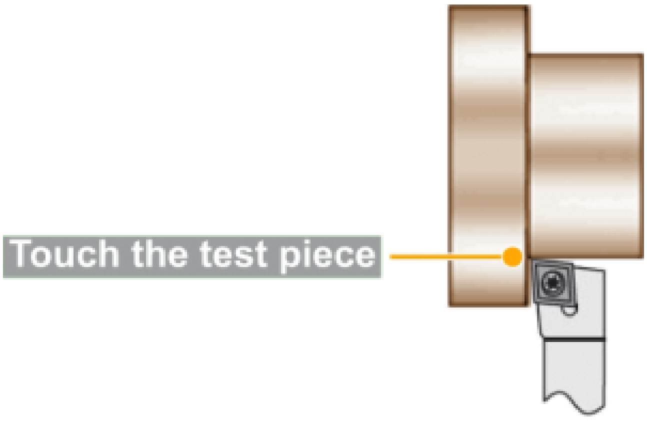


Step 4: Go to **F4-Tools & Work Offset** screen and open the tool number you want to calibrate.

Step 5: Give a name to the tool for your reference and click the **Zero** button. 

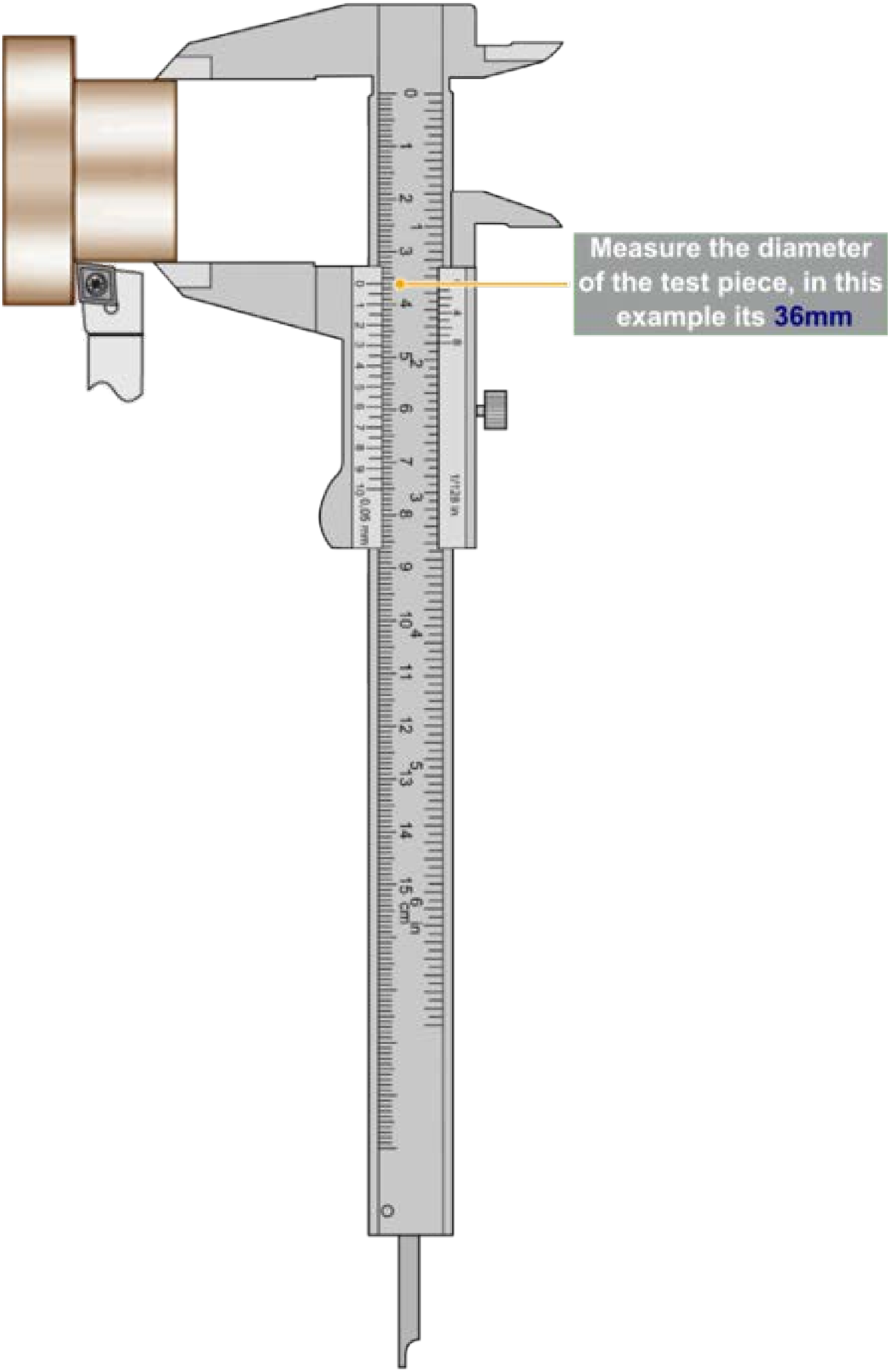

MASSO G3 Lathe v4.02.18a
Work Offset: G54
MPG AXIS: OFF
Optional Stop: On
Jobs: 540
2:02 PM
F1 SETUP
F2 PROGRAM & MDI
F3 JOG & PROBING
F4 TOOLS & OFFSETS
F5 CONVERSATIONAL
F6 LOAD FILE
Current tool in use: 1, Side Cutting
Tool No Slot No Tool Name Z Offset X Offset Z Wear X Wear Tool Radius Tool Dir
0 Threading 0.000 -4.695 0.000 0.000 0.000 0
1 Side Cutting 0.000 -33.755 0.000 0.000 0.000 0
2 0.000 -30.599 0.000 -0.000 0.000 0
3 0.000 0.000 0.000 -0.000 0.000 0
4 0.000 0.000 0.000 -0.000 0.000 0
5 0.000 0.000 0.000 -0.000 0.000 0
6 0.000 0.000 0.000 -0.000 0.000 0
7 0.000 0.000 0.000 -0.000 0.000 0
8 0.000 0.000 0.000 -0.000 0.000 0
Work Offset Work Offset Name Z
G 54 AAA -60.00000
G 55 test 2 0.00000
G 56 0.00000
G 57 0.00000
G 58 0.00000
G 59 0.00000
Parking parking 1 -20.00000
1 2 3 4 5 6 7 8 9 0
ABC

Step 6: Now go to **F3 – Jog/Rapid** screen and touch the tool to the side of the test piece.



Step 7: Measure the diameter of the test piece and note the value.

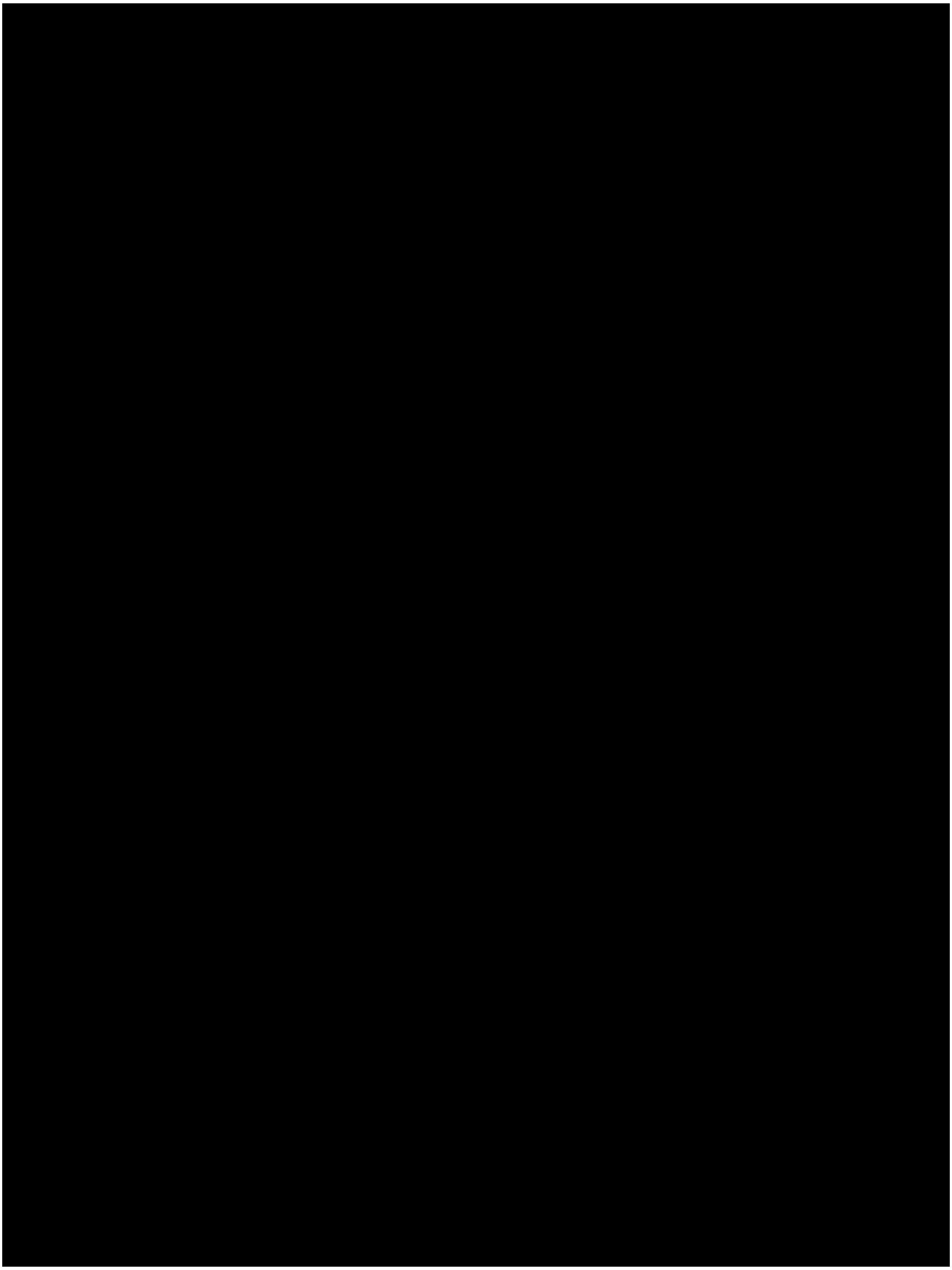
WARNING: Do not Jog or move the tool away unit the next step has been completed.


Measure the diameter
of the test piece, in this
example its 36mm

Step 8: Go back to **F4-Tools & Work Offset** screen and enter the measured diameter value in **Test Piece (Dia)** box and click the **Touch** button. 

CAUTION: Make sure to select the position of the tool depending if it is installed on the front or the backside.

Step 9: Next select if the tool is on the front side or the backside and make sure that the **Z Wear** and **X Wear** values are **0.00**.



Step 10: Click the **Save** button to save and complete tool calibration.


Save

7.11.2. Mill Tool Calibration Steps

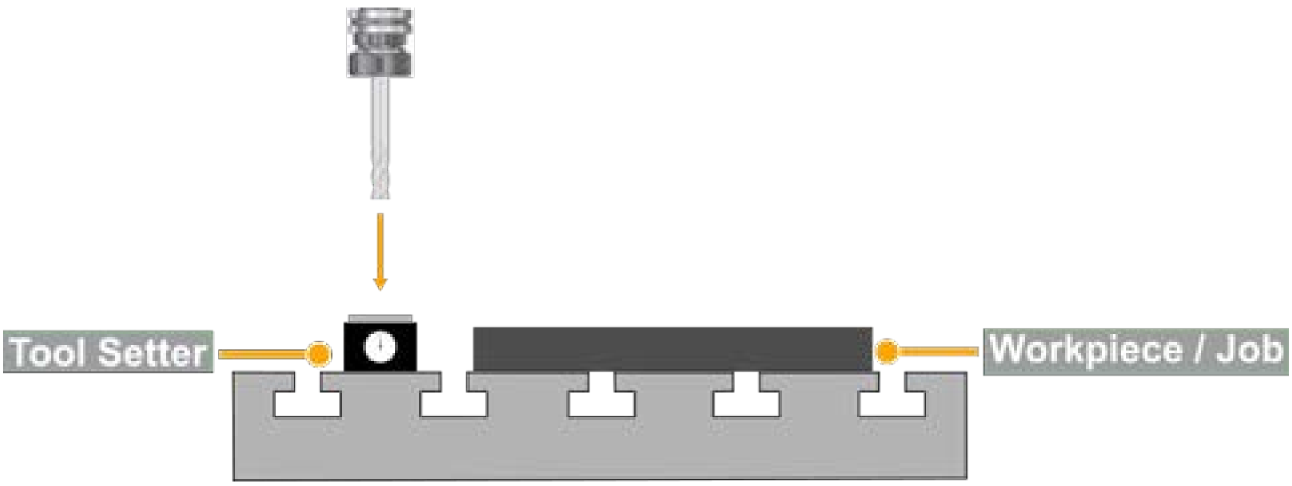
For routers and milling machines, tool length can be calibrated for manually or automatically by using a tool setter or a simple touch plate.

INFORMATION: More information about Touch Probe and Plates setup can he found on this link [CLICK HERE]

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

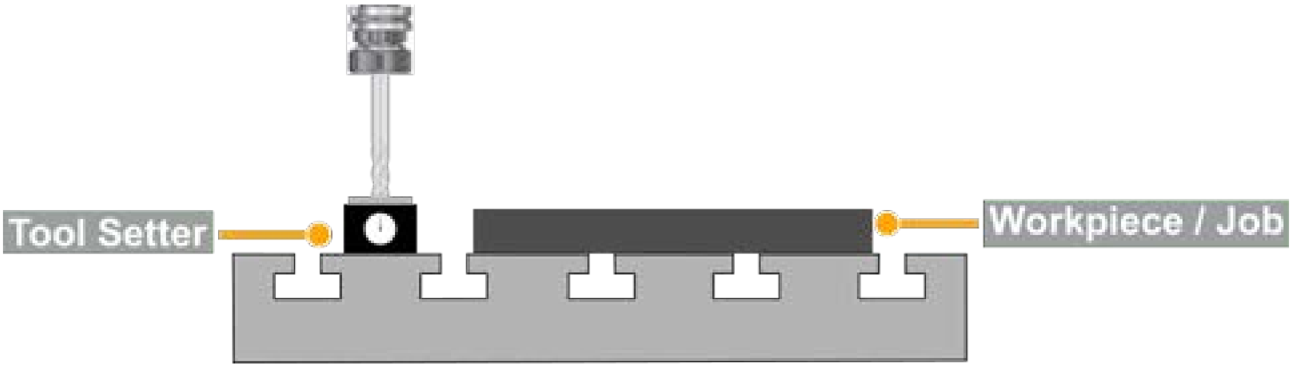
CNC Machine Tool Height Calibration

Step 1: Place the tool setter at a predefined position on the machine.



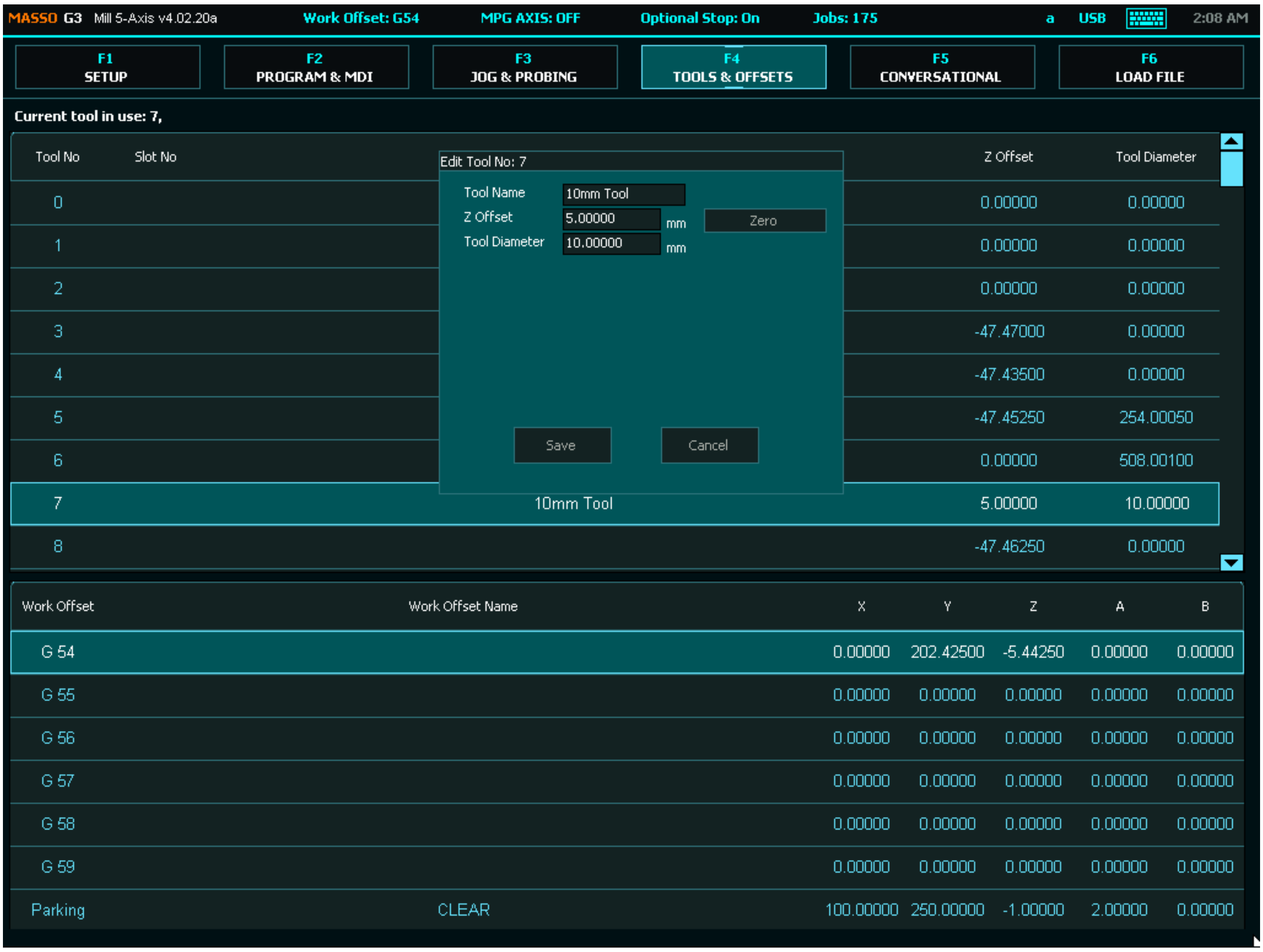
Step 2: On MASSO go to **F3-JOG** screen, next move the tool in position on top of the tool setter and touch the tool till the tool setter shows exactly 0.00.

> **CAUTION:** Once in position **DO NOT MOVE** the tool before completing the next step.

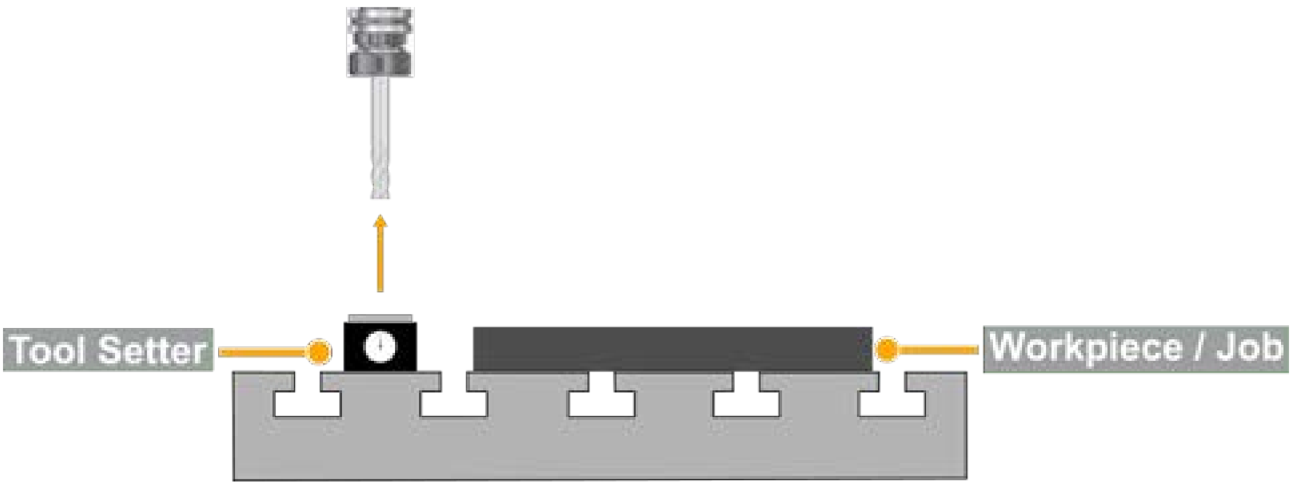


Step 3: On MASSO go to the **F4-Tools** screen and select the tool number you would like to assign to this tool. Now press the enter key to open the Edit Tool window.

Step 4: In the **Edit Tool** window give a tool name as per your requirement. Next move the click the **Zero** button to automatically calibrate the tool, MASSO will calculate the tool height and automatically fill the Z Offset value. Now the tool diameter can be entered if required and press **Save** button to save and complete the calibration process.



Step 5: Once the tool has been calibrated, please go to **F3-JOG** screen and move tool away from the tool setter.



v5.79 - 11 December, 2023

7.12. Work Offsets

Work offsets allows the user to position the work piece and cutting tool to allow cutting at the required position. There are different types of offsets such as work and temporary offsets, its very important to understand these concepts as these will help you generate gcode from a CAD/CAM software and then how to position the work piece on the machine.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Masso Coordinate system - Masso Edition 05

7.13. Cutter Compensation - Z Wear

This feature currently undergoing Alpha testing and will be available for MASSO G3 & MASSO Touch in an upcoming Beta software release.

Cutter compensation on MASSO consists of Z Wear, G40, G41 & G42

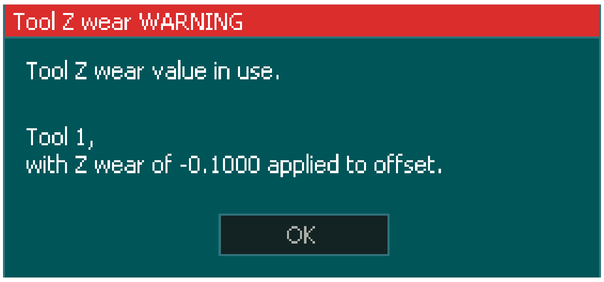
- **Z Wear** - Compensation (Automatic)
- **G40** - Cutter Compensation cancel
- **G41** - Cutter Compensation Left
- **G42** - Cutter Compensation Right

G40, G41 & G42

- G40, G41 & G42 are documented in the Supported Gcode section and can be accessed by selection the appropriate links above.
- These Gcodes deal with the change of cutter diameter over time as a cutter wears down with use though they also have other applications
- Gcode needs to be specially written to use these Gcodes correctly. Simply adding the codes to existing Gcode files will create unpredictable results.

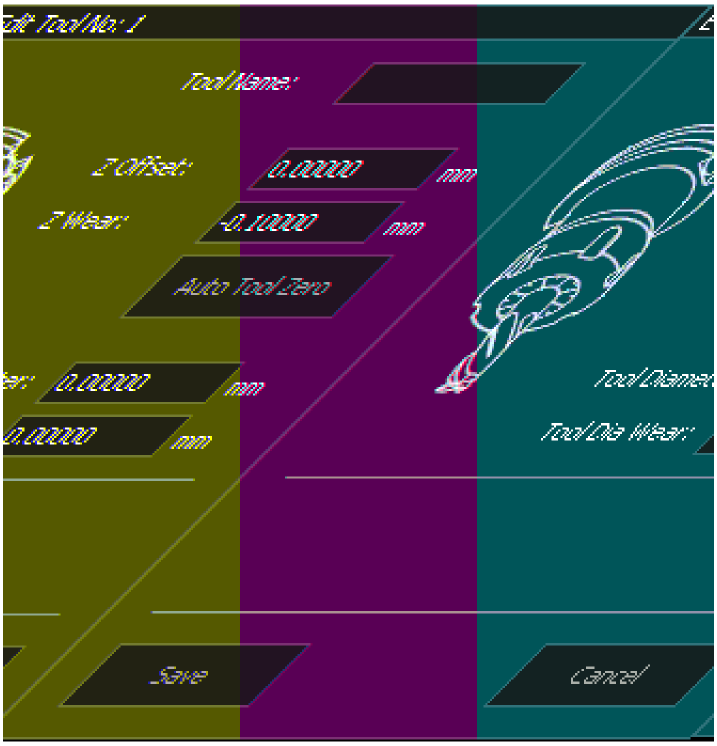
Z Wear

- This feature does not have a dedicated Gcode and is implemented automatically when a Z wear value other than 0 is specified.
- It does not require specially written Gcode to use.
- The Z wear value is entered into the F4 tool table using the Tool Edit page.
- The Z wear value is automatically added to the measured tool length.
- A negative Z wear value indicates that the tool is worn and is shorter than originally measured.
- A positive Z wear value indicates that the tool is longer than measured.
- If using Auto tool Zero the wear value is added to the measured length.
- To cancel set the Z wear value to 0
- If a Z wear value is present when the tool is measured using Auto Tool Zero an informational warning will be put on screen to alert the user but it will not stop machine operation.



Warning after Auto Tool Zero measures tool

- The Z wear value can be manually entered in the Tool edit screen.



Tool is worn by 0.1mm

7.14. Conversational Programming

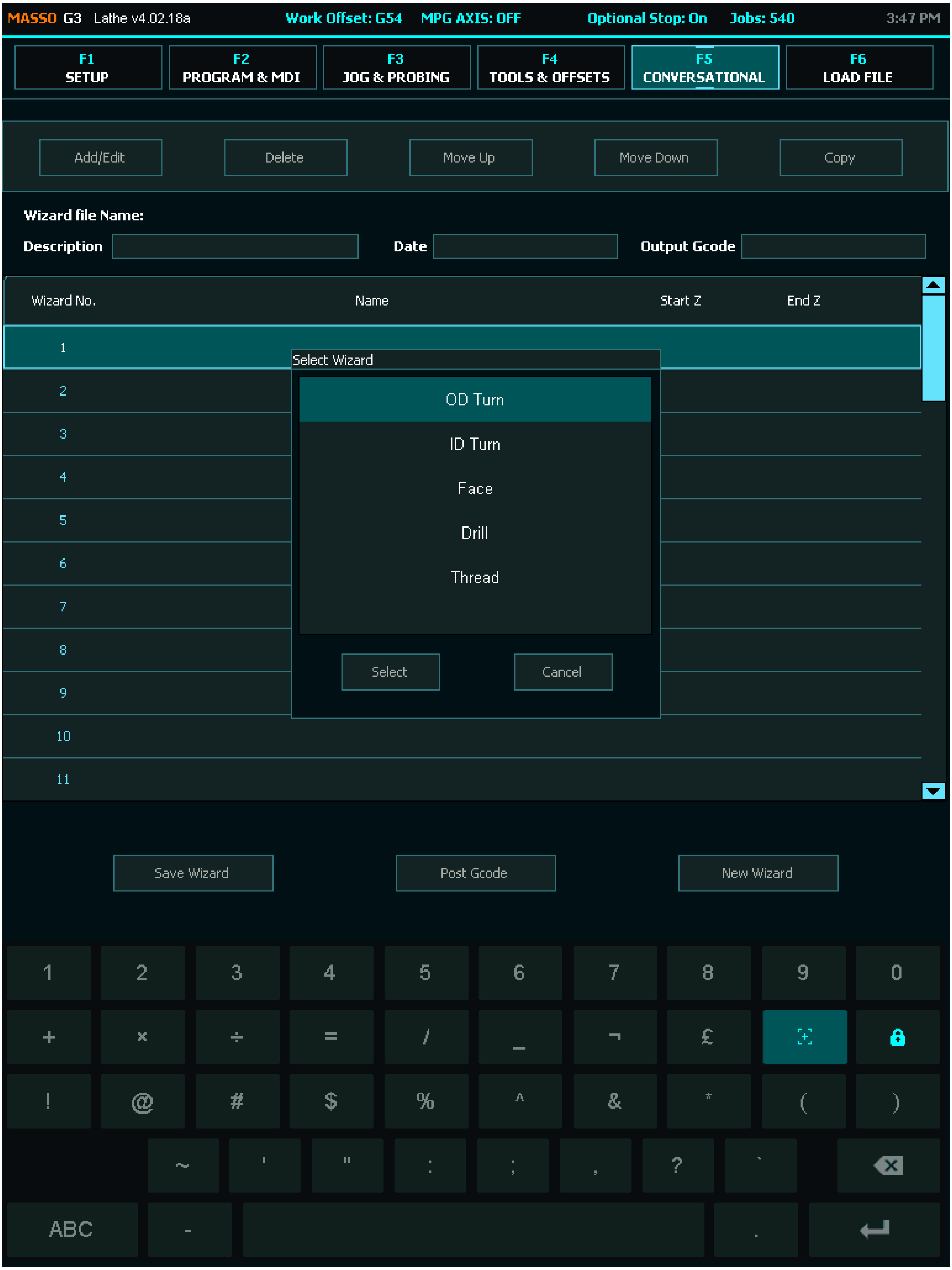
Read other subtopics below:

7.14.1. Lathe Conversational Wizards

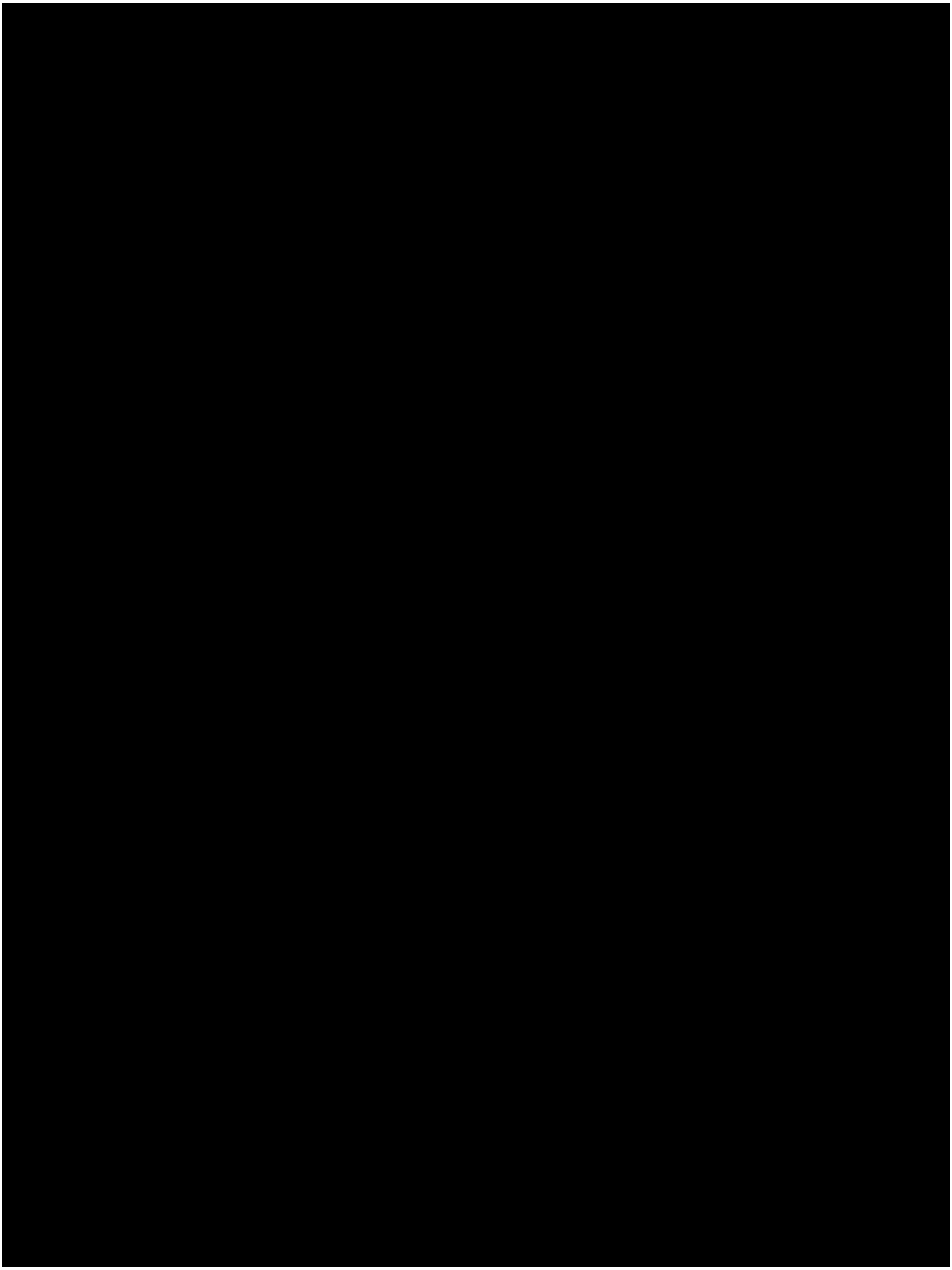
MASSO has built-in conversational wizards to easily generate gcode programs for basic machining operations by entering basic information.

List of wizards available for Lathe Machines:

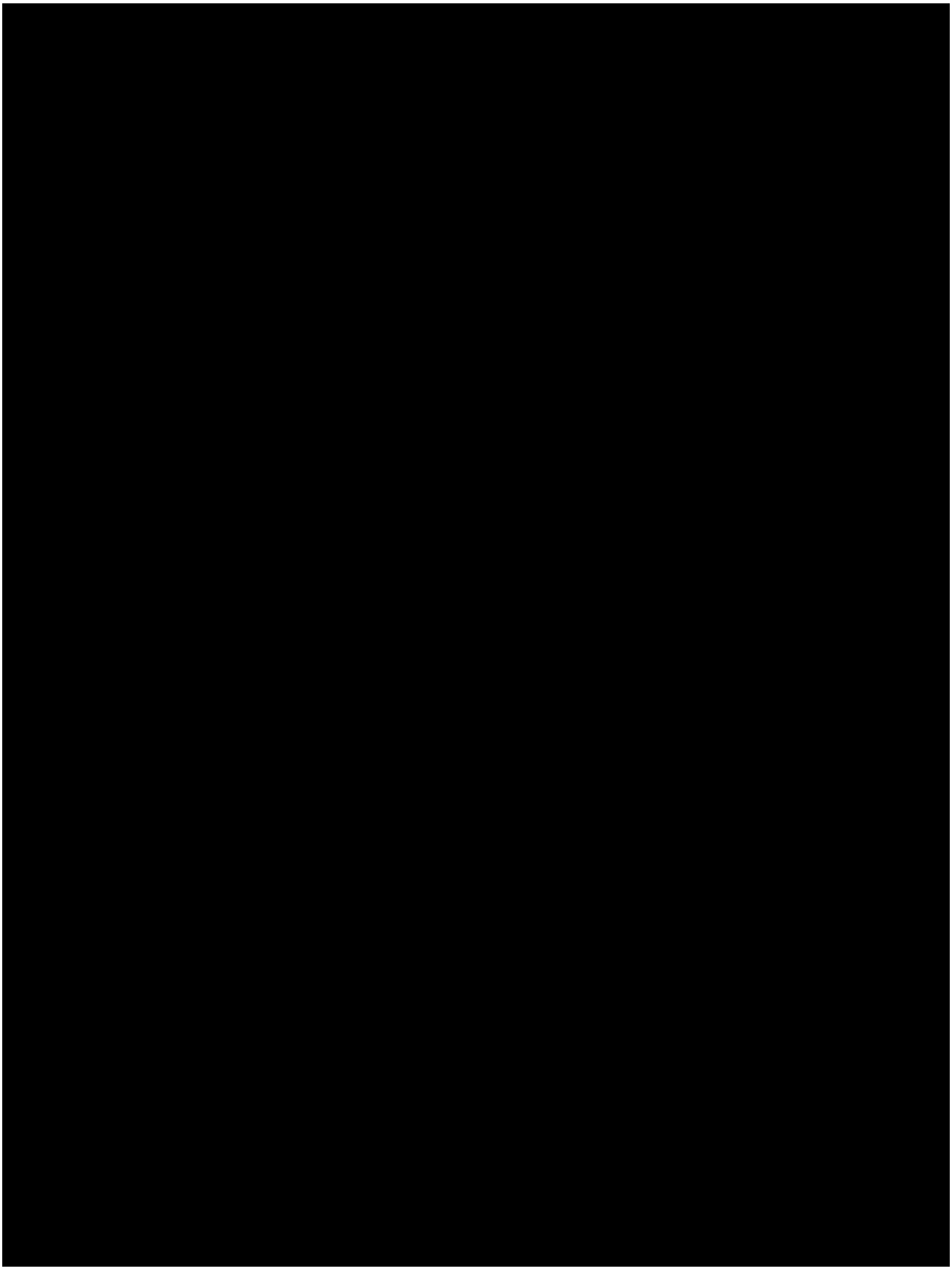
- Outer diameter turn wizard
- Inside turn wizard
- Facing wizard
- Drilling wizard
- Threading wizard



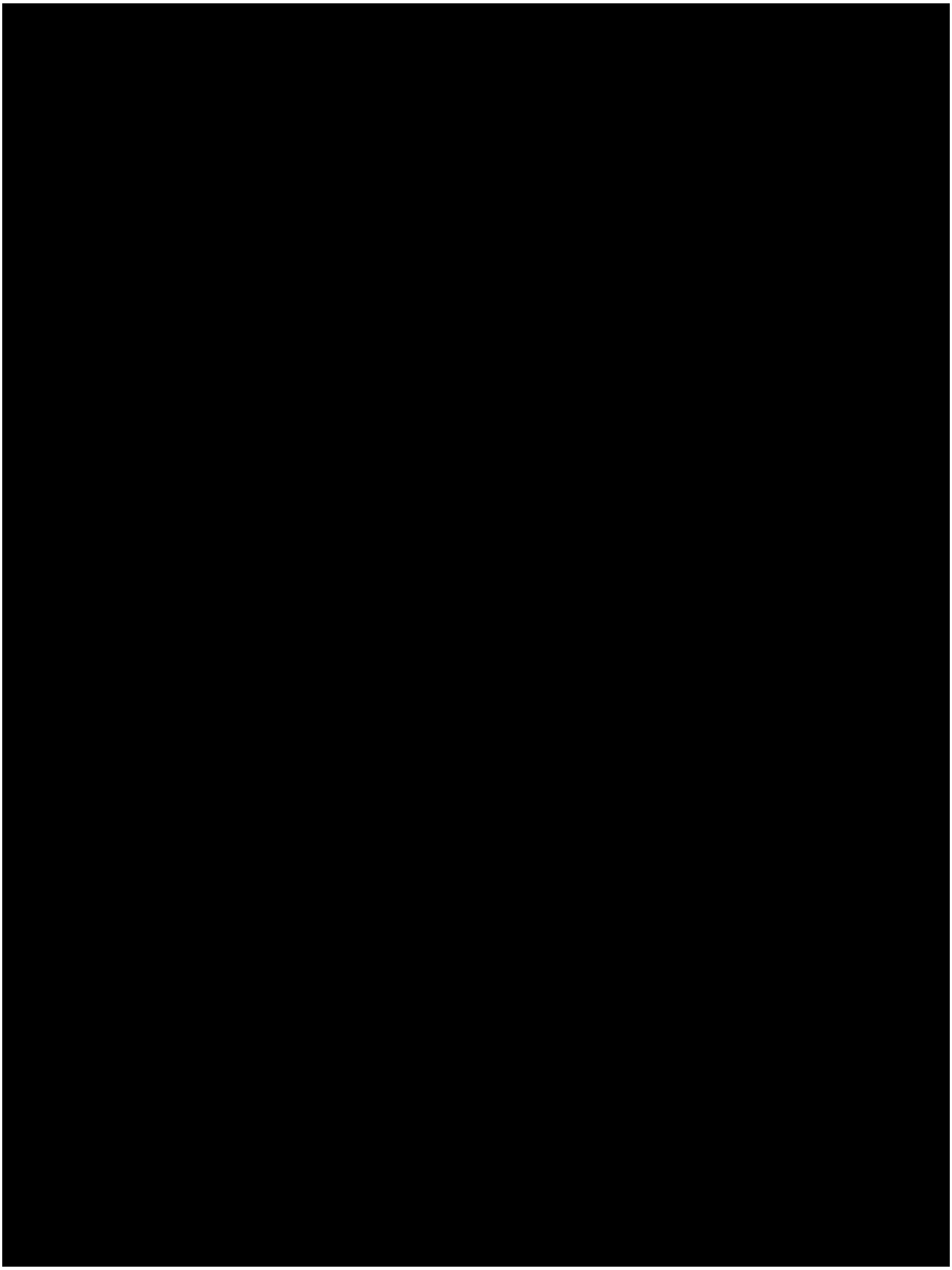
Outer diameter turn wizard



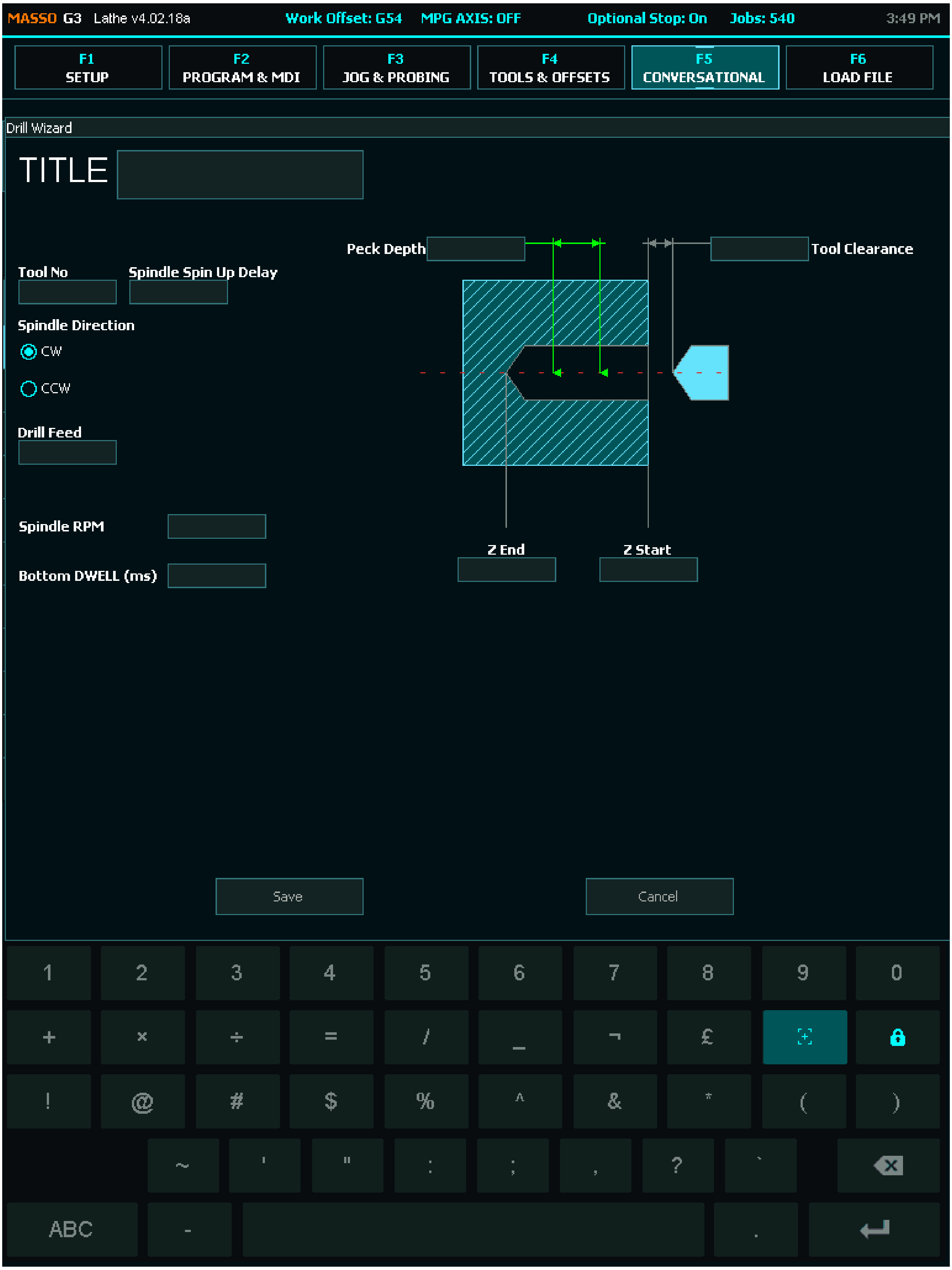
Inside turn wizard



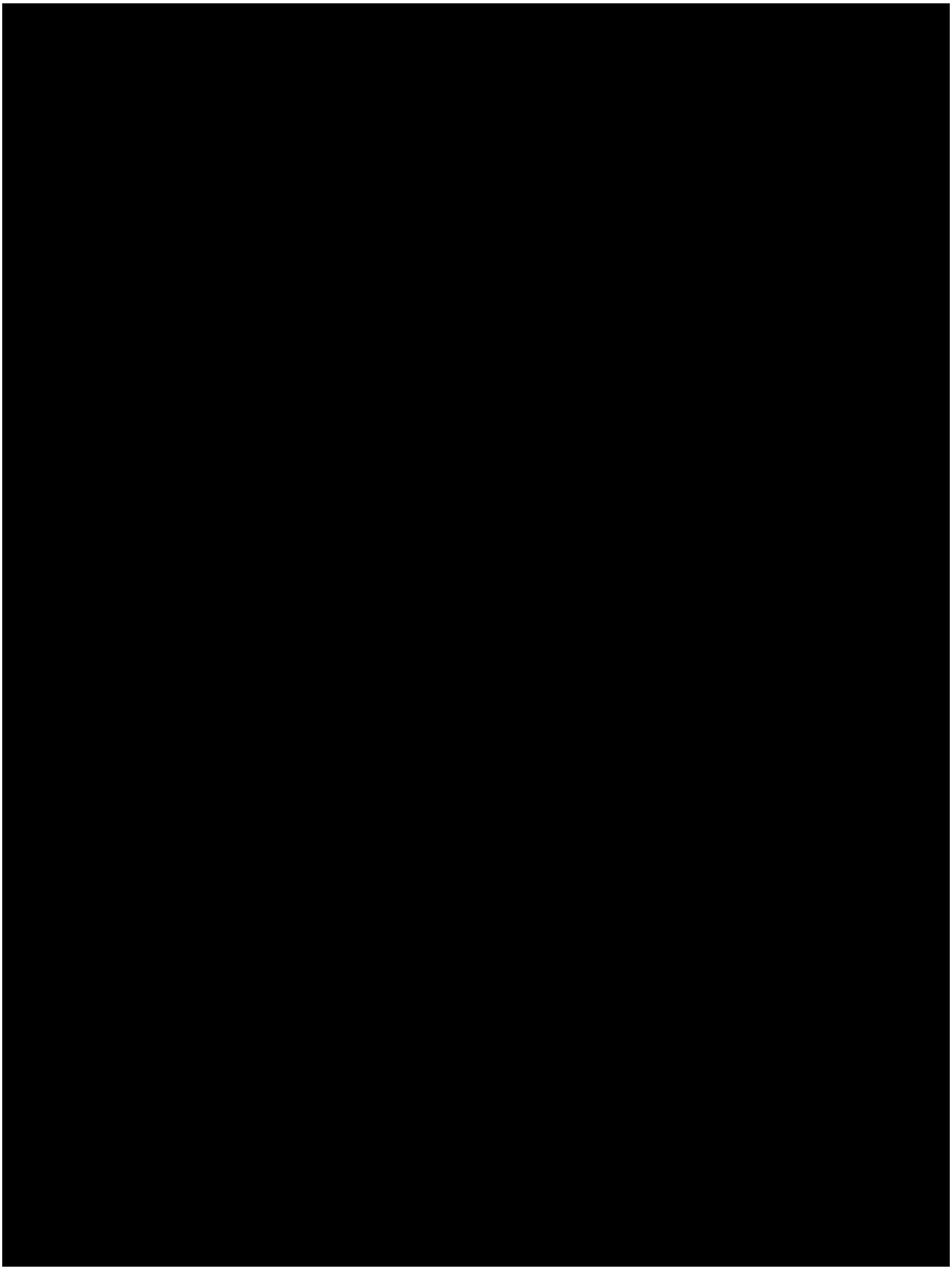
Facing wizard



Drilling wizard



Threading wizard

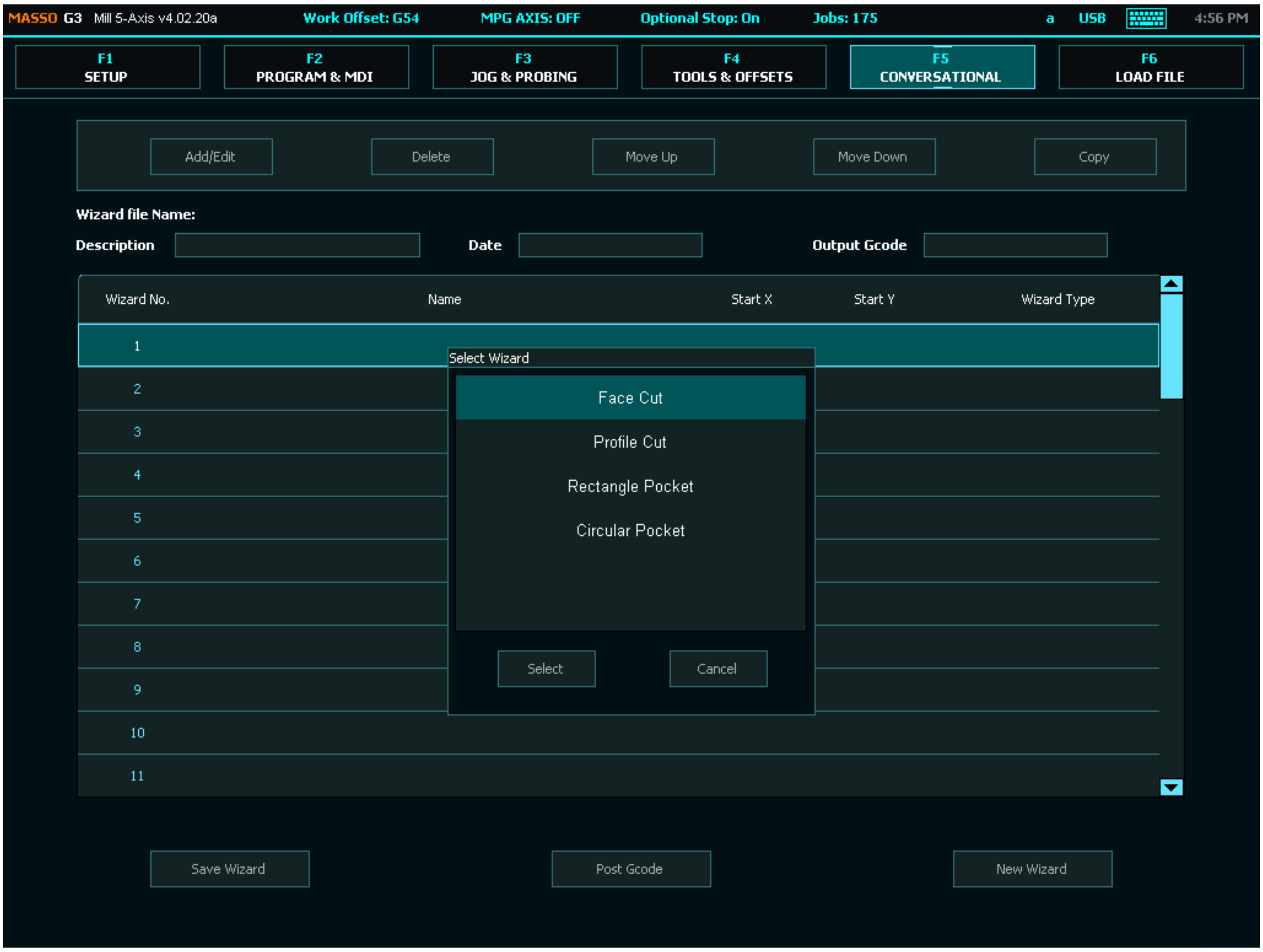


7.14.2. Mill Conversational Wizards

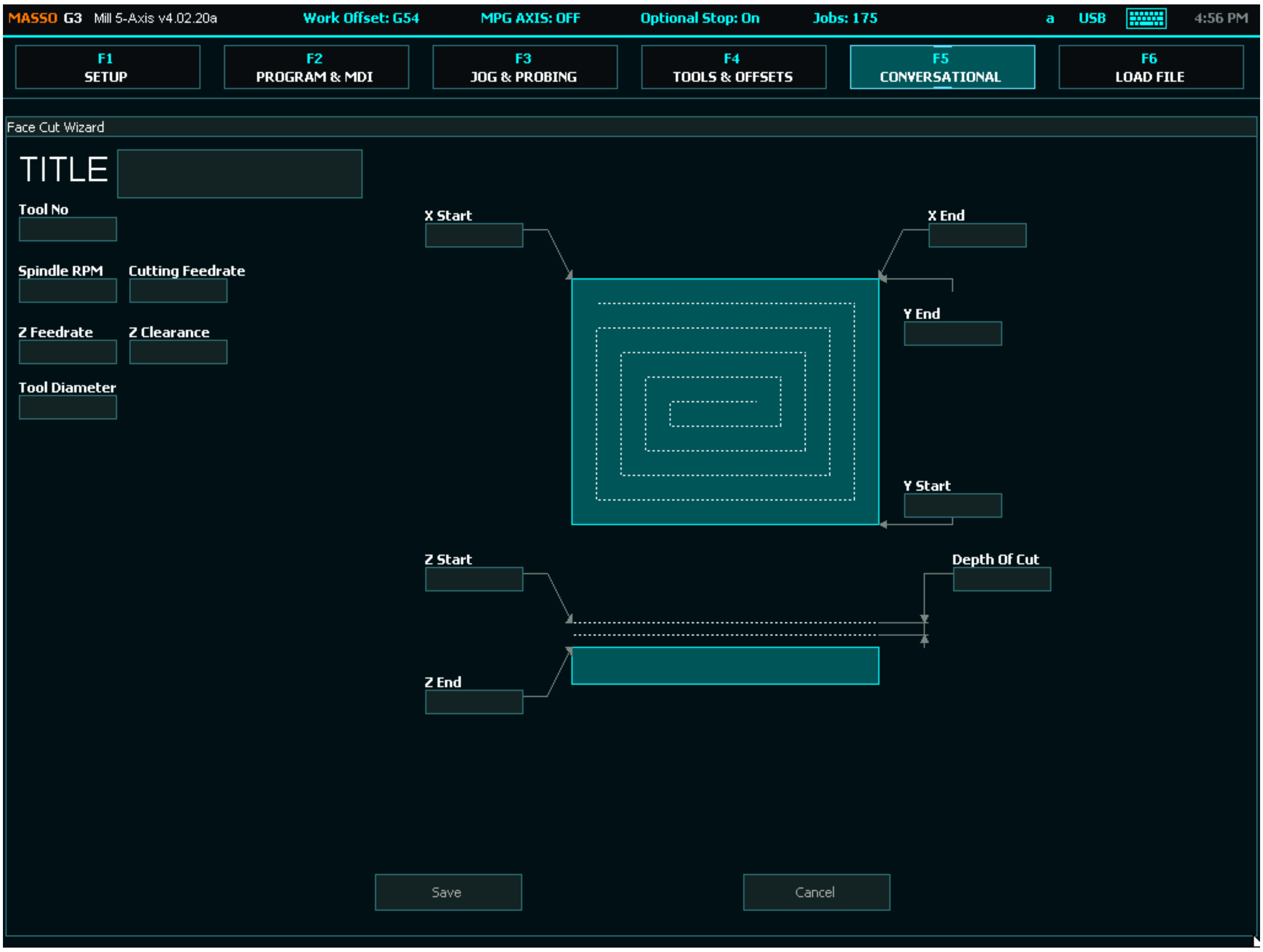
MASSO has built-in conversational wizards to easily generate gcode programs for basic machining operations by entering basic information.

List of wizards available for Milling Machines:

- Face cut wizard
- Profile cut wizard
- Rectangular pocket wizard
- Circular pocket wizard



Face cut wizard



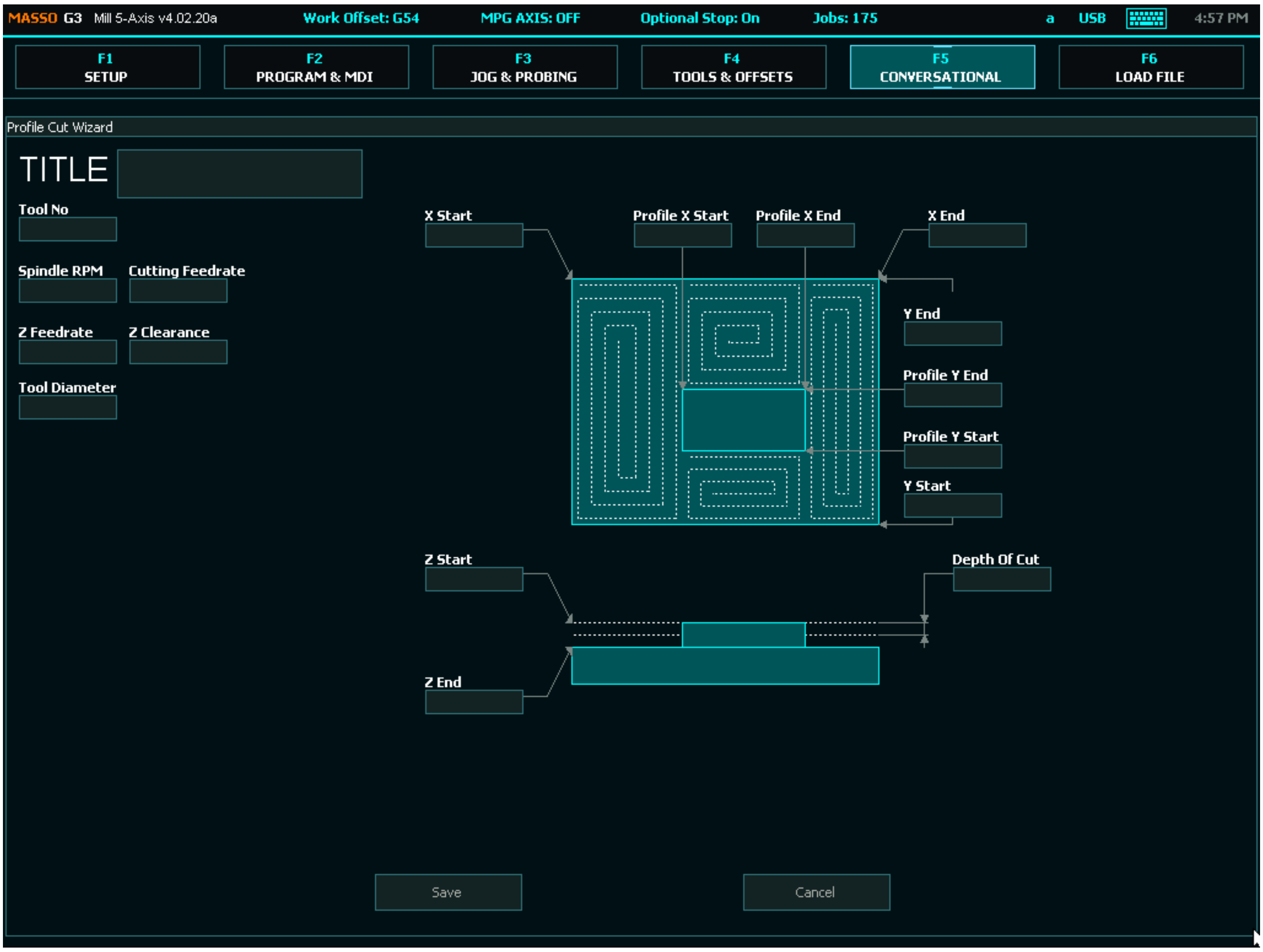
Please be aware that when facing that material will be left on inside corners. This is due to cutters being round and are physically unable to remove material from an inside corner

To ensure that the corner material is removed the X & Y start and end points must be offset by a minimum of the cutter radius. This will give an overall larger cut area.

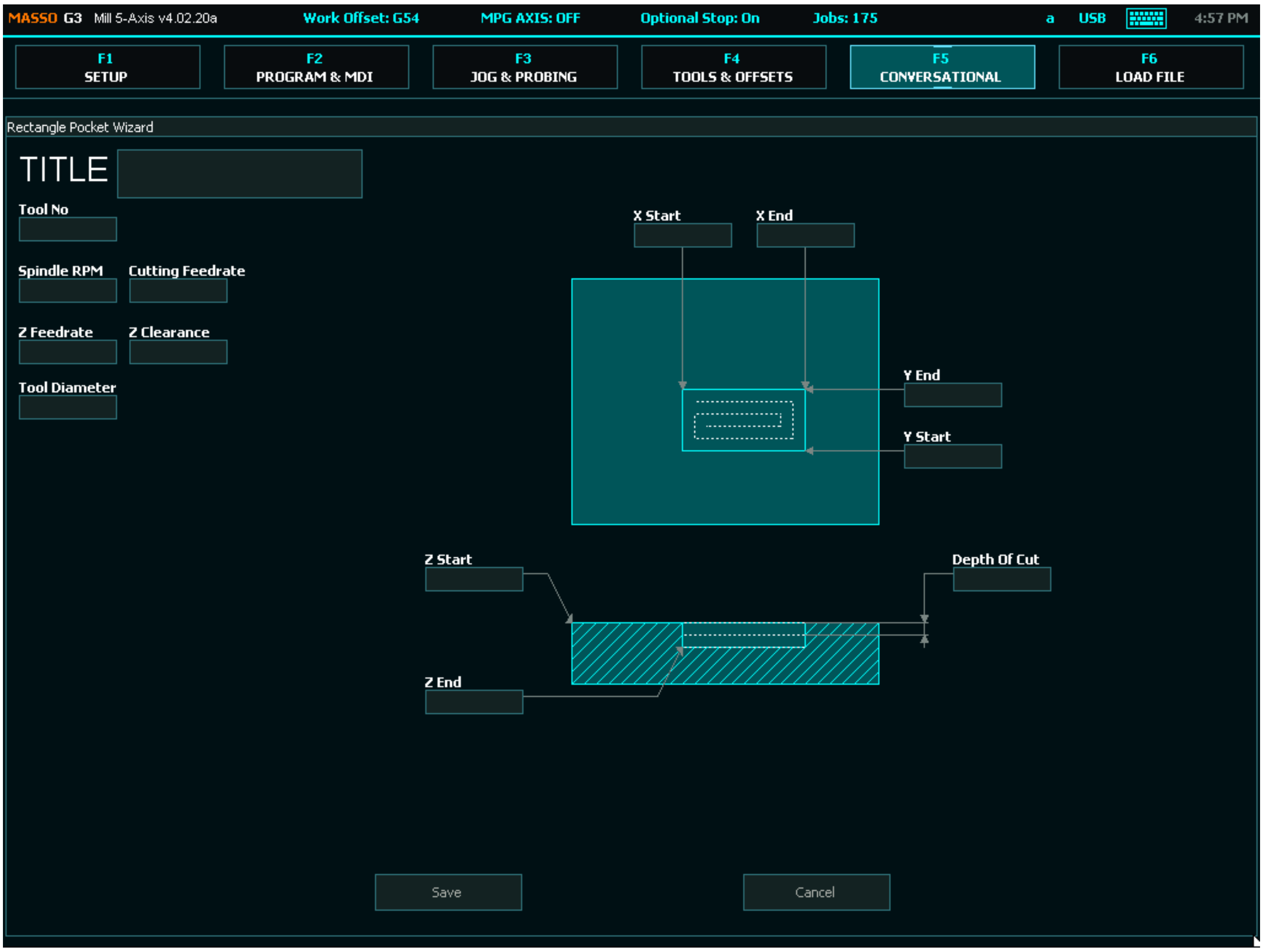
If you cannot make the cut area larger, using a smaller cutter will reduce the material left on the corners but will increase the cut time.

Tool step over is 100% of the tool diameter.

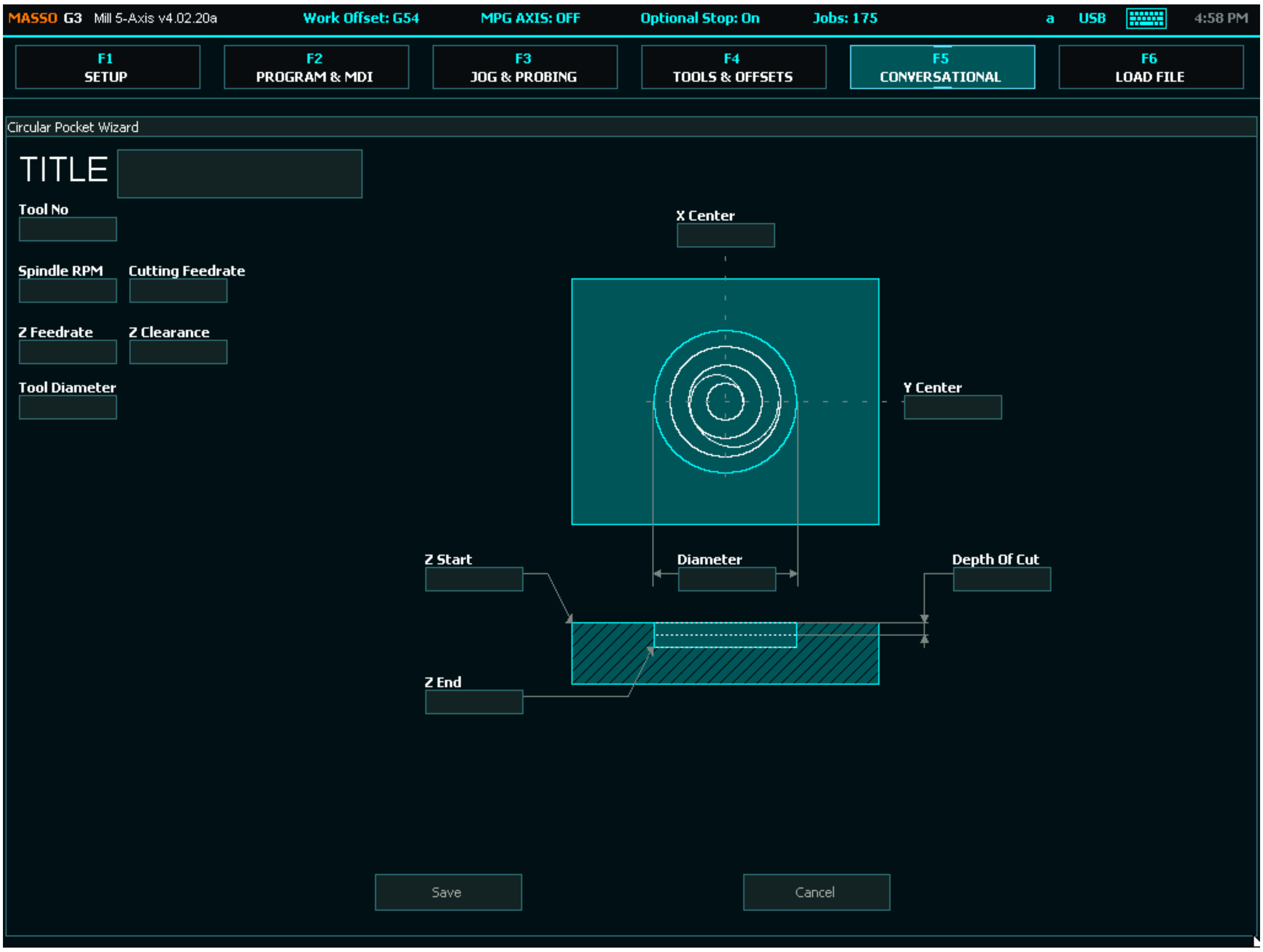
Profile cut wizard



Rectangular pocket wizard



Circular pocket wizard


MASSO G3 Mill 5-Axis v4.02.20a
Work Offset: G54
MPG AXIS: OFF
Optional Stop: On
Jobs: 175
a
USB
4:58 PM
F1 SETUP
F2 PROGRAM & MDI
F3 JOG & PROBING
F4 TOOLS & OFFSETS
F5 CONVERSATIONAL
F6 LOAD FILE
Circular Pocket Wizard
TITLE
Tool No
Spindle RPM
Cutting Feedrate
Z Feedrate
Z Clearance
Tool Diameter
X Center
Y Center
Z Start
Diameter
Depth Of Cut
Z End
Save
Cancel

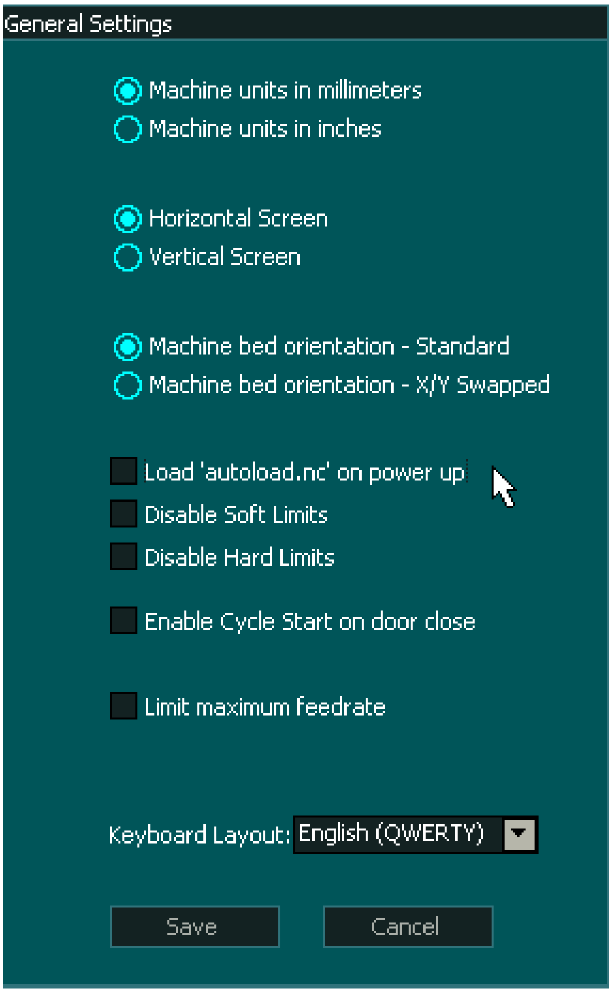
7.15. Auto Loading G-code

G-Code files can be automatically loaded by MASSO for special production runs and below are the different ways of automatically loading gcode files.

Automatically loading gcode file on power up or when connecting USB pen drive:

- Go to **"F1-Setup"** screen and open the "**General Settings"** window.
- Tick the **Load 'autoload.nc' on power up** option and click **Save** button.
- Now MASSO will look for a file **autoload.nc** on the USB Flash drive every time it powers up or if a USB Flash drive is connected. Once the file is found, its automatically loaded and pressing cycle start will start the job.

INFORMATION: The autoload files must be in root folder of the USB Flash drive.

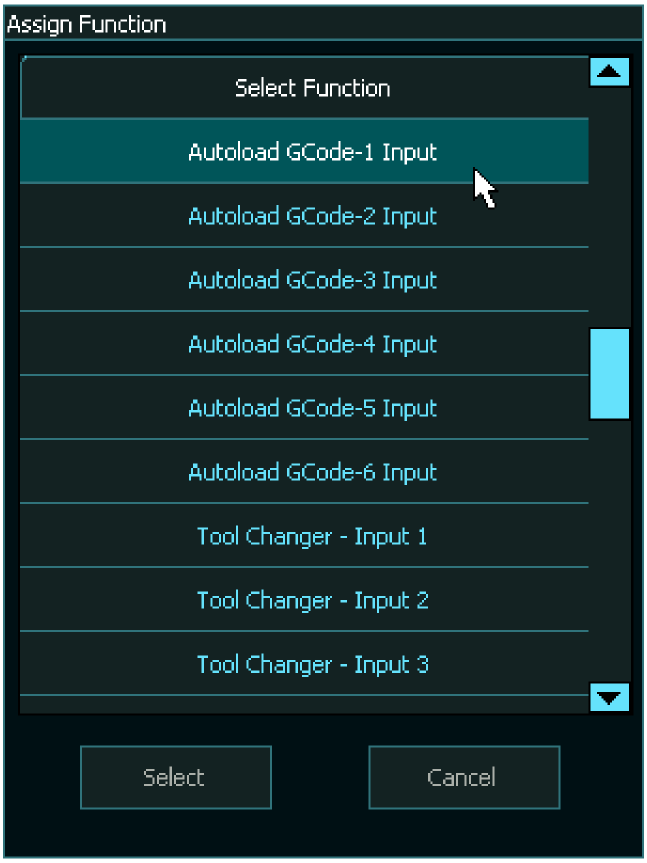


Loading gcode file on Input signal going high:

- Go to **"F1-Setup"** screen and go to the **"INPUTS"** list.
- From the **INPUTS** list select one of the free inputs and select **Autoload GCode-1 Input** option and double click to assign the function to the input.
- When this input goes **HIGH,** MASSO will look for a file **autoload1.nc** on the USB pen drive, once the file is found, its automatically loaded and pressing cycle start will start the job.

INFORMATION: You can assign up to 6 autoload functions on inputs.

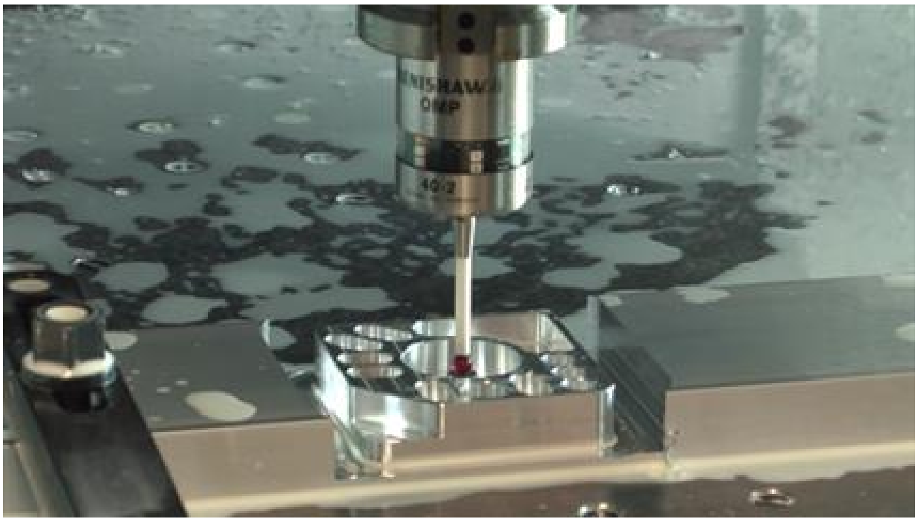
INFORMATION: The autoload files must be in root folder of the USB pen drive.



7.16. Probing

MASSO supports interactive part probing option that allows the user to probe parts and set work offsets. The following probing features are available:

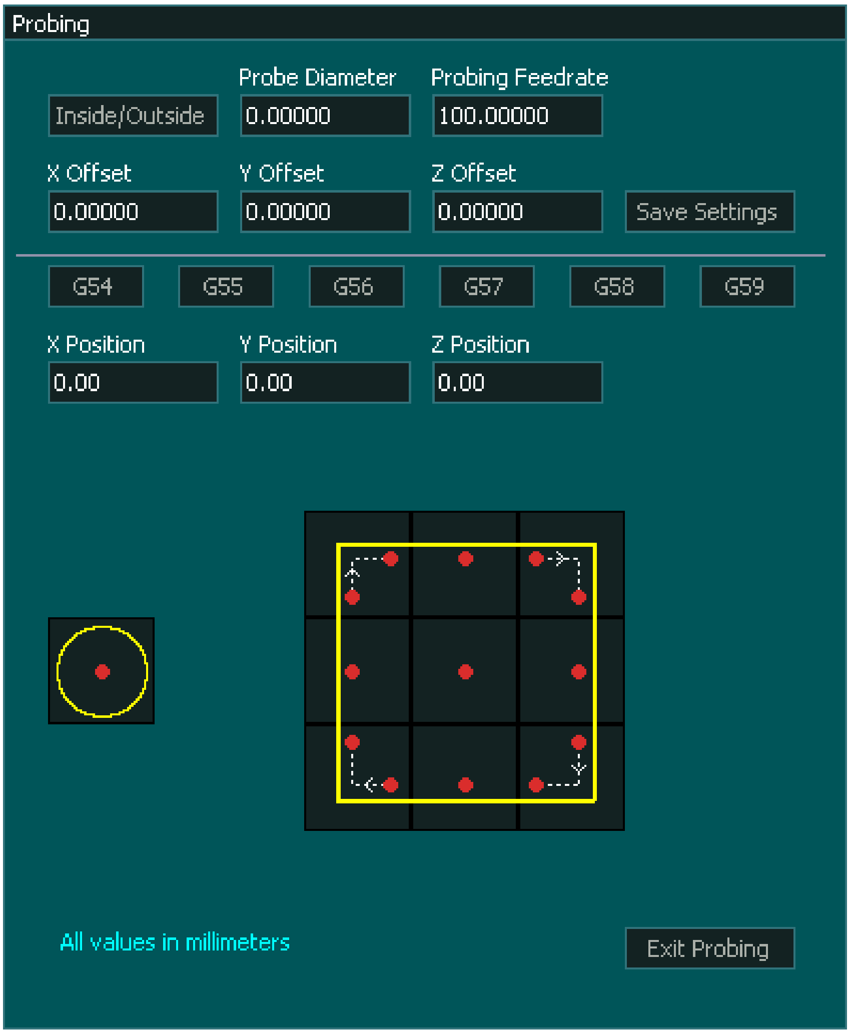
- Top of part
- Sides of part
- Corners of part
- Auto find center of holes

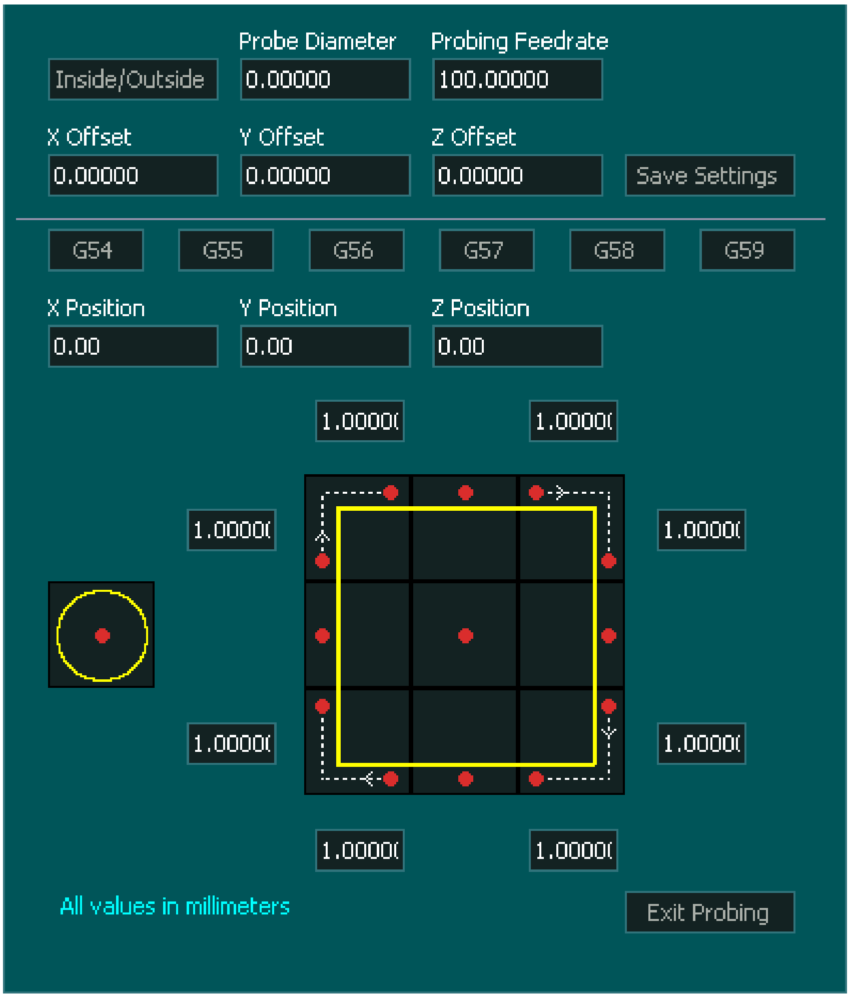


INFORMATION: Touch probe wiring instruction **CLICK HERE**

INFORMATION: Touch plate wiring instruction **CLICK HERE**

INFORMATION: ***Save Settings*** button needs to be pressed for a change of probing mode to take effect.


Probing
Probe Diameter
Probing Feedrate
Inside/Outside
0.00000
100.00000
X Offset
Y Offset
Z Offset
0.00000
0.00000
0.00000
Save Settings
G54
G55
G56
G57
G58
G59
X Position
Y Position
Z Position
0.00
0.00
0.00
All values in millimeters
Exit Probing



Selecting a Work offset

- There are 6 work offset buttons on the Probing screen (Available in Version 5 software and higher)
- This allows the user to select which work offset the probing result will be save in.
- The work offset needs to be selected before doing the probing cycle as the result is stored in the active offset.
- The current work offset is displayed at the top of the screen
- When you exit the probing screen MASSO will remain in the work offset you last selected.

INFORMATION: If you select the wrong probing cycle by mistake, Press Feed hold or ESC on the keyboard. This will bring probing to a halt and you can select the correct one.

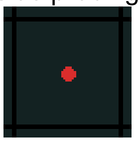
INFORMATION: For more information on each probing cycle and how to use it please use the links below.

CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the Probe indication at the top of the screen. When triggered the indication will change green Probe This is done by touching the probe tip in case of a 3D touch probe or by tapping the plate against the tool in case of a probing plate.

Read other subtopics below:

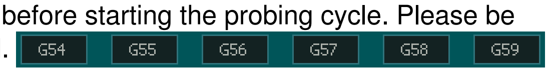
7.16.1. Top of Part Probing Cycle

Top of Part Probe cycle

- This Probing cycle is available for both inside and outside probing cycles and can be started by pressing the center square in the Large probing block 
- When entering new values or changing between inside and outside remember to press the Save button to make the new values or selection active
- This will start the Z axis probing down at a the rate specified in the Probing Feedrate box 

- When the probe finds the surface the Z axis DRO coordinate will be updated with the value specified in the Z Position box 

- The Z probe offset value is most commonly used when using a probing touch off to compensate for the touch off thickness. 

- The Z axis will then return to the starting position where probing began and display it's new coordinate based on its relative position to the probed surface.
- The probing cycle can be stopped by pressing the same or a different probing cycle button.
- As of Software version 5.0 and above the user can select which Work offset the probe result will be applied to by selecting a appropriate work offset button before starting the probing cycle. Please be aware that only the selected work offset will be updated. 

INFORMATION: If you select the wrong probing cycle by mistake, Press Feed hold or ESC on the keyboard. This will bring probing to a halt and you can select the correct one.

CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the 

indication at the top of the screen. When triggered the indication will change green 

This is done by touching the probe tip in case of a 3D touch probe or by tapping the plate against the tool in case of a probing plate.

7.16.2. Side of Part Probe Cycles

There are 8 Side probing cycles. 4 are inside probing cycles and 4 are Outside probing cycles.

The one you choose will be determined by whether you are probing the inside or the outside of a part and also which axis you will be probing X or Y

When entering new values or changing between inside and outside remember to press the Save button to make the new values or selection active

First select Inside or outside by pressing the Inside/Outside button on the probing cycles screen 

Next press the Save settings button to complete the change 

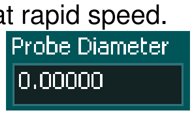
X & Y offsets can be used to compensate for errors or offset the probe from the Spindle because it is in a position different from the spindle. 

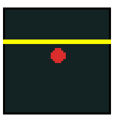
The probing cycle can be stopped by pressing the same or a different probing cycle button.

As of Software version 5.0 and above the user can select which Work offset the probe result will be applied to by selecting a appropriate work offset button before starting the probing cycle. Please be aware that only the selected work offset will be updated. 

Inside, Side of part probing

- The Red dot indicates the position of the probe at the start of the probing cycle and the probe will move towards the Yellow line which represents the object being probed.
- The probing will occur at the speed entered in the Probing Feedrate box 

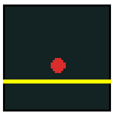
- After touch off the Axis will return to the start position at rapid speed.
- Enter the Probe diameter into the Probe Diameter box 



Probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the Y Position box 

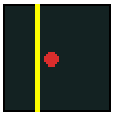
The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the Y Position box 

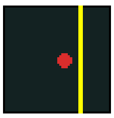
The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the -X direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the X Position box 

The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

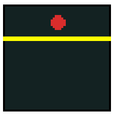
The DRO will update with the value in the X Position box 

The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.

Outside, Side of part Probing

- The Red dot indicates the position of the probe at the start of the probing cycle and the probe will move towards the Yellow line which represents the object being probed.
- The probing will occur at the speed entered in the Probing Feedrate box 

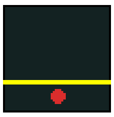
- After touch off the Axis will return to the start position at rapid speed.
- Enter the Probe diameter into the Probe Diameter box 



Probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the Y Position box 

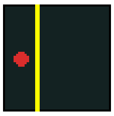
The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the Y Position box 

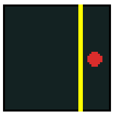
The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the X Position box

The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.



Probe will start moving in the -X direction at the specified Probing feed rate until it touches the part.

The DRO will update with the value in the X Position box

The Probe will return to its start position and display it's new coordinate based on its relative position to the probed surface.

INFORMATION: If you select the wrong probing cycle by mistake, Press Feed hold or ESC on the keyboard. This will bring probing to a halt and you can select the correct one.

CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the Probe indication at the top of the screen. When triggered the indication will change green Probe This is done by touching the probe tip in case of a 3D touch probe or by tapping the plate against the tool in case of a probing plate.

7.16.3. Corner Probing Cycles

There are 8 Corner probing cycles. 4 are inside probing cycles and 4 are Outside probing cycles.

The one you choose will be determined by whether you are probing the inside or the outside of a part

When entering new values or changing between inside and outside remember to press the Save button to make the new values or selection active

First select Inside or outside by pressing the Inside/Outside button on the probing cycles screen 

Next press the Save settings button to complete the change 

X & Y offsets can be used to compensate for errors or offset the probe from the Spindle because it is in a position different from the spindle. 

Each corner probing button shows a dotted white line indicating the order in which probing will take place.

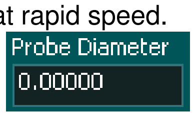
The X & Y Position boxes are used to define the working coordinate of the surface at the point of touch.  

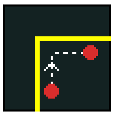
The probing cycle can be stopped by pressing the same or a different probing cycle button.

As of Software version 5.0 and above the user can select which Work offset the probe result will be applied to by selecting a appropriate work offset button before starting the probing cycle. Please be aware that only the selected work offset will be updated. 

Inside Corner Probing

- The Red dot indicates the position of the probe at the start of the probing cycle and the probe will move towards the Yellow line which represents the object being probed.
- The dotted white line indicating the order in which probing will take place.
- Each probing cycle is an automatic two part probing cycle.
- The probing will occur at the speed entered in the Probing Feedrate box 

- After touch off the Axis will return to the start position at rapid speed.
- Enter the Probe diameter into the Probe Diameter box 

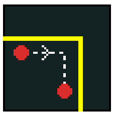


The probe will start moving in the -X direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position.

The probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position and display its new coordinates based on its relative position to the probed surfaces.

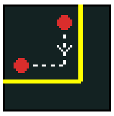


The probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position.

The probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position and display its new coordinates based on its relative position to the probed surfaces.

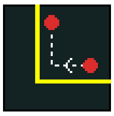


The probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position.

The probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position and display its new coordinates based on its relative position to the probed surfaces.



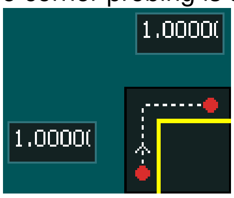
The probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

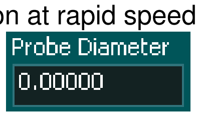
The Probe will return to its start position.

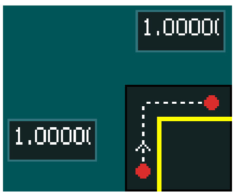
The probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position and display its new coordinates based on its relative position to the probed surfaces.

Outside Corner probing

- When Outside corner probing is selected a set of 2 distance boxes are displayed on the screen at each corner. 
- These boxes represent how far the X and Y axis will travel around the corner before starting the 2nd probe.
- The Red dot indicates the position of the probe at the start of the probing cycle and the Yellow line represents the object being probed.
- The White arrow represents the order in which probing will occur in the cycle and also the direction of travel the probe will take
- Each probing cycle is an automatic two part probing cycle.
- The probing will occur at the speed entered in the Probing Feedrate box 

- After touching off the Axis will return to the start position at rapid speed.
- Enter the Probe diameter into the Probe Diameter box 



The probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

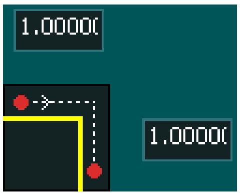
The Probe will return to its start position.

The probe will move at probing speed in the +Y direction for the distance shown.

The probe will move at probing speed in the +X direction for the distance shown.

The probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to the start of the 2nd probing and display its new coordinates based on its relative position to the probed surfaces.



The probe will start moving in the -Y direction at the specified Probing feed rate until it touches the part.

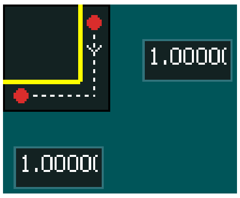
The Probe will return to its start position.

The probe will move at probing speed in the +X direction for the distance shown.

The probe will move at probing speed in the -Y direction for the distance shown.

The probe will start moving in the -X direction at the specified Probing feed rate until it touches the part.

The Probe will return to the start of the 2nd probing and display its new coordinates based on its relative position to the probed surfaces.



The probe will start moving in the -X direction at the specified Probing feed rate until it touches the part.

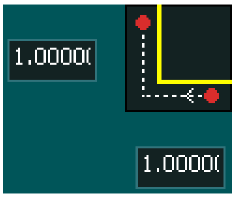
The Probe will return to its start position.

The probe will move at probing speed in the -Y direction for the distance shown.

The probe will move at probing speed in the -X direction for the distance shown.

The probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to the start of the 2nd probing and display its new coordinates based on its relative position to the probed surfaces.



The probe will start moving in the +Y direction at the specified Probing feed rate until it touches the part.

The Probe will return to its start position.

The probe will move at probing speed in the -X direction for the distance shown.

The probe will move at probing speed in the +Y direction for the distance shown.

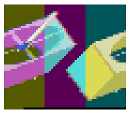
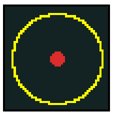
The probe will start moving in the +X direction at the specified Probing feed rate until it touches the part.

The Probe will return to the start of the 2nd probing and display its new coordinates based on its relative position to the probed surfaces.

INFORMATION: If you select the wrong probing cycle by mistake, Press Feed hold or ESC on the keyboard. This will bring probing to a halt and you can select the correct one.

CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the Probe indication at the top of the screen. When triggered the indication will change green Probe This is done by touching the probe tip in case of a 3D touch probe or by tapping the plate against the tool in case of a probing plate.

7.16.4. Center Probing cycles

This probing cycle is available from both inside and outside probing cycle pages. Shown as  on MASSO G3 / MASSO Touch and  on G2

The Red dot indicates the position of the probe at the start of the probing cycle and the Yellow line which represents the side object being probed.

It is used to locate the center of an object such as a hole or a pocket.

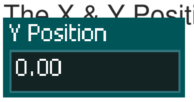
When entering new values or changing between inside and outside remember to press the Save button to make the new values or selection active.

The probing will occur at the speed entered in the Probing Feedrate box 

Probing the center of an object is an automatic 4 probe cycle process and after each touching the side the probe will rapid back to the stating position of the next probing before starting the next probe.

Enter the Probe diameter into the Probe Diameter box 

X & Y offsets can be used to compensate for errors or offset the probe from the Spindle because it is in a position different from the spindle. 

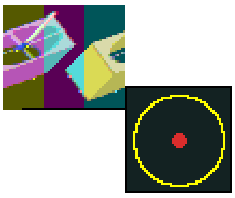
The X & Y Position boxes are used to define the working coordinate at the completion of the probing cycle. 

The probing cycle can be stopped by pressing the same or a different probing cycle button.

As of Software version 5.0 and above the user can select which Work offset the probe result will be applied to by selecting a appropriate work offset button before starting the probing cycle. Please be aware that only the selected work offset will be updated. 

INFORMATION: You can only probe the inside of a part to find center. You cannot probe the outside of a part to find center.

Center Probing Cycle



- The probe will move in the -X direction at the specified Probing feed rate until it touches the part.
- The probe will return to its start position at rapid speed.
- The probe will move in the +X direction at the specified Probing feed rate until it touches the part.
- The probe will move to the X position in the Center of these two readings.
- The probe will move in the -Y direction at the specified Probing feed rate until it touches the part.
- The probe will return to its start position at rapid speed.
- The probe will move in the +Y direction at the specified Probing feed rate until it touches the part.
- The probe will move to the Y position in the Center of these two readings.
- The DRO will be updated with the values shown in the X & Y Position boxes 

INFORMATION: If you select the wrong probing cycle by mistake, Press Feed hold or ESC on the keyboard. This will bring probing to a halt and you can select the correct one.

CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the 

indication at the top of the screen. When triggered the indication will change green 

This is done by touching the probe tip in case of a 3D touch probe or by tapping the plate against the tool in case of a probing plate.

8. Quick Start Guides

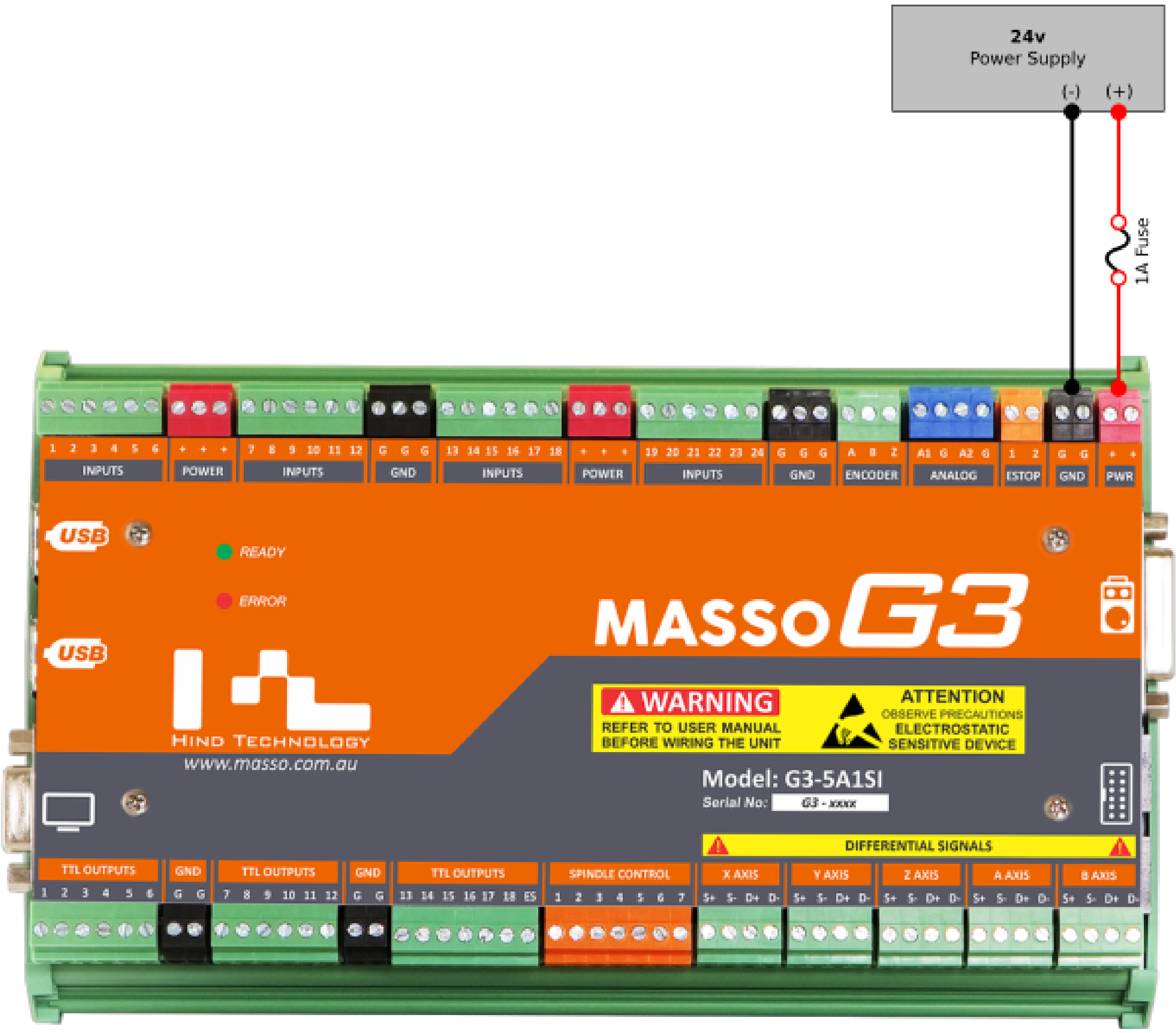
Read other subtopics below:

8.1. Best practice when wiring MASSO

The purpose of this document is to provide information on good work practices while setting up and wiring your MASSO. If you are unsure about the wiring of your machine especially mains voltage equipment, please consult a certified service technician.

Install a Fuse

WARNING: The installation of a 1 amp fuse between your Power Supply and MASSO is required to protect against an accidental short circuit of the auxiliary power connectors on MASSO, such an event can damage the controller beyond repair.



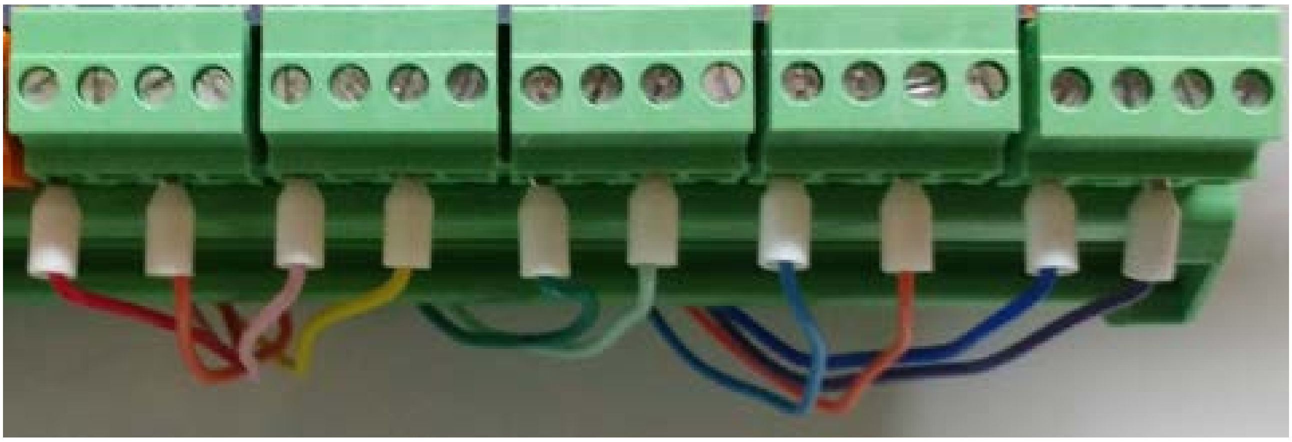
General

- When connecting, disconnecting or making wiring changes to MASSO turn off the power at the mains. This will ensure that if you should you accidentally touch a connection point while working on your system it will not immediately damage your system.

- Check your wiring after making wiring changes to ensure you have correctly wired your system before turning back on.

- Carry out wiring in a tradesman like manner keeping the wires neat where they connect to the screw terminals as a stray wire not captured can accidentally touch the terminal next to it and cause damage. While the use of Bootlace Ferrules are not required they can help keep your wires tidy and eliminate this problem

- Use coloured wires and keep records of how you have wired your MASSO and external devices. This will assist greatly with troubleshooting should you have an issue at a later date.



Sample colour coded wiring with Bootlace Ferrules

Auxiliary Power Terminals

The Auxiliary power terminals are the Red and Black terminals on MASSO G3 labeled POWER and GND.

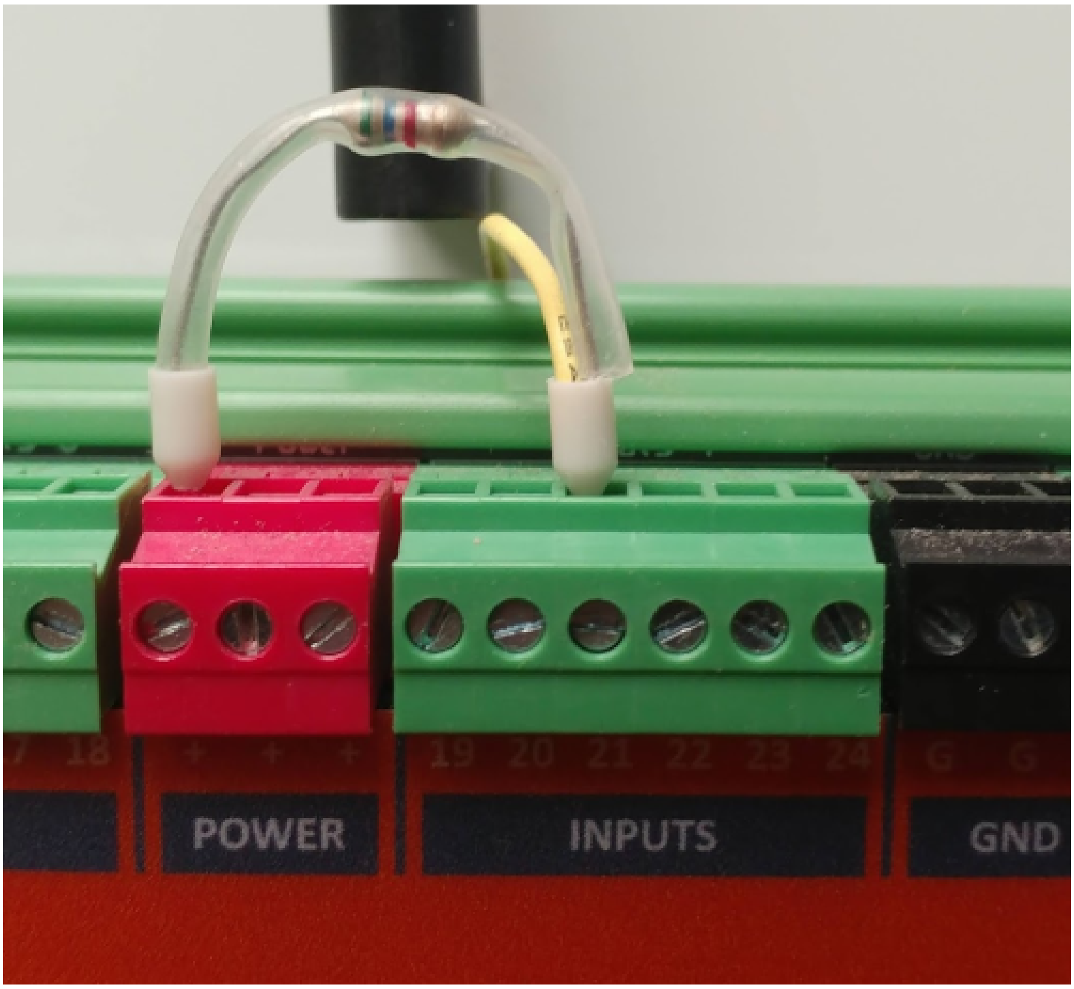
There are there to provide logic level signals and can be used to power low power devices.

If you are at all unsure whether to use these terminals or the +ve and -ve of the DC power supply distribution point, you will never go wrong by using the DC power supply distribution point.

A good use of the Red Auxiliary power terminals is to connect pullup resistors to inputs.

It is advised that the resistors should be protected from accidental contact with other circuits. Using clear heat shrink as shown below is a good way to do this.

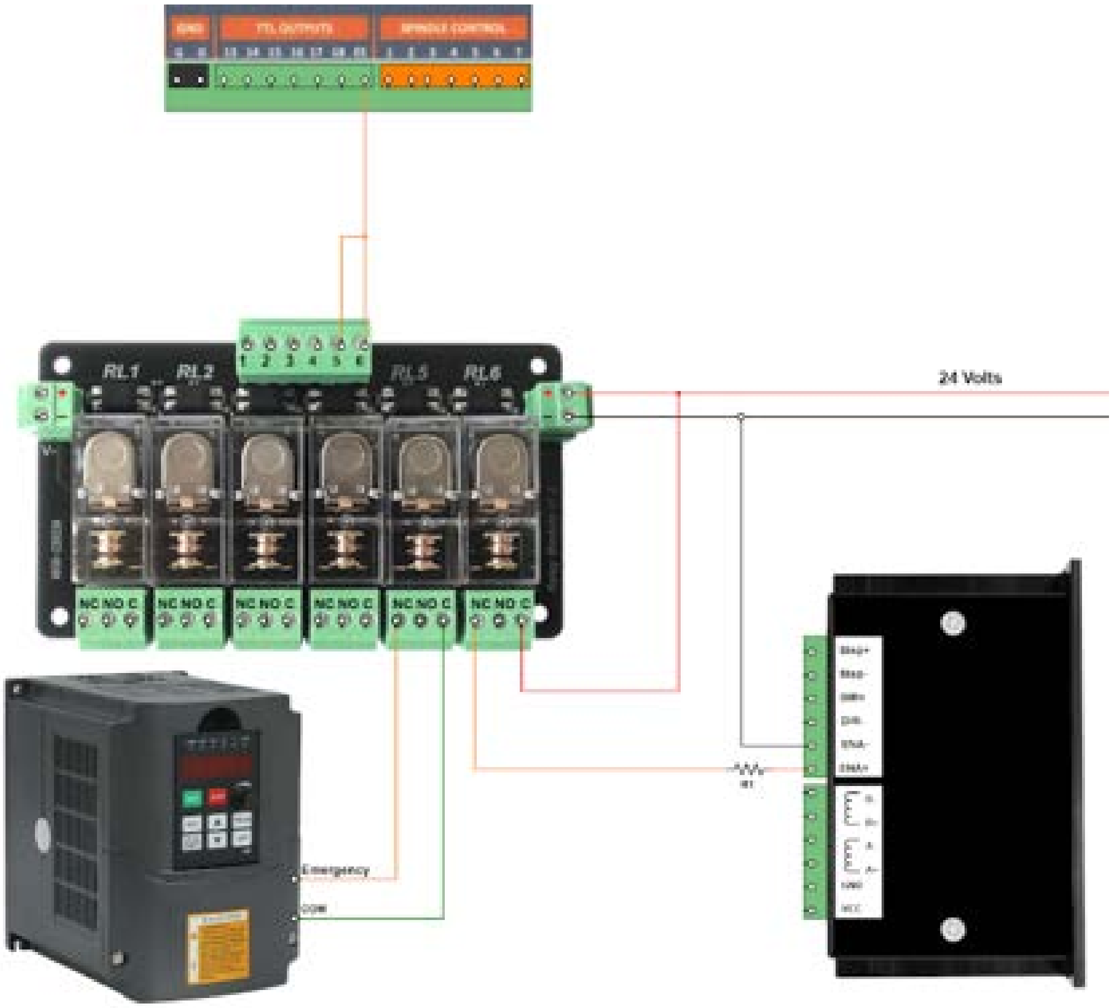
The resistor is clearly visible but well protected.



EStop

> **WARNING:** E-Stop wiring must be done as per your country or region's safety regulation. MASSO will put the machine in feed hold and stop spindle on E-Stop press but all drives and actuators MUST be disabled directly by E-Stop signal from the E-Stop button. MASSO's E-Stop input is only designed to alert the user that the an E-Stop has been pressed.

- An EStop output is provided on MASSO which will allow you to connect a TTL Relay module to disable your drives, spindle and other external equipment. The output is labeled ES on MASSO.



CAUTION: This diagram is for demonstration purposes only to illustrate the concept. Please consult your stepper or servo drive and VFD manuals for the correct method of connection.

INFORMATION: Up to two of the MASSO relay inputs can be connected to the ES output. If more relay contacts are required use the TTL relay output to drive a relay with multiple contacts or wire multiple MASSO TTL Relays as shown on the Estop wiring page here: EStop Wiring

INFORMATION: Note that relays will operate when the Estop is released and release when Estop is engaged.

INFORMATION: If using a MASSO G2 Relay output 7 is the EStop ouput.

VFD Wiring

WARNING: Please exercise extreme care when setting up your VFD and Spindle. These are not toys and can lead to injury or death if not handled correctly. If you have any doubt contact a suitably qualified electrical technician to assist with your installation. VFD's are complex devices that **MUST** be installed by a certified person and treated with respect not only because they contain High voltages but also because incorrect configuration of a VFD can destroy both the VFD and the Spindle.

- Ensure you power down your VFD before making wiring changes

Plasma Wiring

WARNING: Please exercise extreme care when setting up your plasma. These are not toys and can lead to injury or death if not handled correctly. If you have any doubt contact a suitably qualified electrical technician to assist with your installation. Plasma's are complex devices that **MUST** be installed by a certified person and treated with respect not only because they contain High voltages but also because incorrect connection of a plasma can cause damage to your MASSO.

- Earthing is very important to the proper operation of any plasma machine. Correct earthing not only allows the Arc to work as it should and produce good quality cuts it also reduces noise generated by the plasma from causing issues with THC and MASSO operation. Please earth your plasma in accordance with best practices and the manufacturer's instructions.

Control of External mains operated devices

WARNING: The wiring of Mains operated devices MUST be installed by a certified person in accordance with the electrical regulations of your country.

- While the MASSO relay module is rated for 240V 5amp it is recommended that you do not mix low voltage and mains voltages on the same relay module. A better option is to use the MASSO relay output to operate a separate relay or relays located elsewhere within your control cabinet. Keep all of the mains relays together and shielded against accidental contact.

8.2. Setup MASSO Mill

Quick Start Guide MASSO-G3 Mill Configuration

These notes have been created to assist new users to set up key configuration properties in MASSO.

This is not a full configuration guide but seeks to provide configuration guidance. Some items need to be configured in the correct order or things will not work as expected. It will also point out common pitfalls and hints for first time users. I understand that users are keen to see things moving as quickly as possible but usually going slowly and carefully in small steps is far quicker than rushing ahead.

This guide does not seek to show how to connect the various hardware that you will connect to MASSO.

Getting Started

To configure MASSO you first need to connect a minimum of following items: Power supply, Monitor, Keyboard and mouse. Ideally you would also connect your Estop Switch, drives, limit switches, auto touch off, and VFD though you can connect these as you configure each of these components.

Download your Software

Your software is downloaded from your myWorkshop portal.

Login detail are emailed to you when you purchase your MASSO and step by step instructions on how to download the software can be found herer

https://docs.masso.com.au/my-workshop

Power

Please note that a **1 amp fuse must be connected** in the feed from your Power supply on the MASSO G3. An accidental short circuiting of the auxiliary power terminals built into MASSO will cause damage to the main board if the fuse is not installed.

[Powering up MASSO]()

[Safe working Practices when wiring MASSO]()

Load your Software

Please follow the instructions on below link to get your Software loaded.

Hint: Most people have trouble loading software because you do not press the F1 repeatedly within the first 4 seconds of MASSO being turned on. If the software load screen does not appear on the screen please turn off and try again.

[Loading software into MASSO G3 instructions]

[Loading software into MASSO Touch Instruction]

Additional resource video

How to Load and upgrade software on your Masso G3 - Masso Edition 018

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

v5.79 - 11 December, 2023

Load software on your MASSO Touch - MASSO Top Tip 6

Default Password

The default User and Admin password for MASSO is HTG.

Follow the link below to see how to change these passwords.

[Password](#)

Estop Switch

An Estop switch is important and MASSO will not work without one. Please ensure you have your Estop connected.

[EStop Wiring](#)

Hint: How the Estop switch is wired will depend on whether you have a pendant or not.

WARNING: E-Stop wiring must be done as per your country or region's safety regulation. MASSO will put the machine in feedhold and stop spindle on E-Stop press but all drives and actuators **MUST** be disabled directly by E-Stop signal from the E-Stop button. MASSO's E-Stop input is only designed to alert the user that the an E-Stop has been pressed.

Hint: When Estop is pressed the axis will decelerate to a stop. If an instant stop is wanted on your drives you need to wire the drive's enable circuit through an Estop Relay contact. A TTL output called ES is provided to allow you to connect a TTL relay which will release when the Estop is pressed. This can be used to stop external hardware. eg. VFD disable, disable motor drives etc.

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to install Estop on Masso - Masso Edition 012

Axis Wiring

How you wire your motors will depend on the type of motors you have.

The link below gives examples of wiring for various motor types, Stepper and Servo https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/axis-servo-stepper-examples

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

How to connect your Stepper or Servo drive to Masso - Episode 020

Axis configuration

Axis calibration instructions

Distance per revolution: How far your axis travels in one revolution of the motor.

Pulses per revolution: How many steps it will take for your motor to complete 1 revolution

Maximum feedrate: Defines your axis rapid speed.

Acceleration setting: Determines how quickly your axis accelerates to your chosen feedrate.

Travel Minimum: This value determines the extent of travel for the axis in the negative direction

Travel Maximum: This value determines the extent of travel for the axis in the positive direction

Invert direction: If your axis travels in the wrong direction, put a check in this box to reverse it.

Backlash: Enter your axis backlash. Note that it must not exceed 10mm or 0.3937”

Hint: The biggest mistake new users make is to ignore the maximum and minimum travel setting. If you leave these at 0 your axis will not move as these form part of MASSO soft limit system. Please note that disabling soft limits under general settings only disables them while machining but you are still bound by them when it comes to jogging your axis. It is recommended that you enter very large maximum and minimum values into your axis until you are ready to properly configure them. That way you will be able to jog around your table without running into a limit. The Maximum travel MUST be larger than the Minimum travel value or the axis will move in one direction only.

Rotary Axis

For information on how to setup and calculate a rotary axis please see the Quick Start guide on setting up a Rotary Axis

Setting up a Rotary Axis

Jogging

Keyboard key shortcuts page

- To jog your machine you must be in the F3 Jogging screen.
- Jogging can be done on the F3 screen with either Mouse, Touch screen, Keyboard or Pendant.
- If you cannot Jog use the Mouse to click the jog buttons as users have had issues with faulty Keyboards, pendants and touch screens in the past. Using the mouse is the best test for jogging.

Hint: If the Axis DRO is not showing movement then the physical axis will not move. Please check your Axis settings above and especially your minimum and maximum travel values. If you reach a travel limit the button will turn red and the word **Limit** will be displayed on the button to let you know.

Hint: If your axis does not move check that you do not have a value of 0 in any of the following settings: Motor: Distance per revolution, Drive: Pulses per revolution, Maximum feedrate or Acceleration. Leaving a value of 0 in any of these 4 parameters on any axis will cause issues. If you are not using an axis please configure it with dummy values.

Pendant

No software configuration is required to make the MASSO MPG pendant work. Simply plug it in and it will work. To make the Estop button on the pendant work you need to wire the Estop in accordance with the Estop Instructions as per the below links. Once the Estop is wired through the pendant, removing the pendant will cause the E-Stop alarm and you will need to plug it back in to remove the Estop condition.

MPG pendant wiring instructions

Wiring only one e stop on MPG pendant instructions

Hint: The biggest problem new users have with pendants come from using 3rd party pendants with incompatible MPG's built into them. They may look the same but internally they use different components. The MASSO Pendant can be purchased from here: MASSO MPG pendant

Hint: MASSO cannot use USB pendants of any type.

Homing Switches and setting up homing

- These can be mechanical, optical, magnetic or proximity sensors.
- Each axis must have a homing switch including software slaved axis which are used for auto squaring.
- The one thing they all have in common is they must normally show Low on the F1 screen and change to High when triggered. Use the spacebar to toggle the input logic if yours is reversed.

> **Hint:** If homing speed is too high the axis may overshoot the sensor and not be able to back off. If the sensor cannot be cleared within 10mm or 3/8” a homing alarm will indicate.

[Homing setup instructions]

Additional resource video

How to Set up Homing on Masso - Masso Edition 15

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Hard Limits

The homing inputs double as hard limit inputs after the machine has been homed. To work, all hard limit switches must be outside the envelope of axis travel or the hard limit will trip before it reaches the full travel of your axis. Soft limits should be used first and Hard limits as a last resort. Tripping a hard limit will not instantly stop the axis but it will decelerate to a stop. Hard limits can be disabled under general settings.

Hint: if you mount your homing sensors/switch on the moving carriage and put a trigger at each end of the axis travel then only one sensor/switch can work for both homing and Hard limit triggering at each end of the axis travel.

Soft Limits

- Setting up soft limits is important to prevent your machine from crashing due to gcode command that might result in motion outside your machines physical limits.
- Set up incorrectly it will restrict machine travel and in extreme cases prevent the machine from moving at all.

[Minimum and maximum travel setup instructions]

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to Set up Soft Limits on Masso - Masso Edition 16

Auto Tool Zero

This feature is used to automatically calculate and adjust the length of each tool. MASSO takes a measurement when you home your machine and will return to the touch off point when a tool change is requested.

Please note that the thickness of the auto tool zero touch off is irrelevant as it is a reference point only. It uses the difference between where you zero your cutter and the initial measurement it took when homing to determine the length of each tool when making a tool change.

> **CAUTION:** Never change a tool after you have homed your machine unless instructed to do so by MASSO. If you must change a tool without MASSO requesting it then do it before homing or home your machine immediately after to get a new reference. Otherwise your next tool change and all the ones that follow will be wrong.

Automatic tool length setup instructions

Additional resource video

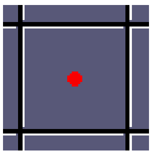
Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

How to set up a Toolsetter in Masso - Episode 017

Probing

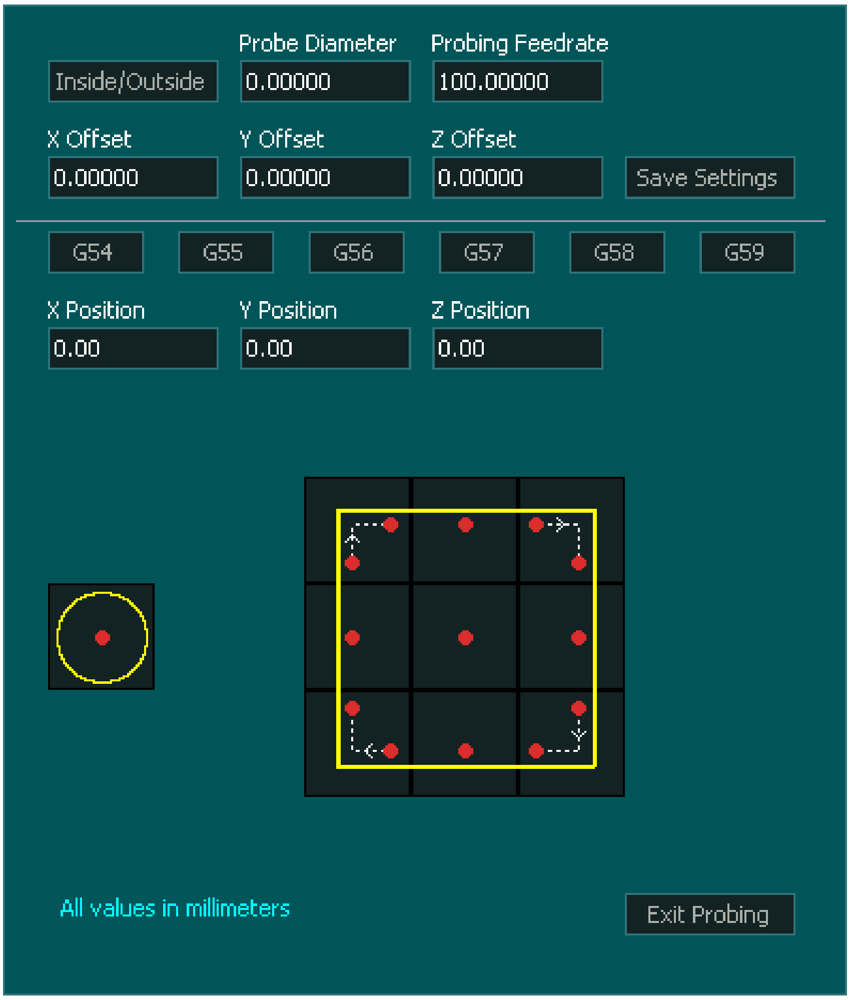
This document only covers Z height probing though there are many more probing routines built into MASSO. Z height probing can be done with either inside or outside probing screens.

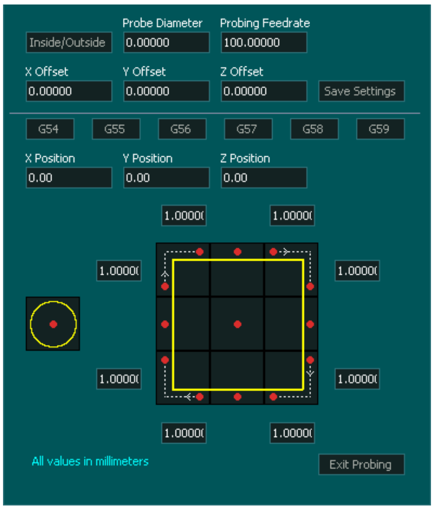
Part probing instructions

- For probing your Z height enter the thickness of your touch off plate into Z Offset.
- If using a probing tool, Z offset is zero and you enter a value into the Probe diameter.
- Set a Probing feed rate and enter click save settings.
- Probe by clicking the center square. 

- Once probing is complete MASSO will automatically update the DRO with the new value.

> **Hint:** If you want to reference your cutter to the surface of the spoilboard you can enter the negative of the nominal material thickness into Set Z and it will work everything out for you. eg for 18mm material enter -18 onto Set Z.





Controlling Spindle using a VFD

WARNING: Please exercise extreme care when setting up your VFD and Spindle. These are not toys and can lead to injury or death if not handled correctly. If you have any doubt contact a suitably qualified electrical technician to assist with your installation. VFD's are complex devices that MUST be installed by a certified person and treated with respect not only because they contain High voltages but also because incorrect configuration of a VFD can destroy both the VFD and the Spindle.

There are various VFD connection examples (provided as a reference only) within the documentation, please note that it is not practical to provide examples of every VFD model and please see the one that suits your VFD model.

- MASSO provides a 0-10v signal to control spindle speed (RPM).
- Two open collector optical switches for forward (clockwise) and reverse (counter-clockwise) signals.

Spindle setup instructions

Spindle VFD wiring examples

HINT: The biggest issue that users have following the VFD install video is they ignore the first instruction of the video to follow all of the steps. Some steps may seem unnecessary like setting the VFD to work manually but this is one of the most important. If you cannot get it to work manually with simple on/off switches and a potentiometer it will not work when connected to MASSO no matter what you do. As tempting as it is to connect everything at once, please do it step at a time and test as you go. Doing this can take a few extra minutes but can save you hours or days of work figuring out what is wrong.

HINT: The Spindle will not turn unless you issue a speed for it to run at. eg **S10000** and a **M3** or **M4** command.

8.3. Setup MASSO Plasma

Quick Start Guide MASSO-G3 Plasma Configuration

These notes have been created to assist new users to set up key configuration properties in MASSO Plasma.

This is not a full configuration guide but seeks to provide configuration guidance. Some items need to be configured in the correct order or things will not work as expected. It will also point out common pitfalls and hints for first time users. I understand that users are keen to see things moving as quickly as possible but usually going slowly and carefully is far quicker than rushing ahead. This does not seek to show how to connect the various hardware that you will connect to MASSO Plasma but will point to various references to assist.

INFORMATION: MASSO Plasma does not have a THC built in to it. For more information see the section below on MASSO DTHC installation

Getting Started

To configure MASSO you first need to connect a minimum of Power supply, Monitor, Keyboard and mouse. Ideally you would also connect your Estop Switch, drives, limit switches, auto touch off, and VFD though you can connect these as you configure each of these components.

Download your Software

Your software is downloaded from your myWorkshop portal.

Login detail are emailed to you when you purchase your MASSO and step by step instructions on how to download the software can be found herer

https://docs.masso.com.au/my-workshop

Power

Please note that a **1 amp fuse must be connected** in the feed from your Power supply on the MASSO G3.

The accidental short circuiting of the auxiliary power terminals built into MASSO will cause damage to the main board if the fuse is not installed.

Powering up MASSO

[Safe working Practices when wiring MASSO]

Load your Software

[Loading software to MASSO G3]

[Loading software into MASSO Touch Instruction]

Additional resource video

How to Load and upgrade software on your Masso G3 - Masso Edition 018

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Load software on your MASSO Touch - MASSO Top Tip 6

Default Password

The default User and Admin password for MASSO is HTG.

Follow the link below to see how to change these passwords.

[Password](#)

Estop Switch

An Estop switch is important and MASSO will not work without one. Please ensure you have your Estop connected.

[EStop Wiring](#)

> **Hint:** How the Estop switch is wired will depend on whether you have a pendant or not.

v5.79 - 11 December, 2023

> **Hint:** When Estop is pressed the axis will decelerate to a stop. If an instant stop is wanted on your drives you need to wire the drive's enable circuit through an Estop Relay contact. A TTL output called ES is provided to allow you to connect a TTL relay which will release when the Estop is pressed. This can be used to stop external hardware. eg. VFD disable, disable motor drives etc.

Additional Resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to install Estop on Masso - Masso Edition 012

Axis Wiring

How you wire your motors will depend on the type of motors you have.

The link below gives examples of wiring for various motor types, Stepper and Servo

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/axis-servo-stepper-examples

Additional resource video

How to connect your Stepper or Servo drive to Masso - Episode 020

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Axis configuration

Axis calibration

Distance per revolution: How far your axis travels in one revolution of the motor.

Pulses per revolution: How many steps it will take for your motor to complete 1 revolution

Maximum feedrate: Defines your axis rapid speed.

Acceleration setting: Determines how quickly your axis accelerates to your chosen feedrate.

Travel Minimum: This value determines the extent of travel for the axis in the negative direction

Travel Maximum: This value determines the extent of travel for the axis in the positive direction

Invert direction: If your axis travels in the wrong direction, put a check in this box to reverse it.

Backlash: Enter your axis backlash. Note that it must not exceed 10mm or 0.3937”

> **Hint:** The biggest mistake new users make is to ignore the maximum and minimum travel setting. If you leave these at 0 your axis will not move as these form part of Masso soft limit system. Please note that disabling soft limits under general settings only disables them while machining but you are still bound by them when it comes to jogging your axis. It is recommended that you enter very large maximum and minimum values into your axis until you are ready to properly

configure them. That way you will be able to jog around your table without running into a limit. The Maximum travel MUST be larger than the Minimum travel value or the axis will move in one direction only.

Jogging

Keyboard-and-key-shortcuts

To jog your machine you must be in the F3 Jogging screen.

Jogging can be done on the F3 screen with either Mouse, Touch screen, Keyboard or Pendant.

If you cannot Jog use the Mouse to click the jog buttons as users have had issues with faulty Keyboards, pendants and touch screens in the past. Using the mouse is the best test for jogging.

Hint: If the Axis DRO is not showing movement then the physical axis will not move. Please check your Axis settings above and especially your maximum and minimum travel. If you reach a travel limit the button will turn red and the word limit will be displayed on the button to let you know.

Hint: If your axis does not move check that you do not have a value of 0 in any of the following settings: Motor: Distance per revolution, Drive: Pulses per revolution, Maximum feedrate or Acceleration. Leaving a value of 0 in any of these 4 parameters on any axis will cause issues. If you are not using an axis please configure it with dummy values.

Pendant

[MPG pendant](#)

[Wiring only one e stop on MPG pendant](#)

No software configuration is required to make the MASSO Pendant work. Simply plug it in and it will work. To make the Estop button on the pendant work you need to wire the Estop in accordance with the Estop Instructions. See above. Once the Estop is wired through the pendant removing the pendant will cause MASSO to Estop and you will need to plug it back in to remove the Estop condition.

Hint: The biggest problem new users have with Pendants come from using 3rd party pendants with incompatible MPG's built into them. They may look the same but internally they use different components. The MASSO Pendant can be purchased from here:

[MASSO MPG pendant](#)

> **Hint:** MASSO cannot use USB pendants of any type.

Homing Switches and setting up homing

Homing home inputs

These can be Mechanical, optical, magnetic or proximity sensors.

Each axis must have a homing switch including software slaved axis which are used for auto squaring.

The one thing they all have in common is they must normally show Low on the F1 screen and change to High when triggered. Use the spacebar to toggle the input logic if yours is reversed.

Hint: If homing speed is too high the axis may overshoot the sensor and not be able to back off. If the sensor cannot be cleared within 10mm or 3/8" a homing alarm will indicate.

Additional resources

Homing Sensor Quick Start Guide

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

How to Set up Homing on Masso - Masso Edition 15

Hard Limits

The homing switches double as hard limit switches. To work all hard limit switches must be outside the envelope of axis travel or the hard limit will trip before it reaches the full travel of your axis. Soft limits should be used first and Hard limits as a last resort. Tripping a hard limit will not instantly stop the axis but it will decelerate to a stop. Hard limits can be disabled under general settings.

Hint: if you mount your Homing switch on the moving carriage and put a trigger at each end of the axis travel the one sensor can be both homing switch and limit switch triggering at each end of the axis travel.

Soft Limits

[Minimum and maximum travel]

Setting up soft limits is important to prevent your machine from crashing at the extremes of travel.

Set up incorrectly it will restrict machine travel and in extreme cases prevent the machine from moving at all.

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to Set up Soft Limits on Masso - Masso Edition 16

Probing

A big part of running your Plasma will include Probing to set the torch height above the material.

You can find how to connect your torch touch here:

Torch Touch (floating head) Signal

For Probing cycles G38.2 is used from within your Gcode to set your torch height.

G38.2 – Straight Probe Cycle

Jump to Line

INFORMATION: When using the Jump to line MASSO will search backwards in the Gcode file to locate the last M5 command and use this as it's starting line. If the line you have selected is an M5 command it will use that line. If there is no previous M5 command it will return to the start of the Gcode file.

Torch Breakaway

The torch breakaway signal is used to stop plasma and machine axis movements if the plasma torch is hit during a cut.

Details of the torch breakaway signal can be found here:

Torch Breakaway Signal

Torch On / Off

An input can be designated Plasma On / Off and is used to start and stop the Plasma.

You can configure any of the MASSO G3 TTL outputs as the Plasma on/off and connect it to your Plasma via the MASSO Relay Module

MASSO Relay Module

More information on connect your Plasma on/off can be found here:

Hypertherm 45, 65 & 85

MASSO DTHC

INFORMATION: Currently in Beta testing, the MASSO DTHC is an addon THC module that is designed to work specifically with the MASSO G3 and MASSO Touch controllers.

The MASSO DTHC (Digital Torch Height Control) module is designed to provide digital arc voltage information from a plasma source. The module is designed to connect between the MASSO G3 controller and the plasma source with an arc voltage divider output option.

The digital arc voltage data is used by MASSO to monitor arc voltage levels and to adjust the torch height while cutting parts. Having full digital information about arc voltages, the user can easily set and adjust cutting voltages for jobs using gcode commands, this makes it very flexible and easy for the user to set all the cutting parameters of a job in a gcode file, there is no requirement to set cutting voltages manually on an external THC, everything is automatically loaded in when the gcode file is loaded.

INFORMATION: The DTHC module is only supported with the MASSO G3 controllers as the old G2 model does not have the required interface electronics.

MASSO DTHC installation

A THC is not required for Plasma but it is helpful in keeping the torch the required distance from the material you are cutting.

The distance you keep the torch above the material will influence the quality of the cut and since metals are subject to warping and can be bent a THC will keep the distance you set constant.

The installation of the MASSO DTHC onto your MASSO can be found in the link below

Install the MASSO DTHC

8.4. Setup MASSO Lathe

Quick Start Guide MASSO-G3 Lathe Configuration

These notes have been created to assist new users to set up key configuration properties in MASSO.

This is not a full configuration guide but seeks to provide configuration guidance. Some items need to be configured in the correct order or things will not work as expected. It will also point out common pitfalls and hints for first time users. I understand that users are keen to see things moving as quickly as possible but usually going slowly and carefully in small steps is far quicker than rushing ahead.

This guide does not seek to show how to connect the various hardware that you will connect to MASSO.

Getting Started

To configure MASSO you first need to connect a minimum of following items: Power supply, Monitor, Keyboard and mouse. Ideally you would also connect your Estop Switch, drives, limit switches, auto touch off, and VFD though you can connect these as you configure each of these components.

Download your Software

Your software is downloaded from your myWorkshop portal.

Login detail are emailed to you when you purchase your MASSO and step by step instructions on how to download the software can be found herer

https://docs.masso.com.au/my-workshop

Power

Please note that a **1 amp fuse must be connected** in the feed from your Power supply on the MASSO G3. An accidental short circuiting of the auxiliary power terminals built into MASSO will cause damage to the main board if the fuse is not installed.

Powering up MASSO

Safe working Practices when wiring MASSO

Load your Software

Please follow the instructions on below link to get your Software loaded.

Hint: Most people have trouble loading software because you do not press the F1 repeatedly within the first 4 seconds of MASSO being turned on. If the software load screen does not appear on the screen please turn off and try again.

Loading software to MASSO G3 instructions

Loading software into MASSO Touch Instruction

Additional resource video

How to Load and upgrade software on your Masso G3 - Masso Edition 018

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Load software on your MASSO Touch - MASSO Top Tip 6

Default Password

The default User and Admin password for MASSO is HTG.

Follow the link below to see how to change these passwords.

[Password]

Estop Switch

An Estop switch is important and MASSO will not work without one. Please ensure you have your Estop connected.

[EStop Wiring]

> **Hint:** How the Estop switch is wired will depend on whether you have a pendant or not.

WARNING: E-Stop wiring must be done as per your country or region's safety regulation. MASSO will put the machine in feedhold and stop spindle on E-Stop press but all drives and actuators **MUST** be disabled directly by E-Stop signal from the E-Stop button. MASSO's E-Stop input is only designed to alert the user that the an E-Stop has been pressed.

Hint: When Estop is pressed the axis will decelerate to a stop. If an instant stop is wanted on your drives you need to wire the drive's enable circuit through an Estop Relay contact. A TTL output called ES is provided to allow you to connect a TTL relay which will release when the Estop is pressed. This can be used to stop external hardware. eg. VFD disable, disable motor drives etc.

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to install Estop on Masso - Masso Edition 012

Axis Wiring

How you wire your motors will depend on the type of motors you have.

The link below gives examples of wiring for various motor types, Stepper and Servo

https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/axis-servo-stepper-examples

Additional resource video

How to connect your Stepper or Servo drive to Masso - Episode 020

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Axis configuration

[Axis calibration instructions]

Distance per revolution: How far your axis travels in one revolution of the motor.

Pulses per revolution: How many steps it will take for your motor to complete 1 revolution

Maximum feedrate: Defines your axis rapid speed.

Acceleration setting: Determines how quickly your axis accelerates to your chosen feedrate.

Travel Minimum: This value determines the extent of travel for the axis in the negative direction

Travel Maximum: This value determines the extent of travel for the axis in the positive direction

Invert direction: If your axis travels in the wrong direction, put a check in this box to reverse it.

Backlash: Enter your axis backlash. Note that it must not exceed 10mm or 0.3937”

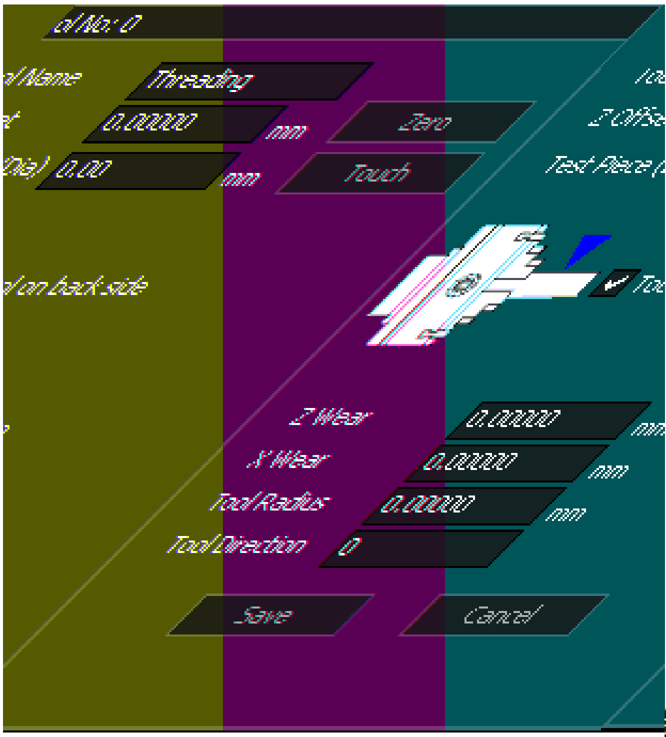
Hint: The biggest mistake new users make is to ignore the maximum and minimum travel setting. If you leave these at 0 your axis will not move as these form part of MASSO soft limit system. Please note that disabling soft limits under general settings only disables them while machining but you are still bound by them when it comes to jogging your axis. It is recommended that you enter very large maximum and minimum values into your axis until you are ready to properly configure them. That way you will be able to jog around your axis without running into a limit. The Maximum travel **MUST** be larger than the Minimum travel value or the axis will move in one direction only.

Understanding Lathe coordinate system

It is important to understand the MASSO Lathe coordinate system and how it works with front and rear tools

- The Machine coordinate system is fixed no matter whether your tool is front or rear mounted.
- To assist with setting up Machine coordinates the MASSO G2 the +X, -X, +Z & -Z axis are marked on the screen. X0 is located at the center.
- There are no markings on the G3 Screen so please be aware that Machine +X is at the top of the screen furthest from the operator , -X at the Bottom of the screen closest to the operator, -Z to the left and +Z to the right. X0 is at the center
- When defining your tool in the tool table you need to specify if the tool is front or rear mounted. If the tool is front mounted MASSO will automatically perform the necessary working coordinate calculations to machine your workpiece correctly. This means you can use the same Gcode file to machine with both a front and rear mounted tool.
- Working coordinates change depending on whether your tool is rear of front mounted. The Z axis is always -Z to the left and +Z to the right. The X axis always is 0 at the center. For a front mounted tool + X is towards the operator and for a rear mounted tool is +X towards the rear. MASSO manages the X axis orientation depending on whether you select a front or rear mounted tool if the F4 tool table shown below. Gcode must be written for a rear mounted tool.
- MASSO Lathe works in diameter mode

CAUTION: Use a post processor designed for a rear mounted tool only regardless of whether your tool is front or rear mounted. Failure to do so will cause unintended results.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0.00
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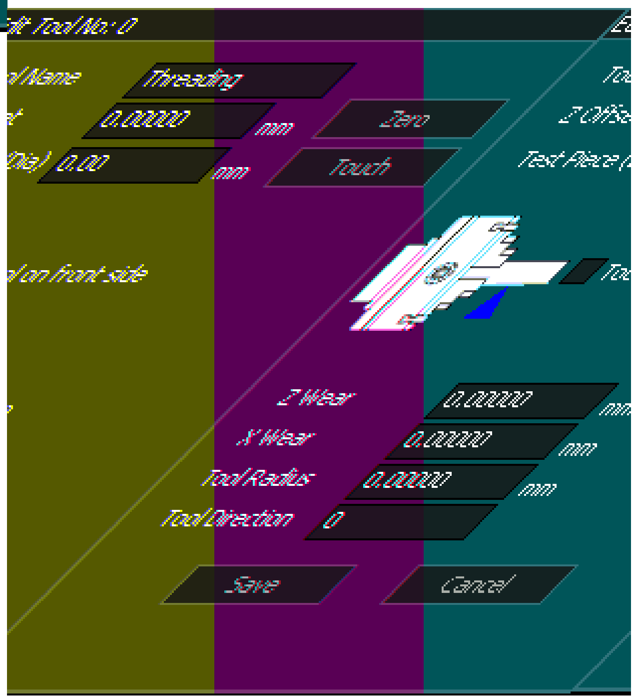
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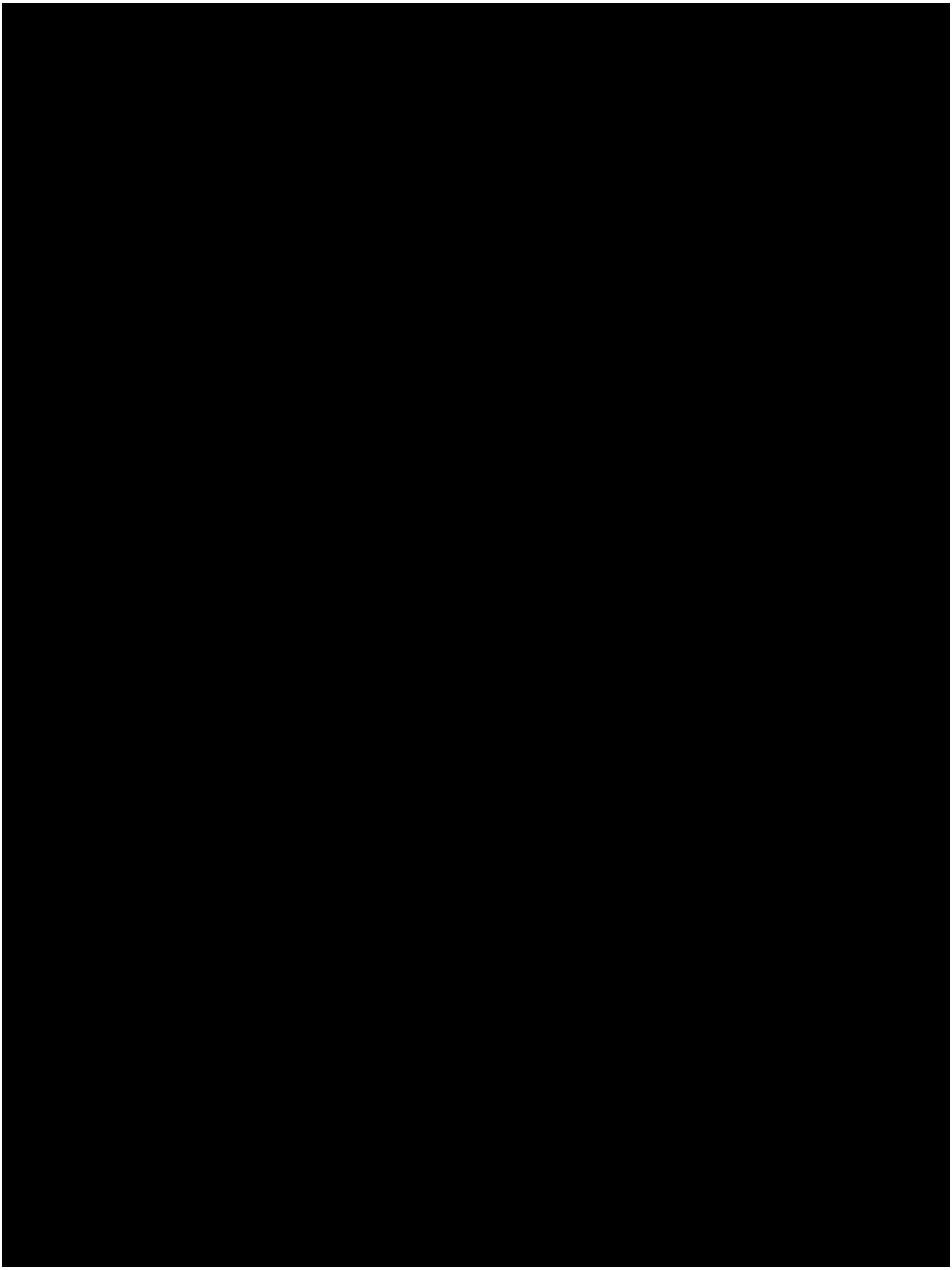


Jogging

Keyboard key shortcuts page

- To jog your machine you must be in the F3 Jogging screen.
- Jogging can be done on the F3 screen with either Mouse, Touch screen, Keyboard or Pendant.
- If you cannot Jog use the Mouse to click the jog buttons as users have had issues with faulty Keyboards, pendants and touch screens in the past. Using the mouse is the best test for jogging.

Hint: If the Axis DRO is not showing movement then the physical axis will not move. Please check your Axis settings above and especially your minimum and maximum travel values. If you reach a travel limit the button will turn red and the word **Limit** will be displayed on the button to let you know.

Hint: If your axis does not move check that you do not have a value of 0 in any of the following settings: Motor: Distance per revolution, Drive: Pulses per revolution, Maximum feedrate or Acceleration. Leaving a value of 0 in any of these 4 parameters on any axis will cause issues. If you are not using an axis please configure it with dummy values.

Pendant

No software configuration is required to make the MASSO MPG pendant work. Simply plug it in and it will work. To make the Estop button on the pendant work you need to wire the Estop in accordance with the Estop Instructions as per the below links. Once the Estop is wired through the pendant, removing the pendant will cause the E-Stop alarm and you will need to plug it back in to remove the Estop condition.

MPG pendant wiring instructions

Wiring only one e stop on MPG pendant instructions

Hint: The biggest problem new users have with pendants come from using 3rd party pendants with incompatible MPG's built into them. They may look the same but internally they use different components. The MASSO Pendant can be purchased from here: MASSO MPG pendant

Hint: MASSO cannot use USB pendants of any type.

Homing Switches and setting up homing

- These can be mechanical, optical, magnetic or proximity sensors.
- Each axis must have a homing switch including software slaved axis which are used for auto squaring.
- The one thing they all have in common is they must normally show Low on the F1 screen and change to High when triggered. Use the spacebar to toggle the input logic if yours is reversed.

Hint: If homing speed is too high the axis may overshoot the sensor and not be able to back off. If the sensor cannot be cleared within 10mm or 3/8” a homing alarm will indicate.

Homing setup instructions

Additional resource video

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

How to Set up Homing on Masso - Masso Edition 15

Hard Limits

The homing inputs double as hard limit inputs after the machine has been homed. To work, all hard limit switches must be outside the envelope of axis travel or the hard limit will trip before it reaches the full travel of your axis. Soft limits should be used first and Hard limits as a last resort. Tripping a hard limit will not instantly stop the axis but it will decelerate to a stop. Hard limits can be disabled under general settings.

Hint: if you mount your homing sensors/switch on the moving carriage and put a trigger at each end of the axis travel then only one sensor/switch can work for both homing and Hard limit triggering at each end of the axis travel.

Soft Limits

- Setting up soft limits is important to prevent your machine from crashing due to gcode command that might result in motion outside your machines physical limits.
- Set up incorrectly it will restrict machine travel and in extreme cases prevent the machine from moving at all.

[Minimum and maximum travel setup instructions]

Additional resource video

How to Set up Soft Limits on Masso - Masso Edition 16

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Spindle

- Spindle uses 0-10 volt signal to control speed normally via a VFD.
- If your spindle does not have speed control you can still do threading as the spindle encoder will track spindle speed for the threading operation however constant surface speed will not function as this requires active speed control.

[Spindle control]

Spindle Encoder

The spindle encoder is used for threading cycles.

Please read and understand the information on the Spindle encoder page. Pay special attention to the maximum frequency allowed and stay below this value.

Information on installing your encoder can be found using the link below.

[Spindle Encoder]

Lathe Tool Calibration

Follow the link below to learn more about the Lathe tool calibration process.

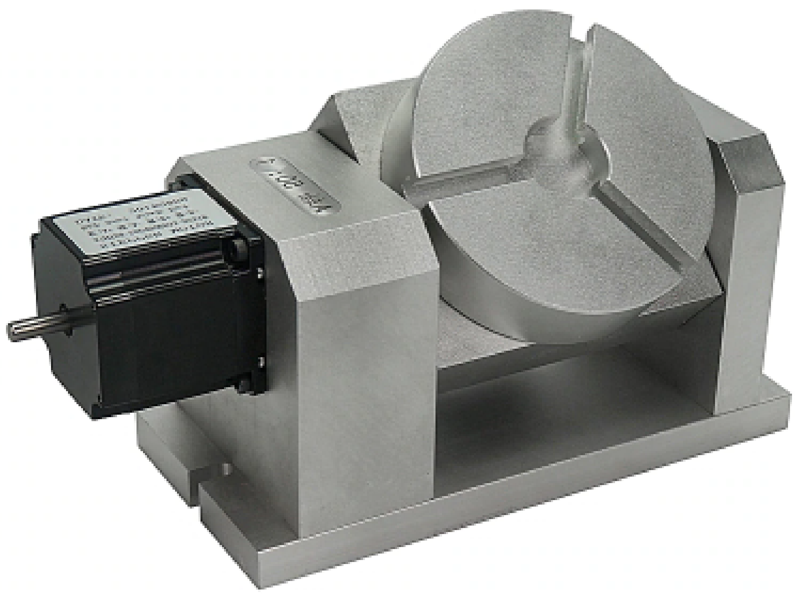
Tool Calibration Process

8.5. Setup Rotary Axis

There are 2 types of rotary axis used on a CNC machine. The Maximum and minimum travel settings will change depending on which type or rotary axis you are setting up.

- The first and most common is a 4th axis traditionally use on a Mill. This is usually the A axis and it rotates the stock in one axis only while the Z axis moves along it's length in the manner of a lathe.
- The second is as part of a 5 axis machine where the A & B axis are used to move the stock in 3D space for machining.

Rotary 4th Axis



5 Axis

Rotary axis settings are angular and not linear. There is no advantage to using huge step rates with large gear ratios. Breaking one rotation into a million steps will not help accuracy and give you a rotary axis that is slow. A value of 8000 to 10000 Pulses per revolution should be more than enough for most applications. Only when you are turning huge diameters 1 or 2 metres in diameter will you benefit from large Drive: Pulse per Revolution rates.

INFORMATION: Make your Motor: Degrees per revolution = 360 and this way you will always get a whole number for the Drive: Pulses per revolution. It is also easier to calculate and will make more sense when you are reading it.

How to Calculate Rotary axis settings

Gather the following information:

The number of steps per revolution of your motor. For example most steppers are 1.8 deg motors with 200 steps.

The gearing reduction ratio between the stepper and the rotary axis output. If you do not have any gearing the ration is 1.

Microstepping set on your motor drive.

- Calculate pulses per revolution as follows:
- Motor: Degrees per revolution = 360 (Please note this value is fixed and cannot be changed)
- Drive: Pulses per Revolution = Motor steps per revolution x Gearing x Microstepping
- Maximum Feed rate = Set a value that suits your rotary axis capabilities. Remember that this is in degrees per minute and not RPM
- Acceleration = This value will depend on your machine's drives and cannot be calculated. These are found by actual testing on your machine.
- Maximum and Minimum Travel = If this is a Mill Rotary 4th axis by setting large maximum and minimum travel will allow you to use it like a wood lathe and sand your masterpiece if your machined part is suitably shaped and your maximum feed rate is fast enough..
- Maximum and Minimum Travel = If this rotary axis is used as part of a 5 axis machine you may need to limit the travel of the axis to prevent it running into hard stops. Set the travel values accordingly.
- Backlash = Measure and set according to your machine's measured backlash.

WARNING: Always calculate the rotary axis setting. Do not run axis calibration. Unlike a linear axis which can vary due to component tolerances, a rotary axis will always calculate accurately.

INFORMATION: MASSO has a rotary axis unwind built into the G28 command. G28-return-to-machine-home

My Rotary Axis moves Slow

This is caused by confusing linear and rotary speeds. Your axis will move at the rate of the slowest axis and reasonable linear speeds can be very slow when changed to degrees per minute

and in the worse case scenario can make the machine look like they are not moving at all. A feed rate of 10 inch per minute will take 36 minutes for the rotary axis to complete 1 rotation. Check out Rapid Rotary to get a better understanding.

Additional resources

https://www.ganotechnologies.com/cnc/rapidrotary/

Homing sensor

A homing sensor may be set up on your rotary axis to home the axis.

- These can be mechanical, optical, magnetic or proximity sensors.
- The homing sensor must normally show Low on the F1 screen and change to High when triggered. Use the spacebar to toggle the input logic if yours is reversed.

INFORMATION: If you do not wish to install a homing sensor then set the rotary axis to Home in the Homing settings and MASSO will zero out the machine coordinates for the Rotary axis when you home the machine. This is a common setup for a rotary 4th axis.

Homing setup instructions

MASSO homing Sensor

Hard Limits

On a rotary axis the hard limit does not work as a rotary axis will pass the switch once every revolution. If you need to limit the axis travel please use your maximum and minimum travel limits.

8.6. Setup Laser for Engraving and Cutting

> **INFORMATION:** This feature is only available on MASSO G3 & MASSO Touch version 5.0 software or higher

This feature allows you to add a Laser to MASSO to use for engraving or cutting as required.

MASSO can turned the Laser on and off as well as control the power of the Laser using PWM. (**P**ulse **W**idth **M**odulation)

This will allow the Laser to be used for Cutting, General line engraving , Dithered and Grayscale engraving.

When working with Grayscale engraving MASSO can display the image by using the Depth Map feature.

Syntax & Parameters

- **T111** - Laser is defined as Tool 111 and cannot be changed. To change to Laser mode you need to load Tool 111
- **M03** - Turn Laser on This turns the laser Engraving/Cutting output on with 0 intensity.
- **S** - This controls the Laser PWM using any number from 0 to 1000. 0 is 0% and 1000 is 100% power. The S command must be included with a G1 and is synchronized with motion.
- **M05** - This turns the Laser off.

EXAMPLE Program

```
N10 T111 M06  N20 S0 M03  N30 G00 X0 Y0  N40 G01 X100 Y0 F600 S350  N50 G01 X100 Y100  N60 G01 X0 Y0 S0  N70 M05
```

Program description

- Load Laser tool 111
- Turn Laser on at 0% PWM
- Rapid Move to X0 Y0
- Move to X100 Y0 at a feed rate of 600 with Laser intensity of 35% PWM
- Move to X100 Y100 at a feed rate of 600 with Laser intensity of 35% PWM
- Move to X0 Y0 at a feed rate of 600 with Laser intensity of 0% PWM (off)
- Turn Laser off

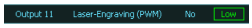
Hardware Requirements

- Any Laser with a TTL PWM input
- Safety glasses suitable for the laser you are using.

MASSO TTL Output

- Laser on 5 volt
- Laser off 0 volt

Configuring MASSO

- Configure MASSO output 11 for the LASER Engraving/Cutting output as shown. 

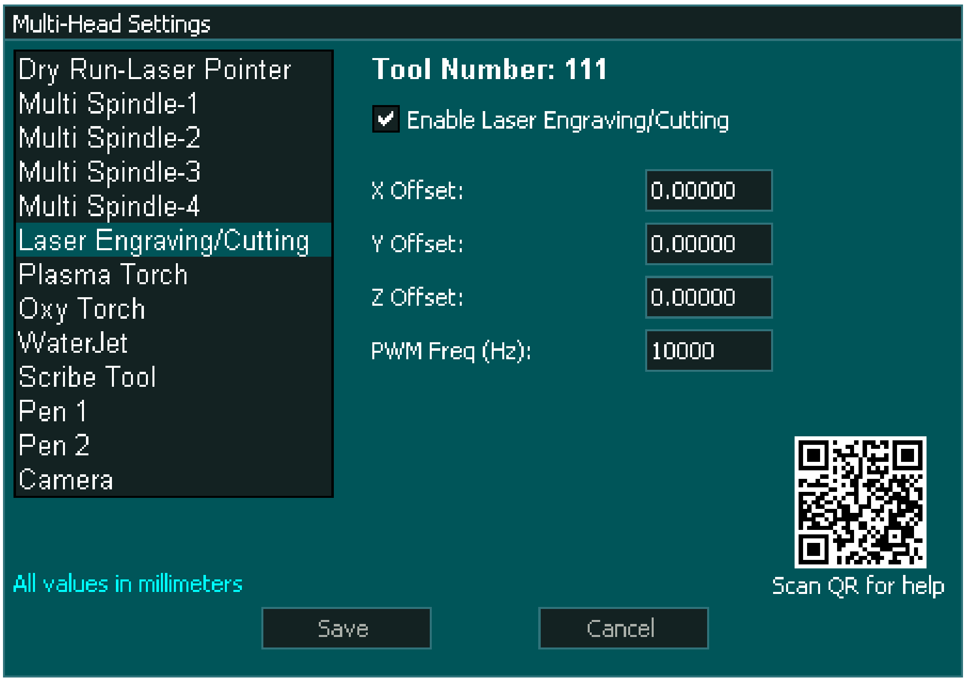
- No other output can be used for this function as it includes special hardware to output a PWM signal.

- An output can be assigned to move the Laser into position when Laser is selected. 

- An output can be assigned for Air assist is required. 

- Go to the Multi-Head setting page and select Laser Engraving/Cutting.
- Click Enable.

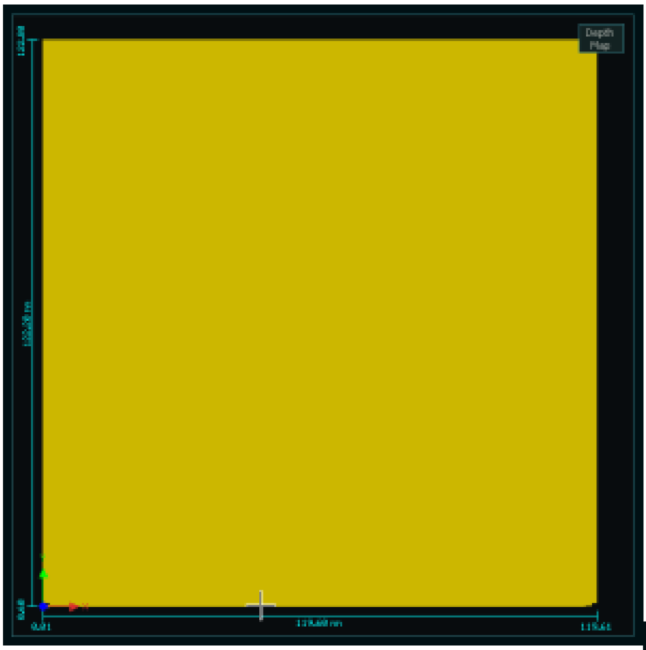
-

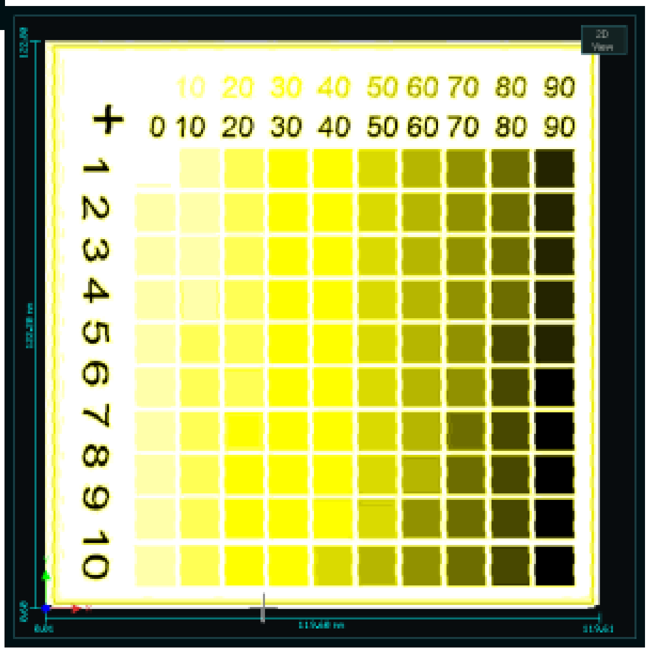


- Set the PWM Frequency for your Laser. It is recommended that you select a value of 10Khz though this will depend on the power of your Laser and the maximum feed rate you will be moving at. Since power is controlled by turning the Laser on and off very rapidly, if you have a low PWM frequency and move quickly you could get a line that has areas where the laser was on or off - - - - - - - - A frequency of 10Khz should be a good balance.
- PWM can be set between 4Khz and 60Khz
- X,Y & Z offset is the distance from the Main spindle or other Main tool if using Waterjet or Plasma. This can be measured zeroing the DRO's, making a spot with the Laser and then jog the Main spindle over to the center of the spot and reading off the X Y Y coordinates on the DRO's. These will be your offsets. The Z offset will be determined by the focus point of your Laser offset to the Z zero point of your Spindle tool. It would not be uncommon to leave the Z offset set to 0 and to manually zero the Laser when doing the job. Offsets are only needed when switching between the Laser and other tools and only if they are part of the same Gcode file.
- Configuration complete.

Displaying Laser Grayscale engravings

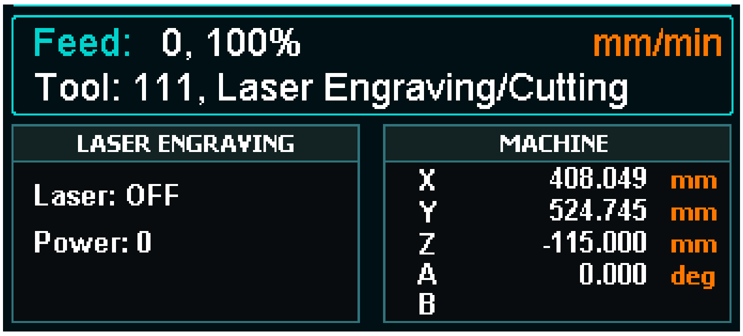
- For a Grayscale engraving to be able to be viewed as Grayscale, the Gcode file must include T111 M06 at the start of the file or the Depth Map view will be blank.
- To change between 2D View and Depth Map view press the button at the top right of the display area.





2D View and Depth Map view

- When the Laser Tool 111 is selected the display automatically changes to show Laser related information.
- This will display the Tool number 111
- Laser on / off status
- Laser Power



LASER Status screen

Connecting your Laser

How you connect your Laser will depend on what type of Laser you have and it's interface.

The 5.6K resistor installed between the PWM output and MASSO GND is important and must be installed on all Lasers that do not include a built in pull down resistor.

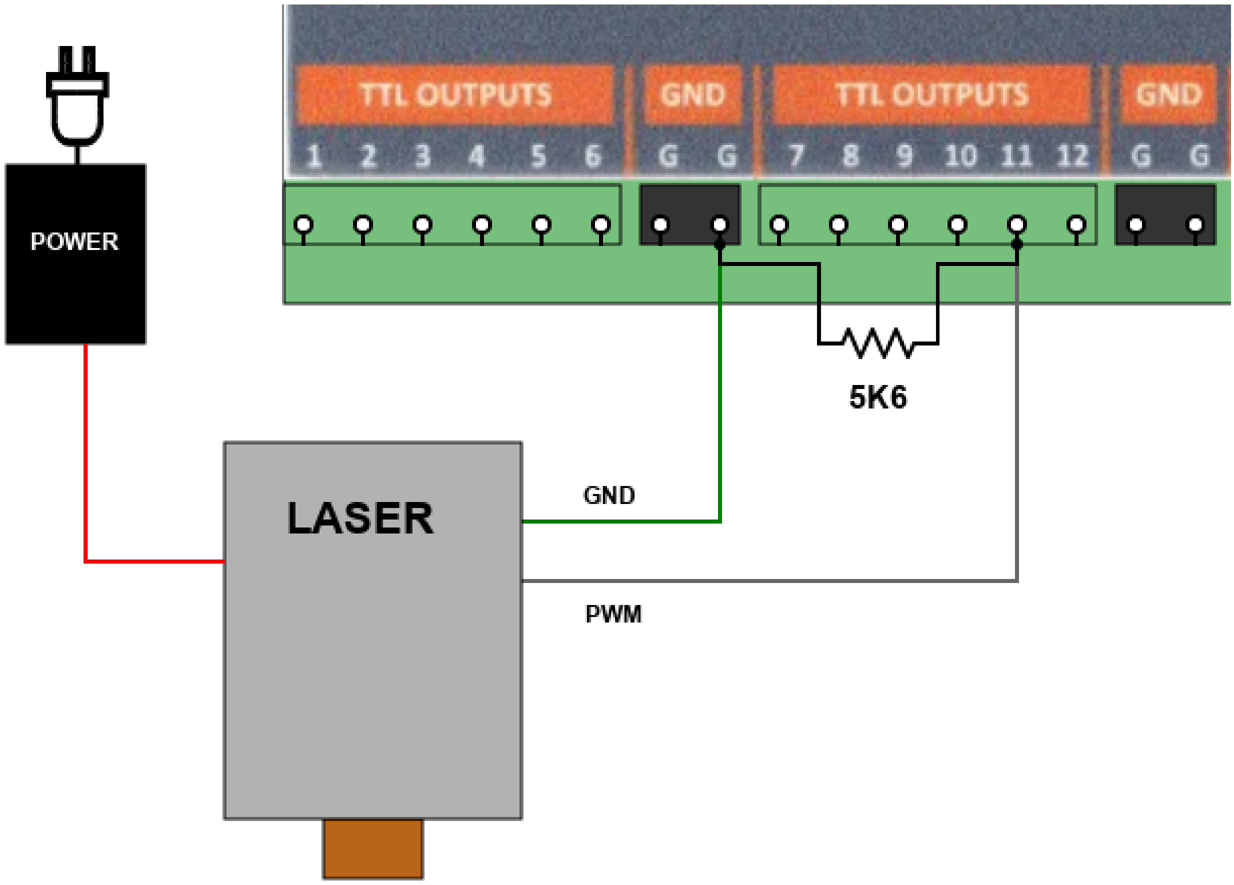
This is needed for correct PWM operation.

If you are unsure if your Laser has a pull down resistor built in there is no disadvantage in adding the resistor.

The connections shown below are for demonstration purposes only. please consult the user manual that came with your Laser to establish the correct connection.

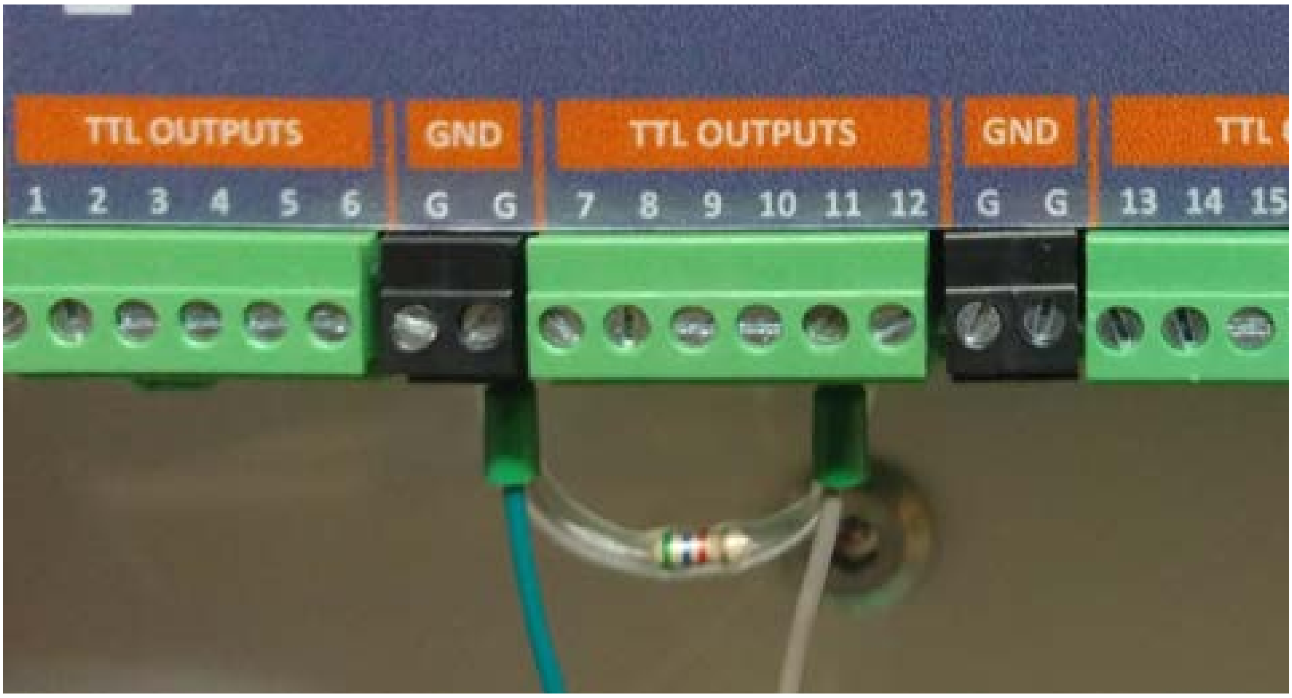
MASSO uses TTL only and controls the power of the laser using PWM. (Pulse Width Modulation)

Information on how the Laser used in testing can be found here: [Opt Lasers]



Installing the PWM Grounding Resistor

- The 5.6K resistor installed between the PWM output and MASSO GND is important and must be installed on all Lasers that do not include a built in pull down resistor.
- This is needed for correct PWM operation.
- If you are unsure if your Laser has a pull down resistor there is no disadvantage in adding the resistor.
- The resistor can be installed at the Laser or directly on MASSO as shown below.
- It is a good idea to insulate any resistor mounted in this manner to avoid accidental contacts. Here it has been put into clear heatshrink.

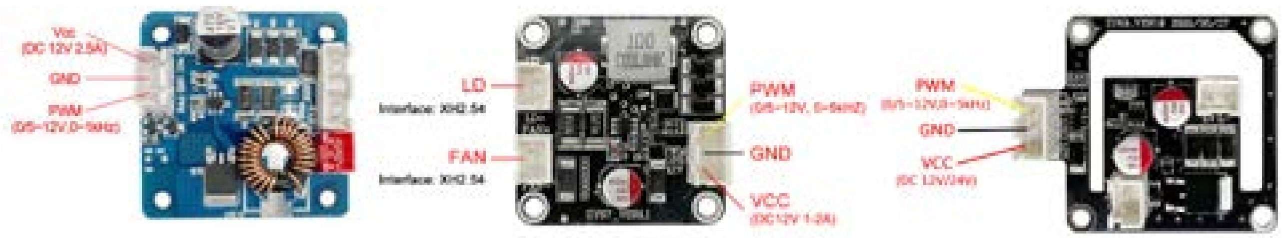


Resistor installed on MASSO

Connecting a Typical 3 Wire Laser Module

It is common for a Laser unit to have only 3 terminals Power, GND and PWM and this is a common configuration with most lasers.

The image below show several examples of typical driver boards.



The Laser module board would commonly be found mounted on top of the Laser itself with or without a fan as shown below.

These all connect using the same method.

The 5.6K resistor installed between the PWM output and MASSO GND is important and must be installed on all Lasers that do not include a built in pull down resistor.

This is needed for correct PWM operation.

If you are unsure if your Laser has a pull down resistor built in there is no disadvantage in adding the resistor.

Ensure that the wires carrying power from the laser power supply are correctly sized for the required current.

Connecting other outputs to your Laser

Estop

If your laser has an enable input you can connect an Estop relay to your Laser to disable it in an emergency.

If you do not have an enable as part of your Laser you could route the power supply that powers the laser through the Estop relay but be aware that when using this method that when the Estop is restored the power will be reconnected and the Laser will turn back on. This may start to burn your material is the Laser is not disabled before power is restored.

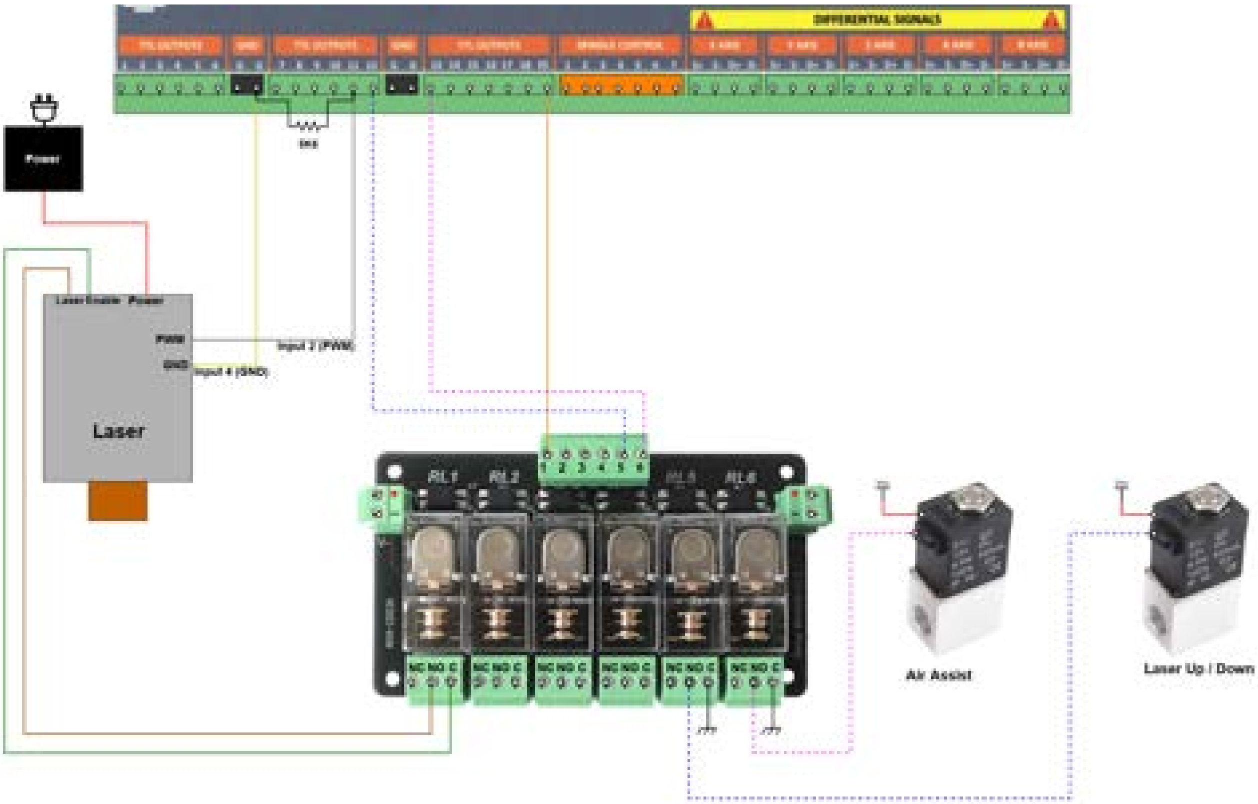
Air Assist

- An output is provided for Air assist if your laser supports it. Air assist is used to increase the cutting power of your laser as well as improve the cut quality.
- An M8 Gcode command will turn the air on and an M9 will turn it off.
- An air solenoid can be connected to turn the air on and off as required.

LASER Up/Down

- An output is provided to allow the Laser to be automatically lowered into position and raised back up once another tool is selected.
- As soon as the Laser tool is selected the Laser Up/Down output will go High. eg.**T111 M6**
- When another tool is selected the Laser Up/Down will go low. eg.**T1 M6**
- The Laser can be lowered by either a Pneumatic cylinder or a linear actuator.
- The Output can also be used to power the Laser on and off for additional safety.

WARNING: The example below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your selected hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.



Generating GCode

MASSO Laser GCode requirements are compatible with many GRBL Gcode softwares.

One of the best Laser software options is Lightburn which will allow you to engrave photos line drawings and cut parts as needed.

To see how to set up LightBurn for MASSO Laser please follow the link below.

Setting up Lightburn

Notes on Gcode format

- You must include **T111 M06** at the start of the Gcode file or the Depth map view will be blank.
- The **S** command can be on a line of it's own before the move or it can be on the same line as the Move.
- The **S** command ranges 0 - 1000 so to know what percentage of total laser power you have set divide the **S** value by 10.
- The **S** command is not actioned until there is an Axis move.

Laser Safety Glasses

The most important part of any Laser is a Quality pair of safety Glasses. Unlike other CNC tools a Laser can cause serious eye damage from a distance in normal use.

Laser Safety glasses are a must and can help reduce the probability of light entering the user's eye from a diffusely backscattered laser light.

Use quality Safety Laser glasses suitable for the Laser that you are using.

You only get one pair of eyes and they don't grow back.

Read other subtopics below:

8.6.1) Installing an Opt Lasers

8.6.2) Setting up Lightburn

8.6.1. Installing an Opt Lasers

Connect an Opt Lasers PLH3D

This page shows how the PLH3D 6 watt laser with CNC adapter was connect to MASSO for our Laser testing.

It comes with premade cables and only 2 wires needed to be connected to get the laser up and running.

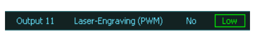
The addition of 2 more wires to the Estop relay adds another level of safety to the setup and is highly recommended.

The kit came with the Laser, a CNC Adapter and all cables necessary to connect it to the MASSO CNC Controller as well as a pair of safety glasses suitable for use with the Laser.

It also included a magnetic nozzle and Magnetic docking station so that you can remove it when not in use.

The PLH3D CNC Adapter provided with the kit is an interface between the Laser and MASSO which has various safety interlocks. These can be used to help ensure that the laser can be locked when not in use to prevent unauthorized use and provides other safety features such as a place to connect the Emergency stop.

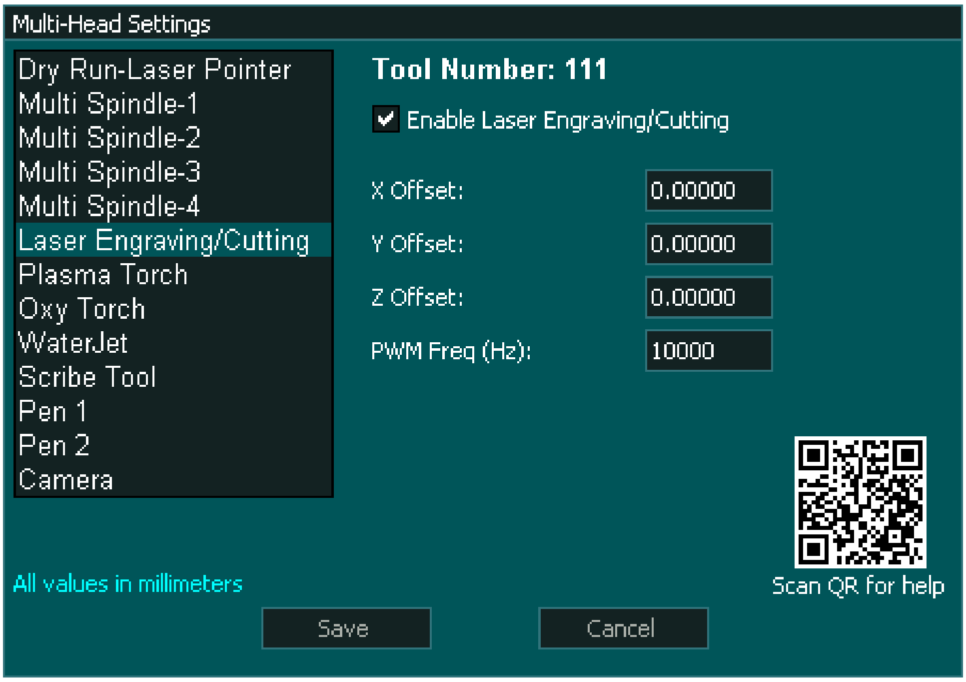
Configuring MASSO

- Configure MASSO output 11 for the LASER Engraving/Cutting output as shown. 

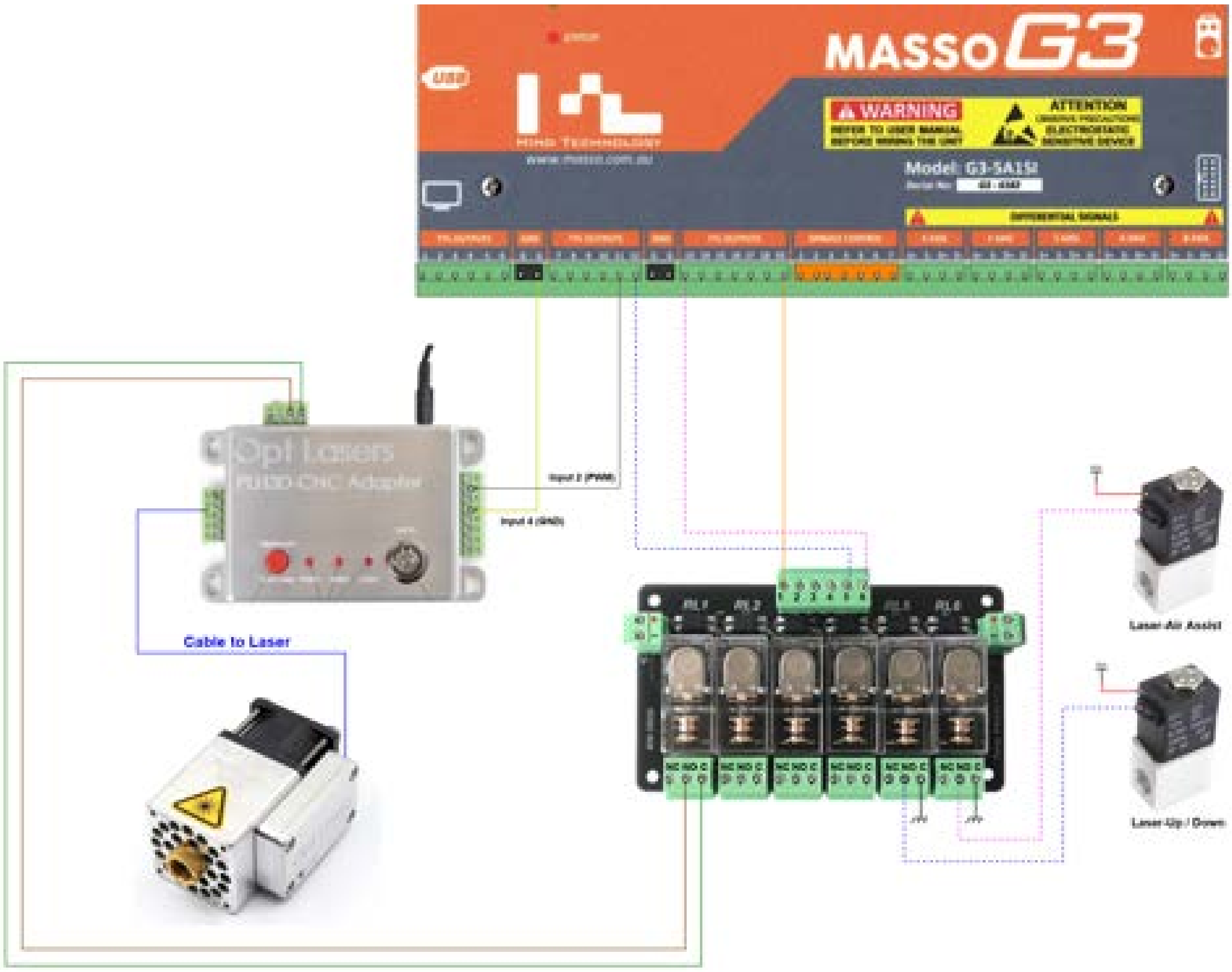
- No other output can be used for this function as it includes special hardware to output a PWM signal.
- An output can be assigned to move the Laser into position when Laser is selected. 

- An output can be assigned for Air assist is required. 

- Go to the Multi-Head setting page and select Laser Engraving/Cutting.
- Click Enable.

- 

- Set the PWM Frequency for your Laser. It is recommended that you select a value of 10Khz though this will depend on the power of your Laser and the maximum feed rate you will be moving at. Since power is controlled by turning the Laser on and off very rapidly, if you have a low PWM frequency and move quickly you could get a line that has areas where the laser was on or off - - - - - - - - A frequency of 10Khz should be a good balance.
- PWM can be set between 4Khz & 60Khz
- X,Y & Z offset is the distance from the Main spindle or other Main tool if using Waterjet or Plasma. This can be measured zeroing the DRO's, making a spot with the Laser and then jog the Main spindle over to the center of the spot and reading off the X Y Y coordinates on the DRO's. These will be your offsets. The Z offset will be determined by the focus point of your Laser offset to the Z zero point of your Spindle tool. It would not be uncommon to leave the Z offset set to 0 and to manually zero the Laser when doing the job. Offsets are only needed when switching between the Laser and other tools and only if they are part of the same Gcode file.
- Configuration complete.



Connecting to MASSO

You can use either set of the GND terminals for the yellow wire. Use which ever us convenient to you

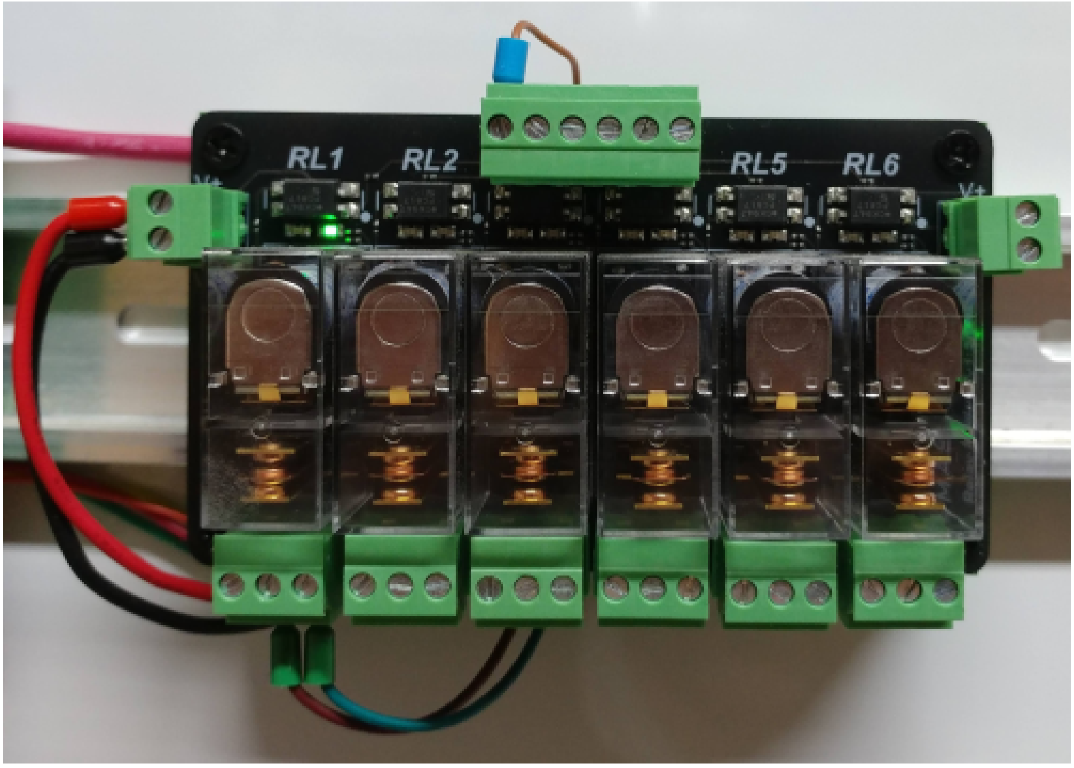
Installing the PLH3D-CNC Adapter

Connect as shown in the wiring diagram above.

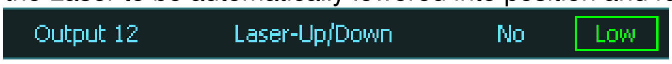
You can see the wire colours used to connect the TTL and Estop relay.

Estop Connection

To connect the Estop to the Laser a MASSO Relay was used and connected to the **ES** output on MASSO. The normally open contacts of the relay was connected to one of the External switch inputs on the CNC adapter. To do this remove one of the pre installed links on Switch connector along the top of the CNC Adapter and connect the Normally open and Common relay contacts of your Estop MASSO relay in place of the link as shown above. This will remove power from the Laser whenever the Estop is operated or MASSO is powered off.

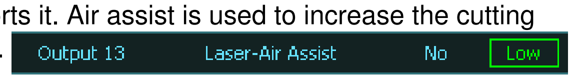


Laser Up/Down

- An output is provided to allow the Laser to be automatically lowered into position and raised back up once another tool is selected. 

- As soon as the Laser tool is selected the Laser Up/Down output will go High. eg.**T111 M6**
- When another tool is selected the Laser Up/Down will go low. eg.**T1 M6**
- The Laser can be lowered by either a Pneumatic cylinder or a linear actuator.
- The Output can also be used to power the Laser on and off for additional safety.

Air Assist

- An output is provided for Air assist if your laser supports it. Air assist is used to increase the cutting power of your laser as well as improve the cut quality. 

- An M8 Gcode command will turn the air on and an M9 will turn it off.
- An air solenoid can be connected to turn the air on and off as required.

Programming the CNC Adapter

The CNC adapter can be configured in many ways and needs to be set correctly to work with MASSO.

You will see the configured mode whenever you turn the Laser on in the first second before the Power LED turns on.

The CNC Adapter is correct if you see the Laser LED come on by itself before the Power LED turns on.

This what you see when you turn the Laser on

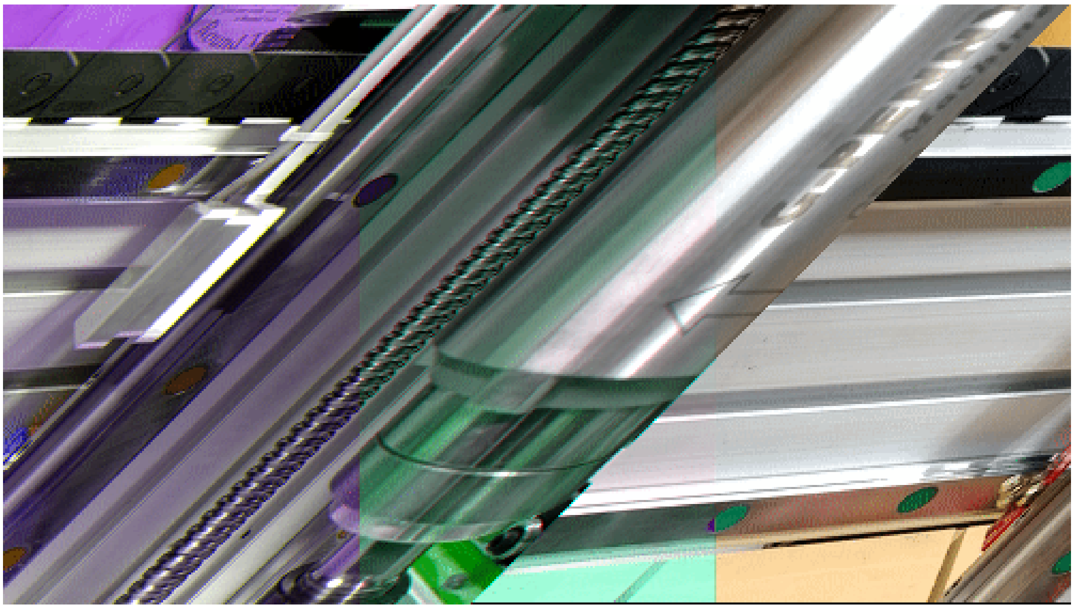
Instructions on setting the CNC Adapter can be found on the Opt Lasers Site. [CNC Adapter Manual]

Docking Station

The Laser kit has a docking station. Ideal if you do not want you Laser permanently attached to you machine.

The Docking station uses powerful rare earth magnets to achieve a good connection of the Laser to the machine and it also passes all electrical signals to the Laser head.

When not in use there is a cover to protect the docking station.



Safety Glasses

The most important part of any Laser is a Quality pair of safety Glasses.

The Laser Safety glasses supplied with the kit are high quality and help reduce the probability of light entering the user’s eye from a diffusely backscattered laser light.

They are rated as OD 7+ over the range of 190 to 540 nm, blocking deep ultraviolet to green including violet and blue light.

You only get one pair of eyes and they don't grow back.

8.6.2. Setting up Lightburn

What is Lightburn?

Lightburn is a software package designed to be used with Lasers of all types and can be used with CNC machines.

It has a free trial that allows you to test it with your machine before purchasing.

Lightburn

With Lightburn you can design, edit and create the Gcode which you can send to your MASSO CNC controller.

It is a very powerful software that can be used with Windows, Mac OS and Linux.

When you are happy that the software is what you want you will need to purchase a license for the GCode version of Lightburn software.

This document does not seek to teach you how to use Lightburn but how to set it up to use with MASSO.

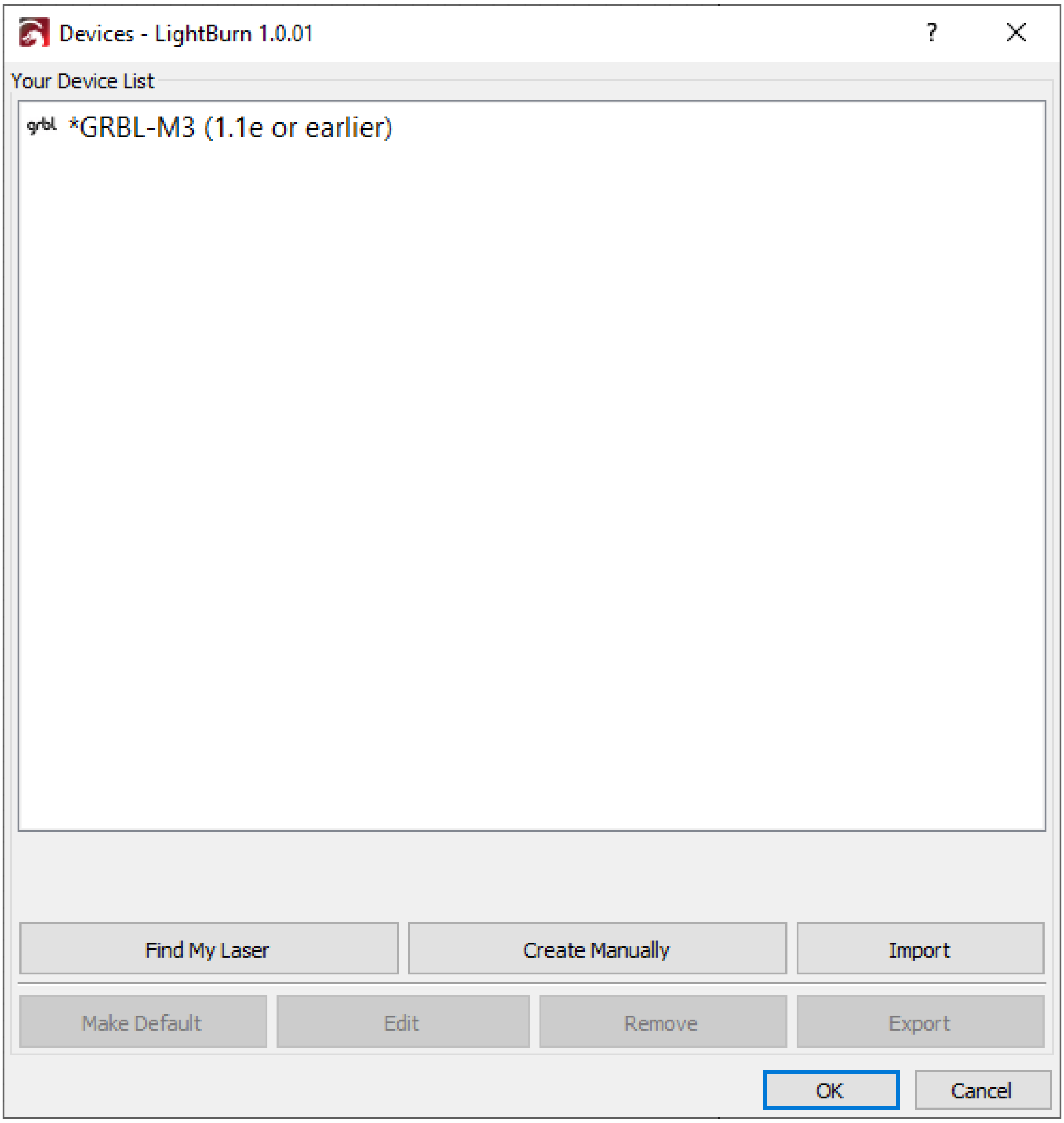
It assumes that you are using a Diode Laser.

Configure Lightburn to use with MASSO

Step 1 Select the right Machine type.

When you first open Lightburn it will Ask you to select your Device.

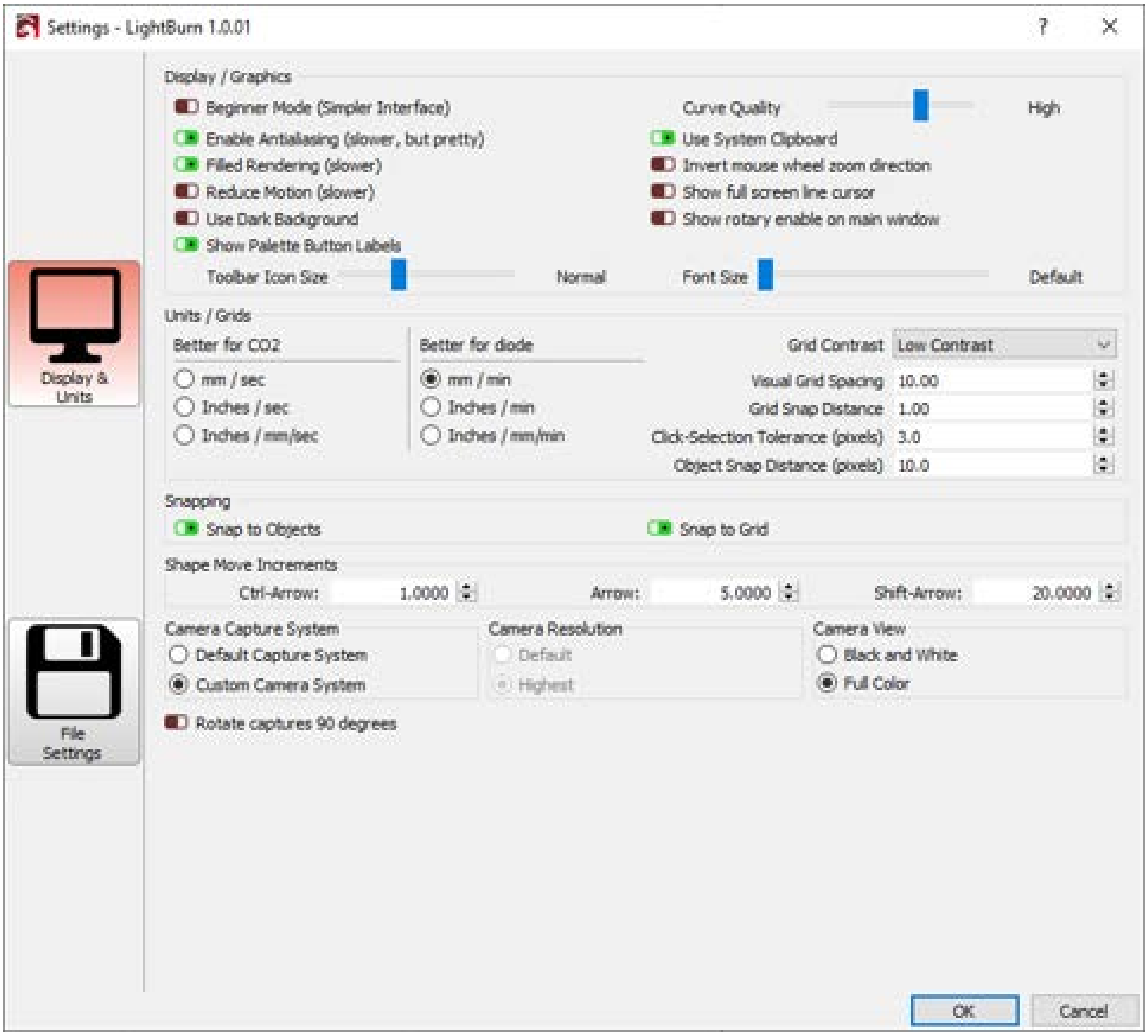
- Click on **Create Manually**
- select **GRBL-M3 (1.1e or earlier)** and click Next
- Select **Serial/USB** and click Next
- Enter the X & Y axis length for your machine and click Next
- Turn off Auto "home" your Laser, (switch will be brown when off), and click Next
- Click **Finish**



At the completion of step 1

Step 2  General settings

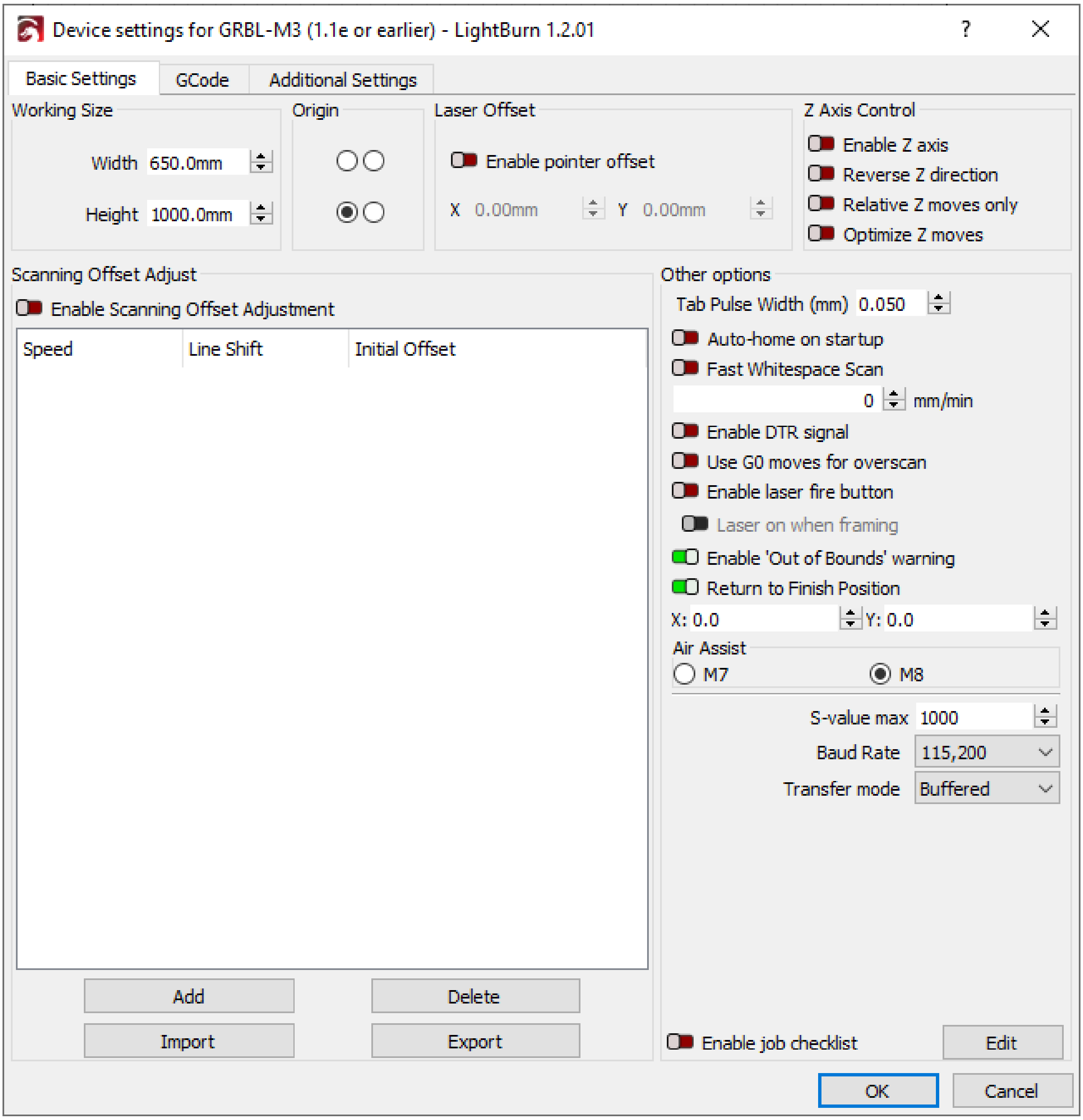
- Along the top line find the  symbol and click on it
- Under Unit / Grids select **mm** / **min** or **Inches** / **min** as required.
- Click **OK**



Completed General settings

Step 3  Device settings Basic settings tab

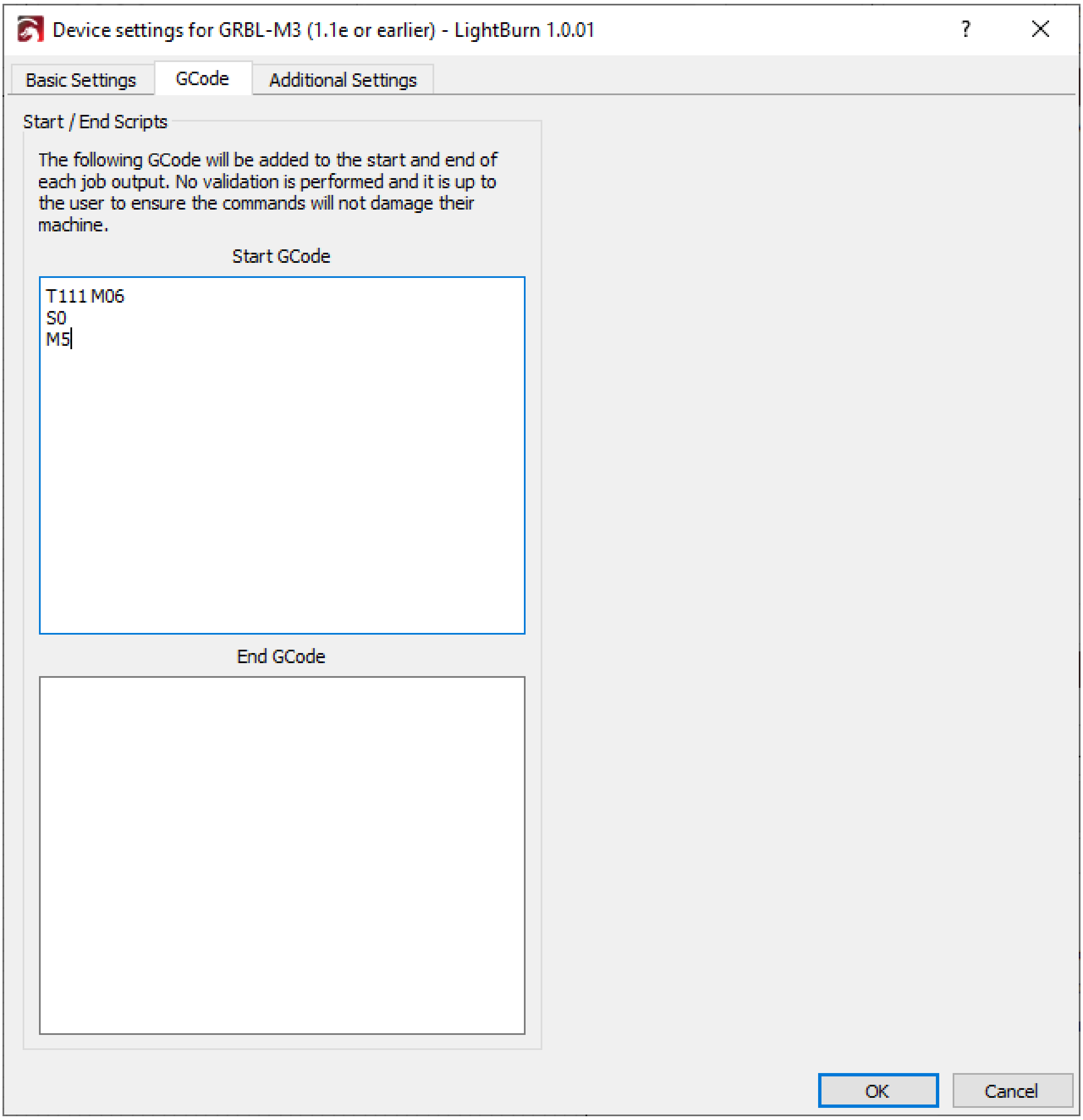
- Along the top line find the Along the top line find the  symbol and click on it.
- Under the Basic settings tab select **M8** for Air assist
- Set the **S-value max** to 1000



Completed Basic settings

Step 4  Device settings Gcode Tab

- Along the top line find the Along the top line find the  symbol and click on it.
- Under Start Gcode enter **T111 M06**
- Enter **S0**
- **M5**
- Click **OK**



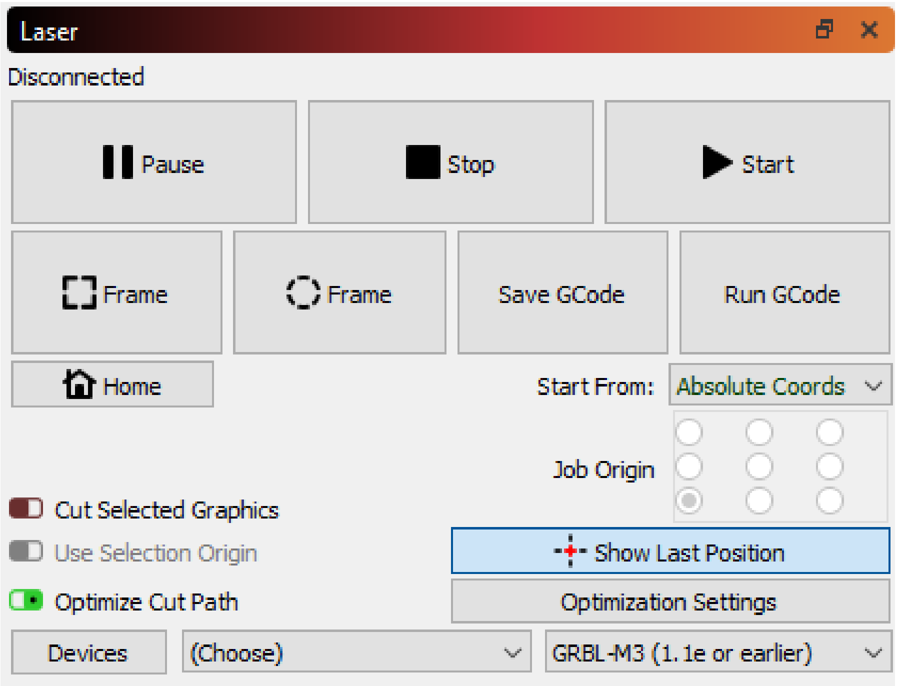
Completed Gcode Screen

Lightburn configuration is now complete.

Outputting Gcode

While there are many settings that you can use the steps above are the minimum needed to get up and running.

- Once you have created your project select Save Gcode to output your file.
- Remove the **.gcode** at the end of the file name and add **.nc** and all files from then on will save as **.nc** files
- Ensure that you have selected GRBL-M3 (1.1e or earlier) for your device when saving to ensure it outputs the correct Gcode format. This is only a problem if you set up more than one device.
- Ignore the disconnected message on screen as it only applies when the Laser is connected directly to Lightburn.



Overscanning

This is an important feature then engraving photos or shading an object.

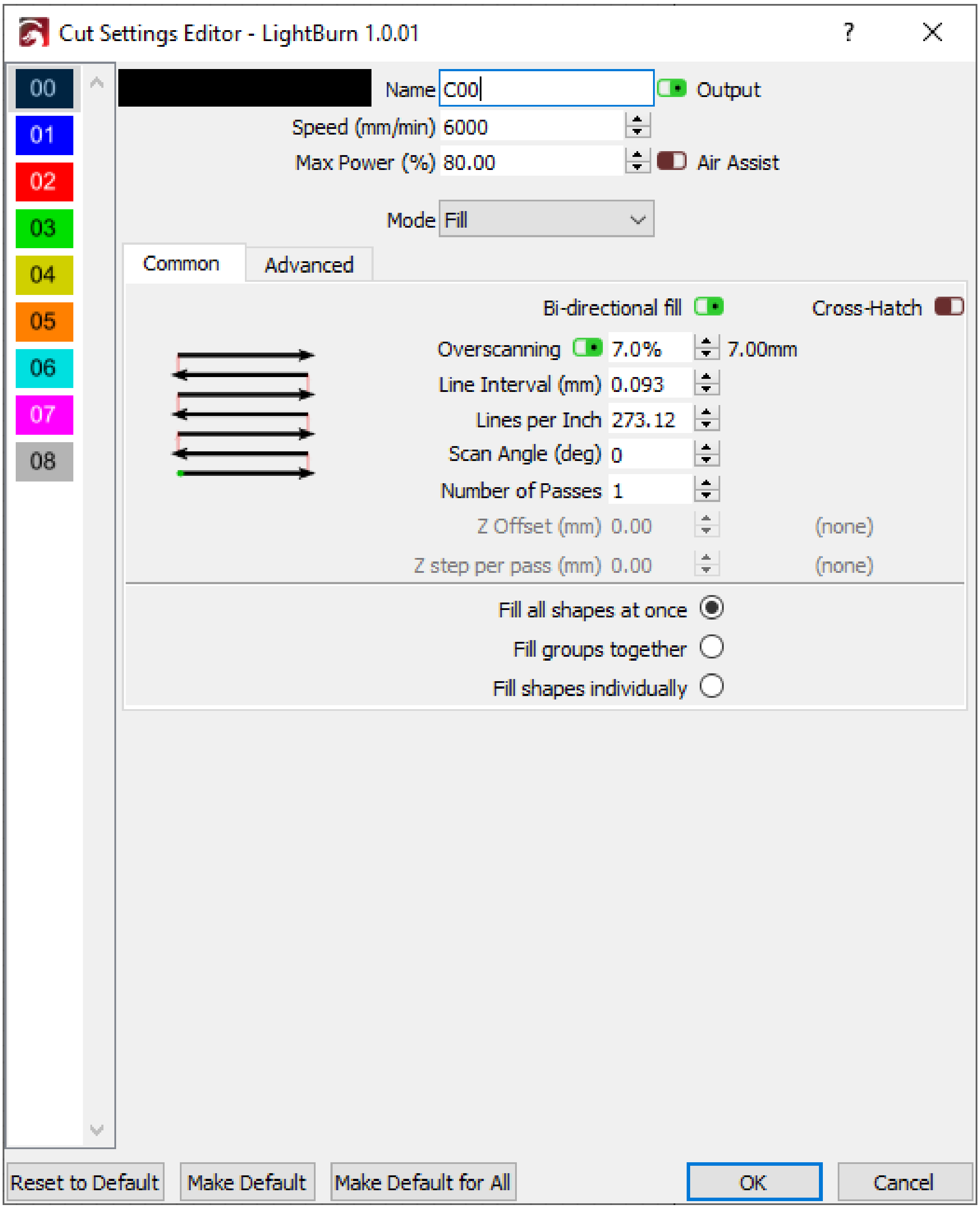
It allows the Laser to move past the end of the object you are engraving.

This is necessary to overcome acceleration and deceleration. Without overscanning the laser would slow down as it nears the end of the engraved area but because the laser is still turned on the area of acceleration or deceleration will get darker burning because the laser is moving slower in that area. This causes a fringing effect on your engraving.

By using overscanning on your layer the laser will move past the end of the engraving and turn the laser off then decelerate.

Likewise when accelerating it will start outside the engraving and turn on when it reaches the correct position. This will allow the Laser to reach the correct speed before turning on.

The faster you move longer the overscanning will need to be.



8.7. MASSO QR Scanner

INFORMATION: This feature is only available on MASSO G3 & MASSO Touch version 5.0 software or higher

What is the MASSO QR scanner?

The QR Scanner feature is only available for the MASSO G3 or MASSO Touch. It is not available for the MASSO G2.

It uses a standard 2D barcode scanner capable of reading QR codes to allow users to load their GCode files from the flash drive ready to run.

It works in concert with MASSO Link which has the ability to generate the required QR code and can send the file direct to MASSO via Wi-Fi.

Requirements

USB barcode scanner capable of reading QR codes.

Some scanners are only capable of reading 1D barcodes which are the type seen on food product packaging in supermarkets so please check with your supplier that the scanner does work with standard QR codes.

The Scanner must also be able to be configured to simulate a USB HID-KBW. In this mode the the reading module in the scanner will become a virtual keyboard to output data to the host.

The scanner also needs to be set to send a CR (carriage return) at the end of the scanned code.

Modern barcode scanners come with a user manual that include a set of series of barcodes that can be scanned by the reader which will program the barcode scanner to give the required outputs.

These may include

Communication interface: USB-KBW, USB-COM or HID-POS

Beep sound: On,Off, High, Medium, Low

End Character: None, Add CR, Add CR + LF, Add LF, Add Tab

Scan mode: Manual (trigger), Contineous or Auto sensing

Barcode type: QR enable, QR Disable

Setting up your scanner

The link below will take you through the setup and install process to connect your scanner to MASSO

https://docs.masso.com.au/getting-started-guides/installing-masso/qr_scanner

Generate QR code with MASSO Link

The link below will take you through the setup of MASSO Link and show how to generate your QR code

https://docs.masso.com.au/index.php/getting-started-guides/machining-with-masso/wi-fi-connectivity/qr-code-generation

USING your QR Scanner

After creating your Gcode file you can use MASSO Link to send the Gcode file to your MASSO G3

It is important that you send the Gcode file to the Flash Drive using the same directory structure as in your mapped folder on MASSO Link

If the file is in the root directory of the mapped folder then it must go in the root directory of the MASSO Flash Drive.

If it is in a sub folder in the mapped folder on MASSO Link it must be put in a folder of the same name on the MASSO Flash Drive.

The QR Code includes the file path information so if you do not put the Gcode file in the correct location MASSO will not be able to find it.

The Gcode file can also be copied directly from the PC onto the Flash drive as well.

The QR Code can be taken to your machine in printed form or it can be scanned direct from the screen of a device such as a phone tablet or computer screen.

For home or industrial applications a job sheet can be created by the CAD/CAM team with the relevant information needed for the machinist to cut the file.

The machinist can have a book of standard jobs on hand for they can choose from and scan as need.

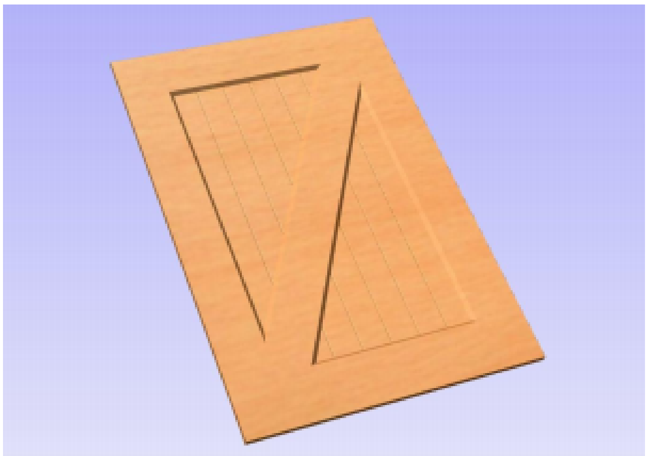
The use of a scanner can improve workflow and reduce errors.

The CNC Shop

Job No.	C4573	
Client	The ACME cupboard company	
Drawing	Rhodes cupboard door	
Quanty	4	
Required date	ASAP	
Material	Type	MDF
	Size	**X** 850mm **Y** 1220mm **Z** 18mm
Tools	1	90 degree Vbit 12mm
	2	6mm Endmill carbide
	3	N/A
	4	N/A
Machined by		
Notes:		

MASSO

\Rhodes cupboard door.nc



8.8. Homing Sensor Identify & Connecting

Homing Switch Overview

This document provides wiring and input configuration information based on the type of switch and wiring you are using. Due to the large variety of switches on the market we are unable to provide individual support for your chose sensor. This document will help you identify and connect your chosen sensor or switch and provide information on how to connect. Please use this in concert with the information that came with sensor. This document seeks to help identify Electronic switches such as proximity, optical or hall effect with the use of a voltmeter and some basic testing.

Wiring also provided for mechanical switches such as lever, push button and magnetic reed switches at the bottom of the page. Use a continuity tester to identify if your switches are normally open or closed and wire accordingly. Always used normally closed if you have the option of additional safety.

HINT: All MASSO inputs are optically isolated and require a voltage of 5V to 24V from your sensor to register an input.

INFORMATION: To invert an inputs logic, highlight the input and press the spacebar on your keyboard. All Homing inputs must show **LOW** when not operated and change to **HIGH** when active.

INFORMATION: If you are unsure what homing switch to purchase and how to wire it then MASSO supplies a Homing switch with full wiring instructions available.

Powering your Homing sensors

Power for the homing sensors on **MASSO G2** can be provided from:

- Directly from the MASSO power supply distribution point.
- A separate power supply which shares a common ground, (-ve rail), with your MASSO power supply.

Power for the homing sensors on **MASSO G3** or **MASSO G3 Touch** can be provided from:

- Directly from the MASSO power supply distribution point.
- A separate power supply which shares a common ground, (-ve rail), with your MASSO power supply
- The Auxiliary power terminals built into MASSO. These are the Red and Black terminals found between the input and output terminals.

WARNING: The installation of a 1 amp fuse between your Power Supply and MASSO is required to protect against an accidental short circuit of the auxiliary power connectors on MASSO, such an event can damage the controller beyond repair.

CAUTION: Power and **Ground** terminals provided on the controller are only to be used for very low current signals. Connecting high current loads can damage the controller beyond repair.

How to wire the MASSO homing sensor

[MASSO Homing Sensor]

Identify your Electronic homing switch type

Complete the following testing matrix using the steps below to identify your sensor type and required wiring / input setting.

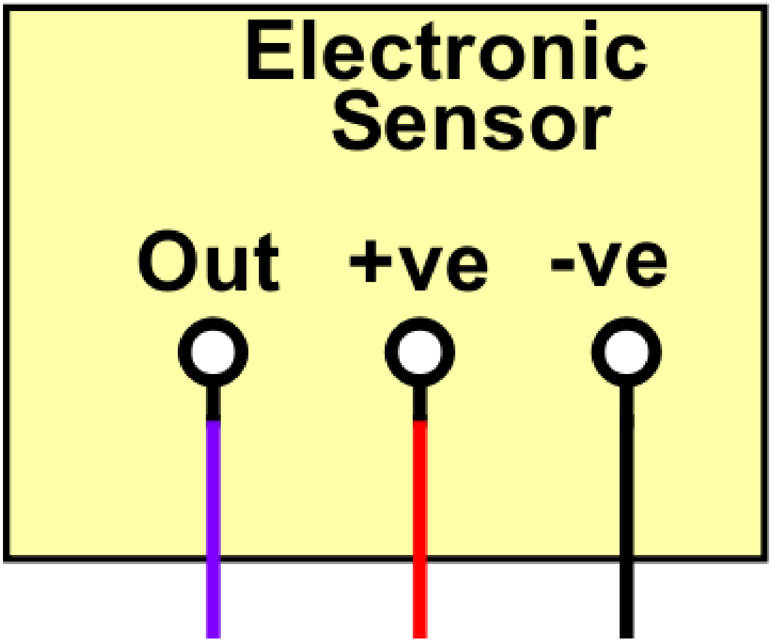
Step 1: Connect your sensor to a suitable power supply

Step 2: With sensor in normal state measure the voltage between the output & +ve and the output &-ve record the results in the table below. If the voltage is greater than 3.5 volts record a 1 otherwise record a 0. Ignore the polarity shown on the meter.

Step 3: Trigger the sensor and measure the voltage between the output & +ve and the output &-ve record the results in the table below. If the voltage is greater than 3.5 volts record a 1 otherwise record a 0. Ignore the polarity shown on the meter.

Electronic Homing Switch Matrix

	Output to -ve	Output to +ve	
Normal State			If the measured voltage is 3.5 volts or more write 1 in the box otherwise write 0. Ignore voltage polarity.
Triggered state			

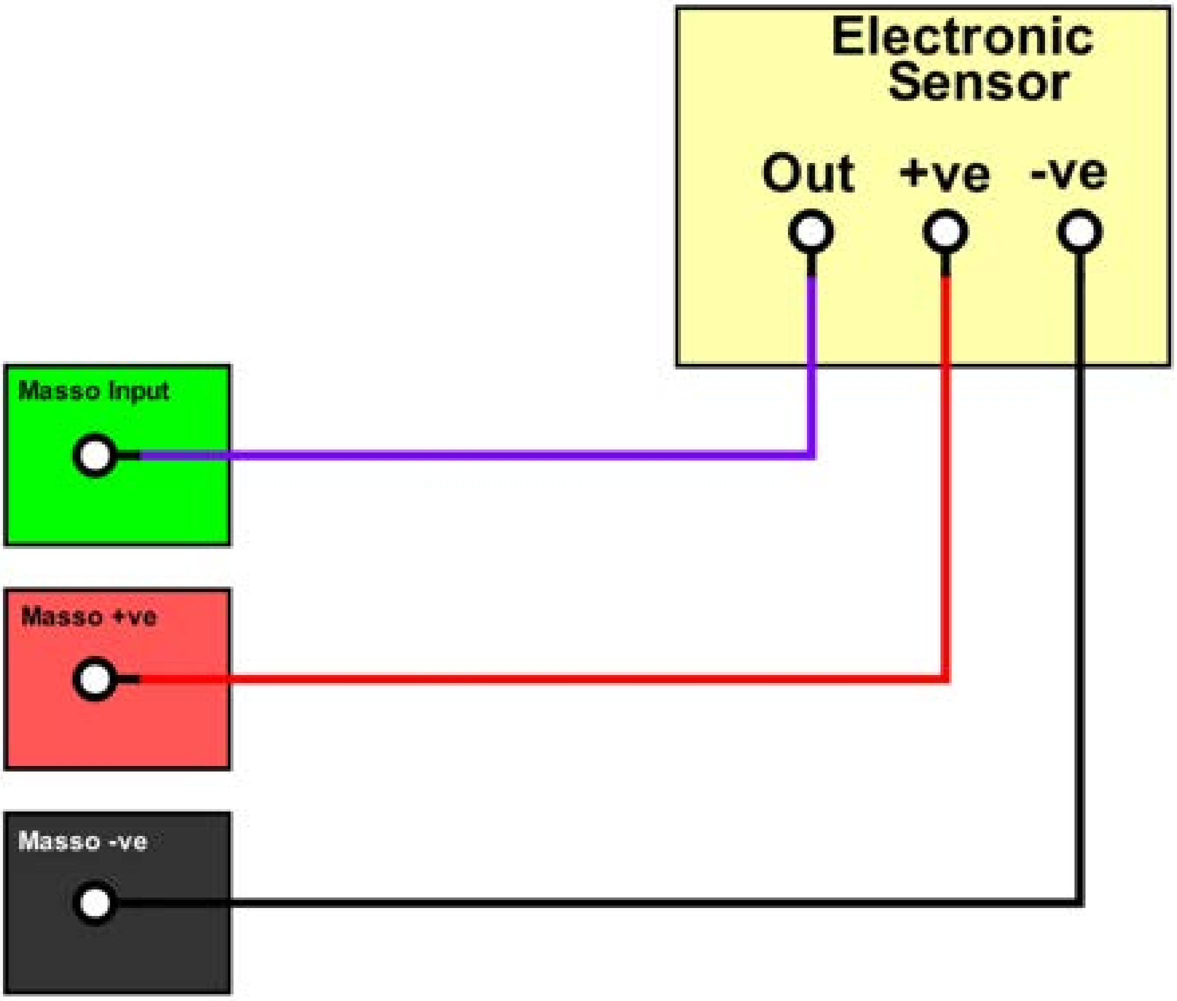


Step 4: Find the matching table below and use the wiring diagram and input configuration indicated.

Sensor Types and Wiring

Type 1

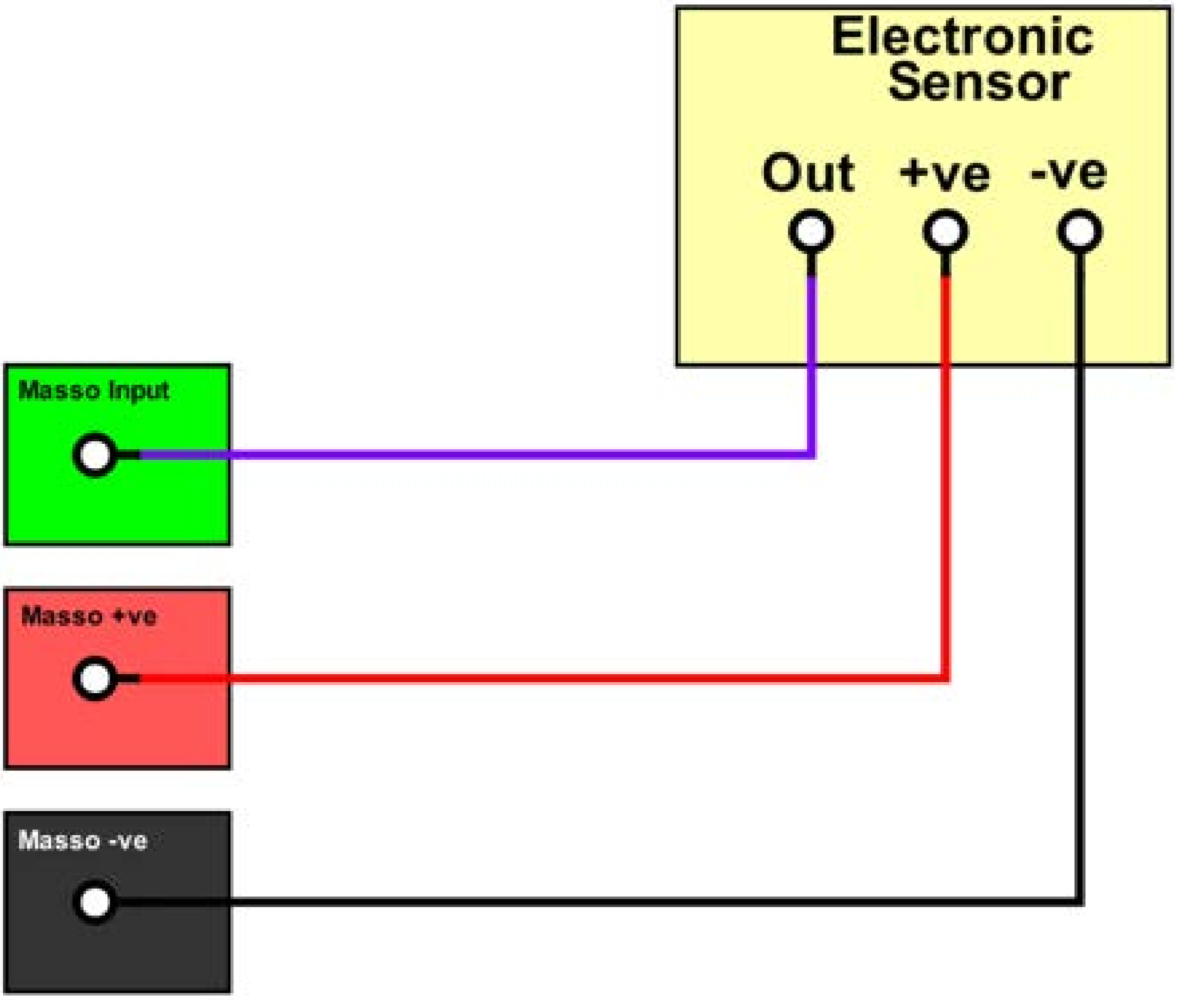
	Output to -ve	Output to +ve
Normal State	0	1
Triggered State	1	0



Type 2

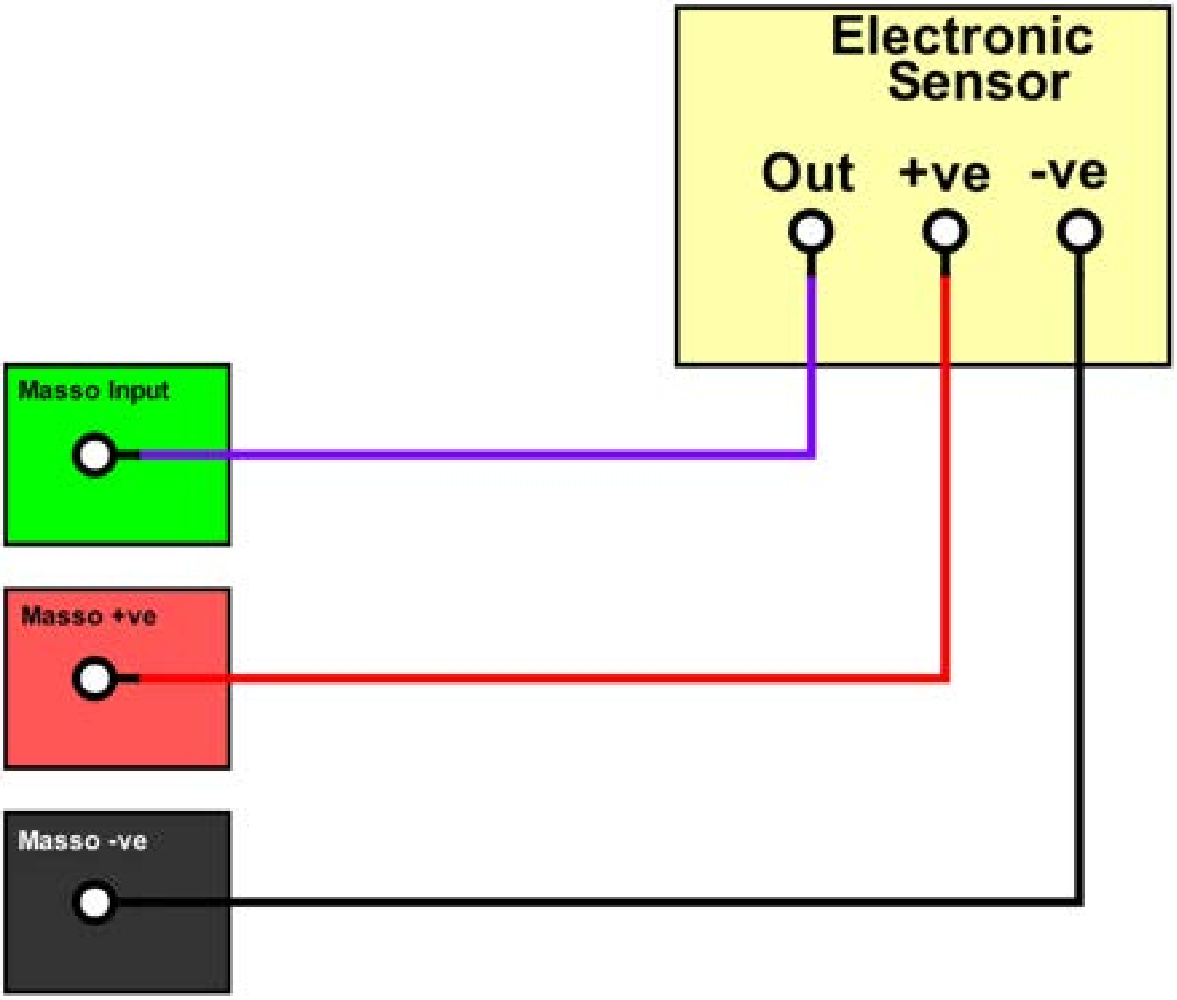
	Output to -ve	Output to +ve
Normal State	1	0
Triggered State	0	1

Note: Invert MASSO input for Type 2 sensor



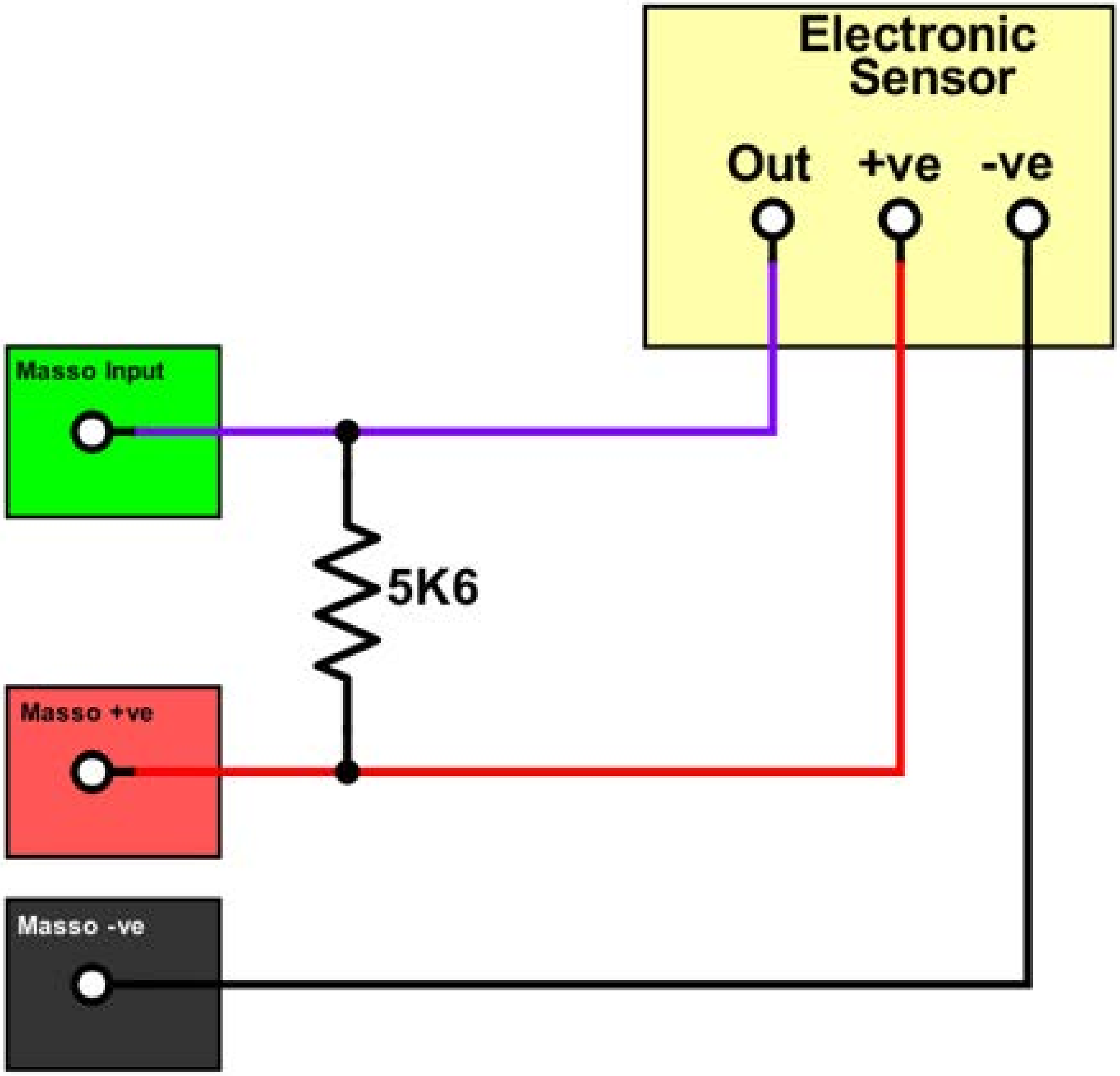
Type 3

	Output to -ve	Output to +ve
Normal State	0	0
Triggered State	1	0



Type 4

	Output to -ve	Output to +ve
Normal State	0	0
Triggered State	0	1



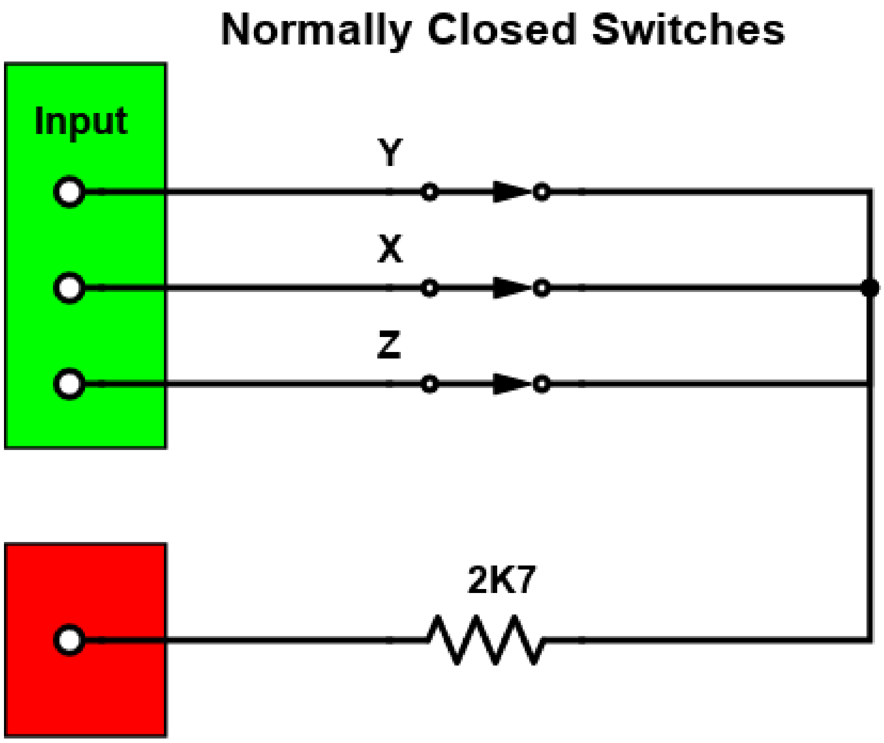
Note: Invert MASSO input for Type 4 sensor

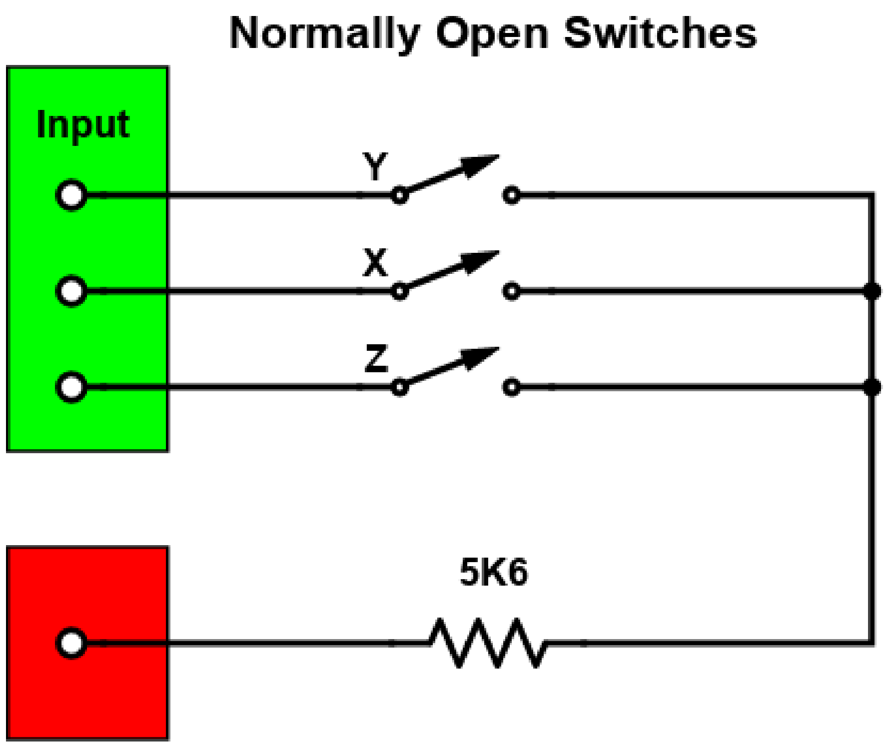
Mechanical Homing Switch connection

There are 2 ways of connecting Mechanical switches but the preferred method is using a normally closed switch which is the more fail safe method of the two. Should a homing switch wire break, the homing input will go high making MASSO think the Homing switch is already active so will attempt to back off the switch and will stop after 10mm.

In case of normally open switches a broken wire will not change the input and MASSO will drive the entire distance allowed before giving a homing alarm.

Note: Invert MASSO inputs when using Normally closed switches





Additional Resourses

For additional information on Homing and how to set it up please see our documentation on setting up homing.

[Setting up Homing]

Detailed video on setting up Homing settings in MASSO

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to Set up Homing on Masso - Masso Edition 15

8.9. Homing

Homing is an important part of using your MASSO and there are several types of homing available.

It is important to understand that the homing sensor at the end of the homing process changes to become the Hard limit sensor which allows the same sensor to home the machine as well as monitor when the machine moves outside of it's limits.

For additional information on how to start the homing process please see: How to home your machine

Mounting the Homing sensor

Traditionally Homing sensors and limit switches are placed at the extreme ends of the Axis travel and are wired back to the controller.

This is wasteful of system resources, hardware and wiring.

Homing sensors work very well when only homing and soft limits are used.

When using your Homing sensor as both homing sensor and Hard Limit sensor it is recommenced that you mount the Homing sensor on the moving axis carriage and place a trigger for the sensor at each end of the Axis travel. The allows the one sensor to be triggered at each end of it's travel with minimal hardware and wiring required. see the example below.

Note: the trigger for the sensor must be such that the sensor remains High throughout the homing process.

Example axis with the sensor mounted on the moving carriage and the trigger mounted on the stationary rail

If converting an existing machine with Homing and limit sensors at each end of the axis these will need to be multiplexed and connected to the axis homing input on MASSO.

How this is done will depend on the sensor or switch being used.

Auto Homing

This is the recommended method of homing your machine.

For Auto homing to work a sensor is required for each axis that will be homed.

On a 3 axis mill that would be the X, Y & Z axis and will require 3 homing sensors.

If you have a hardware slaved axis such as 2 motors connected to your Y axis then only one homing sensor is required for the Y axis as both motors are driven from the same Y axis signal.

Auto Homing with Axis Squaring

If you are software slaving then this includes the Auto squaring feature.

It uses the position of the homing switches on the dual motor axis to automatically square the machine as it homes.

It does this by having individual motors on the dual axis connected to different axis such as the Y & B axis.

Each axis will have it's own sensor and will home to its own sensor.

When the first motor triggers it's sensor it will stop and wait for the 2nd motor to locate its sensor and stop.

Both motors will back off their sensors. and at the end of the homing process will Lock together to form a single axis.

The position of each sensor will determine the squareness of the axis.

Squaring of the Axis is best achieved by moving the sensor on one side of the axis with respect the the sensor on the other side of the axis.

It is not recommended to use the pull off distance to adjust squaring as this will force the axis out of square and then back into square each time the machine is homed. This can lead to damage to the axis over time as tit will constantly twist the axis.

If you do not have one sensor per motor on a Software slaved axis you will get a Homing Alarm.

For more information on the types of Axis slaving please see the following page

Axis slaving

The Homing process

Regardless of which Auto homing process you use the Homing sequence is the same.

Homing is started by Double clicking or double tapping the Homing indication on screen using CTRL+ALT + H on an external keyboard or pressing an external Home Machine Button.

It consists of 4 distinct phases

1. Seeking the homing sensor
2. Back off which locates the primary home location
3. Pull off
4. Set Home Position

Example Homing sequence

- The axis moves towards its axis homing sensor until MASSO sees the axis Homing sensor changes to High
- If the homing sensor is already High MASSO will assume that the sensor is already found and will move to next step in the homing process.
- When the Sensor changes to High the axis decelerates and stops.
- The distance the axis travels after it starts to decelerate is determined by the axis acceleration setting.
- During the deceleration and stop the sensor must remain High at all times.
- The axis backs slowly off the sensor until the sensor changes to Low.
- The axis stops and the Back off process is complete with the primary home position located.
- If a Pull off distance is specified the axis will move at rapid speed the specified distance from the primary home location and stop.
- The current position is now assigned the coordinate shown in the Home position.

Homing Sequence

This defines the order in which the axis will home.

- You can do them one at a time or do them all together
- Axis that are software slaved are automatically grayed out and cannot be selected. 

- If a slave axis shows a tick it is because it was ticked previous to being slaved and will work the same as an unticked one.

- Any axis that is not selected will automatically be set to the Home position value at the end of the homing process.

Direction invert

This setting changes the direction that the axis uses when seeking the Homing sensor.

> **INFORMATION:** Before setting this direction make sure you have set the axis to move in the correct direction for machining

Homing Feedrate

This setting determines how fast the axis will move when seeking for the Homing sensor.

Your maximum homing feed rate is ultimately determined by your motor acceleration.

The lower your acceleration the longer it will take to decelerate the axis once the homing sensor is triggered.

Your axis must stop within 10mm or 0.3937" of this trigger point or MASSO will not be able to back off before giving an alarm.

Slow axis acceleration means slow deceleration and longer travel before coming to a halt with the result being that motors with higher accelerations can have higher a Homing Feed Rates.

Back off

The purpose of Back off is to accurately locate the point at which the homing sensor returns to Low.

This accurately fixes what is called the primary home location on the machine.

This may or may not be the final home position.

Rules

- The trigger for the homing sensor must remain High until the axis backs off the sensor. ie it must not trigger and return to Low before the axis comes to a halt.
- Ensure your sensor remains high for a minimum of 10mm once triggered.
- If the homing sensor does not return to Low within 10mm or 0.3937" a homing alarm will be given.
- If the homing sensor changed to Low during the deceleration phase it will not back off the sensor.

Pull Off Distance

This setting has several uses depending on your application.

- The pull off moves the axis away form the homing sensor which after the back off is sitting on the edge of the trigger point. If hard limits are enabled this can create a safe distance from the trigger point of a few mm to prevent false triggering of the hard limit alarm.

- MASSO allows the tool changer to be located outside soft limits and it is not uncommon for the Homing sensors to be located in this area.
- If the homing position is located in the Tool change area outside soft limits then the Pull off distance can be used to move the axis into the allowable soft limit area before homing is completed.
- If this is not done you will receive either a Homing alarm or a Soft limit alarm.

Home Position Setting

The Home position setting is the Machine coordinate that is given to the final axis position at the end of Homing

This setting will ultimately define the G28 home position and the machine coordinates of your machine.

- This setting does not need to be set to 0
- A good example of changing the Home position is where the machine homes at the rear of the machine but you want you Machine Coordinates to start at 0 referenced from the front of the machine. If your Y axis is 1 meter away from the front of the machine then setting Home Position to a value of 1000 will make the Y 0 point at the from of the machine and the G28 home position will be at the front of the machine.
- Another use is when the Z axis is long but you want your Z0 machine coordinate to be lower down the axis. This has application in machining where various functions such as tool changes, Auto tool Zero, Jump to line and in Plasma where the Z axis will rise to Machine coordinate Z0. By changing the Home Position setting in the homing screen you can define how high the Z axis rises in these processes.

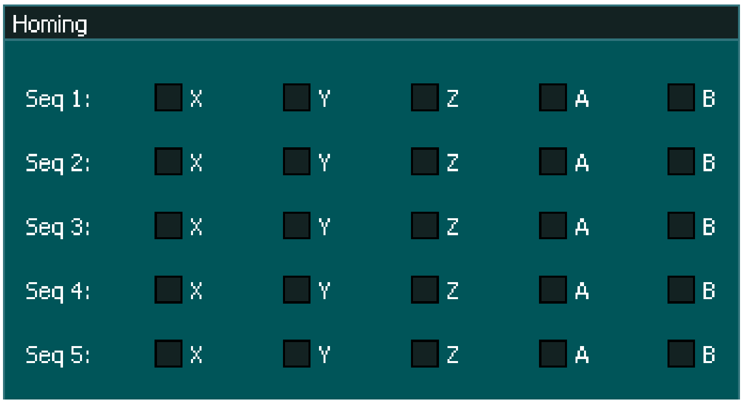
INFORMATION: The G28 Home position and machine home position is Machine Coordinates X0,Y0, Z0,A0, B0.

Manual Homing / Stall Homing

This involves moving to a specific, repeatable location on the machine that you want to call your home position.

- This can be done by manually moving the X, Y & Z axis to the designated position and double clicking the Home button.
- This includes stall homing which involves jogging the axis until they stall against physical barriers to act as a repeatable position then double click the Home button to set this as the home position.
- This method requires no homing sensors.

- To use this method all axis must be left unticked in the Homing sequence
- Each axis will be assigned the coordinate of the Home Position



Setting up homing Step by Step

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to Set up Homing on Masso - Masso Edition 15

TroubleShooting

If you get Homing alarms when homing there can be several causes which you should investigate.

- Ensure all homing sensors show Low in the F1 screen when the sensor is not triggered
- Ensure that the homing sensors change to High when triggered by the axis.
- If when you home the Axis moves slowly backwards 10mm and alarms instead of moving towards the homing sensor then your homing sensor is either set High in on the F1 page or the sensor is faulty.
- If you get a homing alarm when the axis is backing off a sensor the most likely cause is the deceleration of the axis took it beyond 10mm. Reducing the Homing Feedrate will fix this problem.
- If you get a hard limit alarm during homing an axis it is most likely that you triggered the homing sensor and then moved past it to the other side and the sensor went low again. In this case the axis will not back off the sensor because it is already low and when it tries to pull off the sensor it will trigger a hard limit alarm. The sensor must remain high until the axis backs off the homing sensor. Ensure your sensor remains high for a minimum of 10mm once triggered. Reducing homing speed or increasing axis acceleration can also help if this is not possible.
- If after homing the machine sits and Flashes homing but does nothing the most likely cause is Auto Tool Zero is turned on but you have not set it up correctly. Disable Auto Tool Zero.
- If after homing the machine sits and flashes Homing but does nothing you may have a tool changer enabled on your machine but have not set it up correctly. Some tool changer types home during the homing sequence. Change the tool changer to manual until you have completed the install of your Tool Changer.
- If after homing the machine sits and flashes Homing another cause can be that you have a Soft limit issue. This can be that the tool setter is outside the soft limits or you have set the soft limits for the Z axis preventing it moving Z axis to machine coordinate Z0. The Z axis will rise to Z0 before moving the the tool setter and if your soft limits prevent the then the machine with stop and eventually time out. Ensure that all axis soft limits allow movement to the tool setter location and the Z axis is allowed to move up to Z0 and down far enough to touch off the tool on the tool setter.
- If unsure how your Homing sensor should be wired please see our Quick Start guide on Homing sensor Identification.
- On a software slave axis it is very important that the right sensor is assigned to the right motor or you will get very strange results when homing the slaved axis. Use the technique shown in the Homing video above to identify which motor of a slaved axis is which and which sensor is which. Do not Assume..

9. Troubleshooting Guides

Read other subtopics below:

9.1) Ground Loops

9.2) Symptoms of Ground Loop Damage

9.3) Checking Optocouplers

9.4) VFD and Spindle Testing

9.5) Axis Testing

9.1. Ground Loops

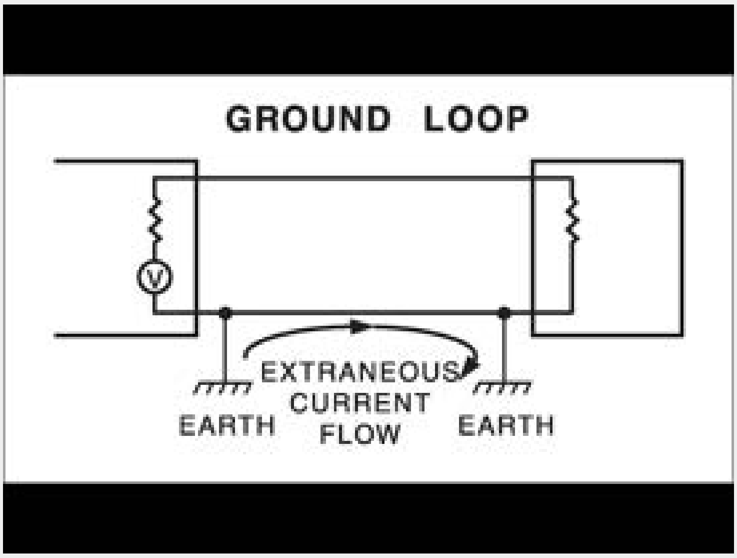
While wiring and setting up a machine or any electrical equipment, grounding loops can be formed between different electronic devices, and the high current flowing through the grounding loops can cause sensitive electronic equipment to malfunction or fail.

WARNING: Ground loops can cause equipment malfunction and damage if the ground loop potential difference is too high.

Understanding ground loops

A ground loop is formed when multiple parts of electrical equipment that are connected together are connected to the ground at multiple locations. The distance and resistance in the current flow from the grounding point can cause these differences in potential. Even a small potential difference of 1v to 2v can cause high amounts of current to flow between the equipment which can severely damage components on equipment.

The below is a great video explaining ground loops and how they can be prevented.

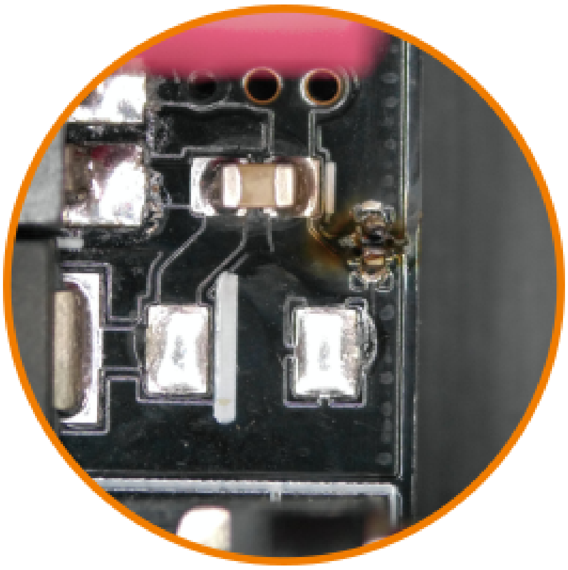


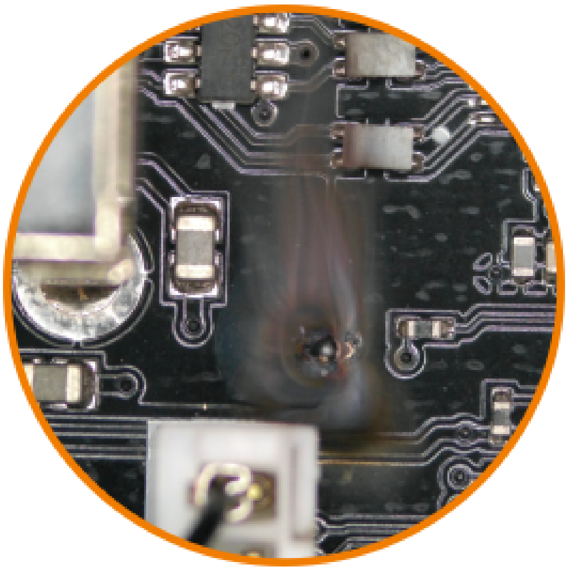
Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Ground Loops: Grounding Series (Part 6)

Examples of damage caused by ground loops

The below show burnt components due to the ground loop on the MASSO G3 touch unit.





Preventing ground loops

On any machine setup, multiple ground loops can happen where long cables are connecting equipment. Some examples:

- Ground wires between controller and motor drives.
- VGA screen ground wire between controller and VGA monitor.
- Ground wire between external powered USB HUB. NOTE: If the USB HUB is only powered by the

controller's USB port then a ground loop is not formed.
- If a long USB cable is used from the controller and the other side of the USB socket's body touches another ground such as the body of a machine.
- If the controller's ground pin is connected to the frame of the machine. This is can happen on the MASSO G3 Touch controller via the rear mounting plate.

The best way to avoid ground loops is to make sure that the entire machine is only grounded at one point only. The same applies to when wiring the machine frame and other electronics. Ground loops can be formed in a lot of different ways and are hard to document but having this understanding can help plan the wiring of machines and troubleshooting.

9.2. Symptoms of Ground Loop Damage

Symptoms of Ground Loop Damage

Inputs stop working

- This would normally affect multiple inputs rather than a single input.
- If a visual inspection of the board does not show damaged components you may just have a faulty optocoupler.
- Tests can be done by using the standard optocoupler test procedure for you particular controller type as per the links below.
- Testing MASSO G3 and MASSO G3 Touch optocouplers
- Testing MASSO G2 Optocouplers

Inputs randomly going high or low

- This may affect one or more inputs changing state for no apparent reason.
- Start with a visual inspection of the main board for signs of damage.
- Testing this may require the use of test equipment to test the input signal, replacement of an input source and the investigation of it's associated wiring.
- Please be aware that electrical noise as well as ground loops can cause similar symptoms.

USB Stops working

- One or more USB ports on MASSO stop working.
- Plug a known good USB flash drive into the affected port and see if MASSO can read it. If possible test the flash drive on a working port on MASSO to ensure that MASSO can read it.
- If the Flash drive does not work you can test the USB port to see if it is outputting 5 volts by plugging a USB cable between the port on MASSO and your phone. If the Phone starts charging them MASSO is supplying 5 volts.
- If you do not get 5 volts on the MASSO USB port you may have ground loop damage.
- Start with a visual inspection of the main board for signs of damage.

9.3. Checking Optocouplers

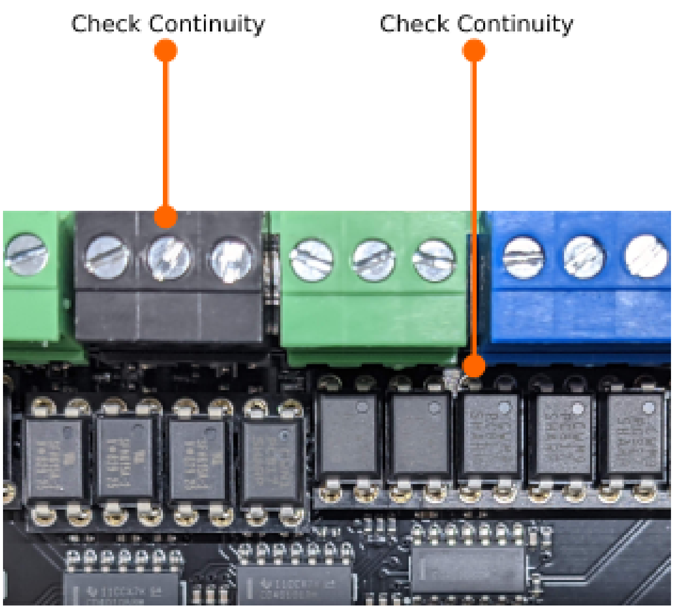
If any of the optically isolated inputs on the controller do not work then the below steps can be done to find the cause of the problem.

Step 1: Checking ground side continuity

With a multimeter check, the continuity between the black connector and the below-marked pin of the optocoupler input that's not working.

If there is no continuity then it can be caused because of the below reasons:

- The optocoupler is not plugged in properly.
- The track on the circuit board has been damaged.



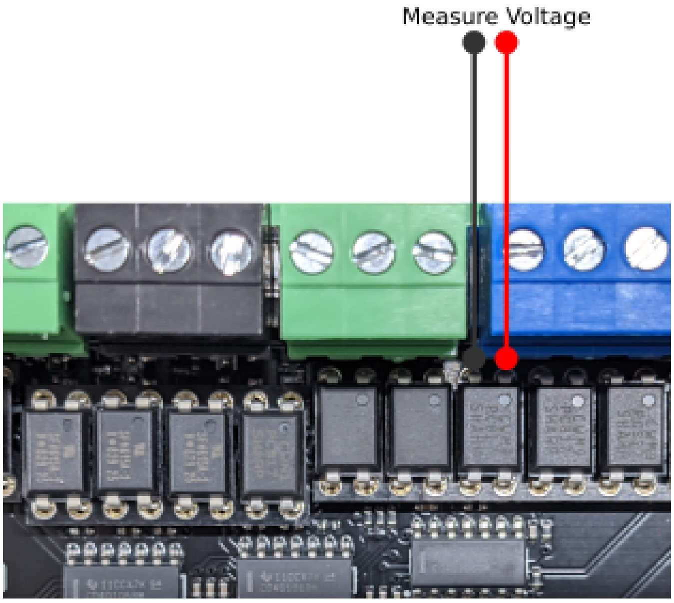
Step 2: Measuring input signal voltage

Connect a 5v to 24v signal to the input that is being tested and measure the voltage on the below-marked points.

This voltage should be around 1.1v. If this voltage is not received then it can be caused because of the below reasons:

- The optocoupler is not plugged in properly.
- The track on the circuit board has been damaged.

- The resistor for this optocoupler is damaged.



Step 3: Measuring output signal voltage

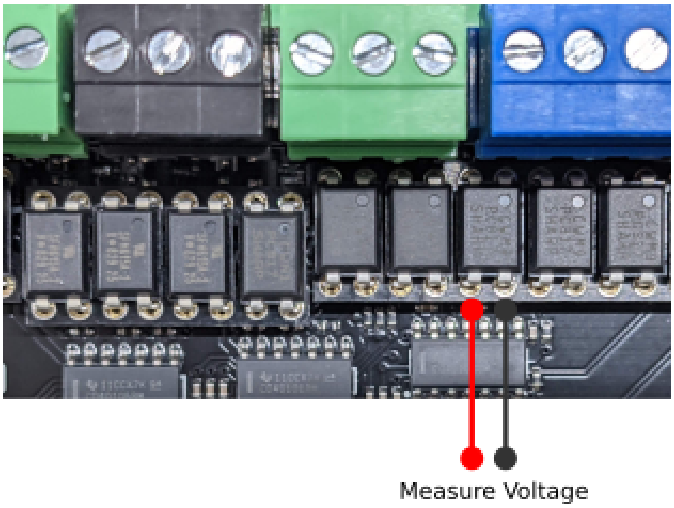
Ensure that no signal is connected to the input and measure the voltage on the below-marked points.

This voltage should be around 3.1v.

Connect a 5v to 24v signal to the input and measure the voltage on the below-marked points.

This voltage should drop to around 0.14v. If this voltage is not received then it can be caused because of the below reasons:

- The optocoupler is not plugged in properly.
- The optocoupler is damaged.
- The track on the circuit board has been damaged.


Measure Voltage

9.4. VFD and Spindle Testing

Introduction

This guide outlines the steps needed to troubleshoot a VFD / Spindle problem.

The video at the bottom of this page will take you through the test procedure step by step and you can follow the written instructions below.

It's purpose of the troubleshooting guide is to identify if the problem is located within MASSO or the VFD.

If the problem is identified as the VFD or Spindle please contact your supplier for further troubleshooting procedures.

A Spindle need to know two things to work, how fast and what direction.

- How fast is determined by the voltage on Pin 1 of the MASSO Spindle control
- The direction is determined by the Clockwise / Counter Clockwise outputs on pins 4 & 5, 6 & 7 of Spindle control.

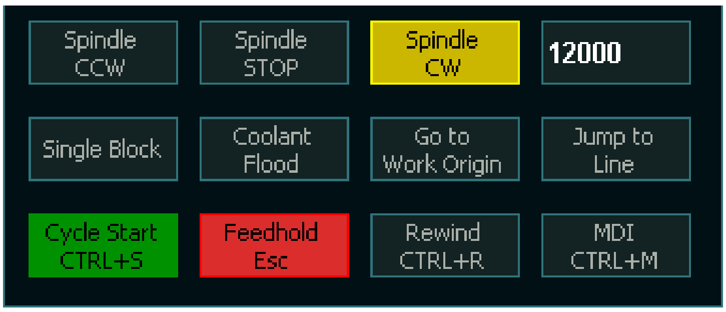
Test Equipment

- Multimeter

Testing the Speed control

Enter a spindle speed of 50% of your spindles maximum speed into the spindle speed box on the F2 screen and press the Spindle CW button.

In this example the maximum spindle speed is 24000 so 12000 is used for the test.



Measure the voltage between Spindle control Pin 1 and one of the Black terminals on MASSO.

You should see a reading of 5 volts. (Note: it will now show exactly 5 volts but it will be close)

If you are seeing 5 volts the spindle speed control it working ok and you can proceed to testing the direction signal.

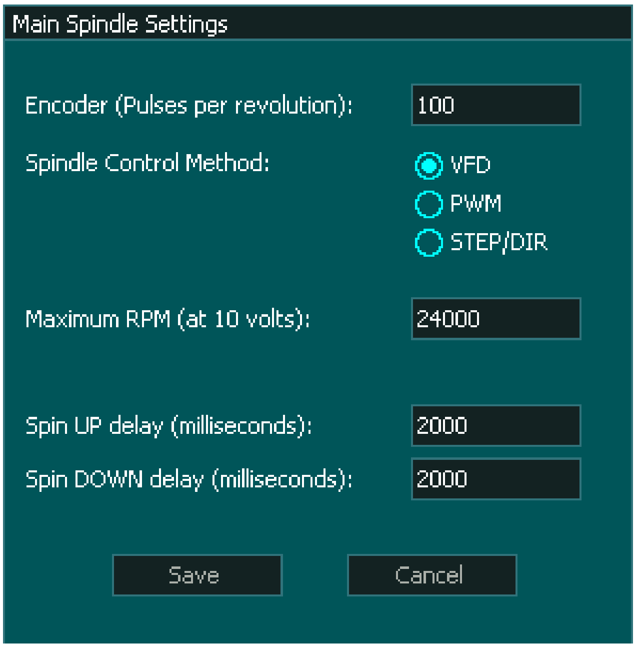
If the voltage is low then unplug the Spindle control plug from MASSO and test again.

If the voltage is now correct then you have a problem with the VFD or its wiring as something is dragging the voltage down.

Check your wiring and consult your VFD supplier for further assistance.

If the Voltage is still low, check the spindle settings.

Make sure you have VFD selected and the spindle speed at 10 volts setting, is double your test speed.



If you still cannot get 5 volts you may have a damaged spindle control output.

Please contact MASSO support for further troubleshooting.

Testing Direction Clockwise

Step 1

Stop the spindle with the Spindle Stop button and measure the voltage across Spindle control Pins 4 & 5.

Put the Black meter lead on Pin 4 and the Red meter lead on Pin 5.

You should read a voltage coming from the VFD. This voltage varies depending on the VFD but 24 volts is common.

If the voltage reading is negative then you have pins 4 & 5 reversed, correct and test again.

If the voltage reading is correct move to Step 2

If you do not see a voltage or it is lower than expected you may have a faulty VFD or faulty wiring or optocouple

Check the F2 screen to ensure that Spindle Stop is lit up yellow to indicate the spindle is turned off. 

Check that optocouple by unplugging the Spindle control plug and testing the voltage across pins 4 & 5 on the plug.

If the voltage remains low then the problem is the VFD or the cable. Check your cabling and consult your VFD supplier for further assistance,

If it now shows the correct voltage then you have a problem with the optocouple.

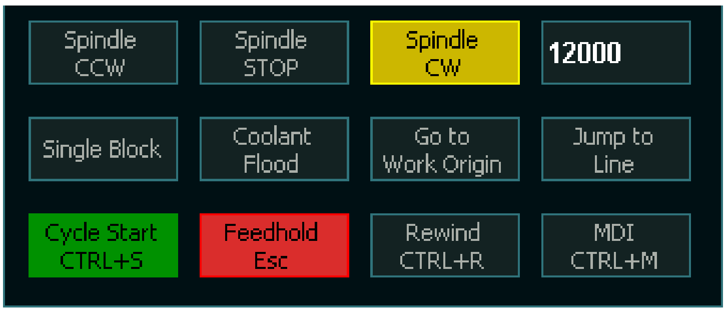
How to replace a faulty Optocouples on MASSO G3 & MASSO Touch

How to replace a faulty Optocouples on MASSO G2

If after replacing the Optocoupler it continues to drop the voltage when you connect the VFD please contact MASSO support for further troubleshooting.

Step 2

If the voltage is correct, Enter a spindle speed of 50% of the maximum spindle speed and press the Spindle CW button.



Measure the voltage across Spindle control Pins 4 & 5 and this time it should read less than 0.3 volts.

If the voltage shows 0.3v or less, the clockwise signal is correct and the problem is with the VFD. Please consult your VFD supplier for further assistance.

If the voltage drops when the Spindle is set to CCW but does not get as low as 0.3v, this may indicate a wiring issue between MASSO and the VFD or a faulty optocouple.

For example a drops from 24v to 5v

Please check the wiring between MASSO and the VFD to ensure that you do not have a high resistance connection.

If the voltage does not then the Optocouple in MASSO is faulty and needs replacing.

How to replace a faulty Optocouples on MASSO G3 & MASSO Touch

How to replace a faulty Optocouples on MASSO G2

If after replacing the Optocouple and turning on the spindle the voltage from the VFD does not fall to 0.3v or less, please contact MASSO support for further troubleshooting.

If the voltage between Spindle control pins 4 & 5 shows 0.3v or less, the clockwise signal is correct and the problem is with the VFD.

Please consult your VFD supplier for further assistance.

Testing Direction Counter Clockwise

Step 1

Stop the spindle with the Spindle Stop button and measure the voltage across Spindle control Pins 6 & 7.

Put the Black meter lead on Pin 6 and the Red meter lead on Pin 7.

You should read a voltage coming from the VFD. This voltage varies depending on the VFD but 24 volts is common.

If the voltage reading is negative then you have pins 6 & 7 reversed, correct and test again.

If the voltage reading is correct move to Step 2

If you do not see a voltage or it is lower than expected you may have a faulty VFD or faulty wiring or optocouple

Check the F2 screen to ensure that Spindle Stop is lit up yellow to indicate the spindle is turned off. 

Check that optocouple by unplugging the Spindle control plug and testing the voltage across pins 6 & 7 on the plug.

If the voltage remains low then the problem is the VFD or the cable. Check your cabling and consult your VFD supplier for further assistance,

If it now shows the correct voltage then you have a problem with the optocouple.

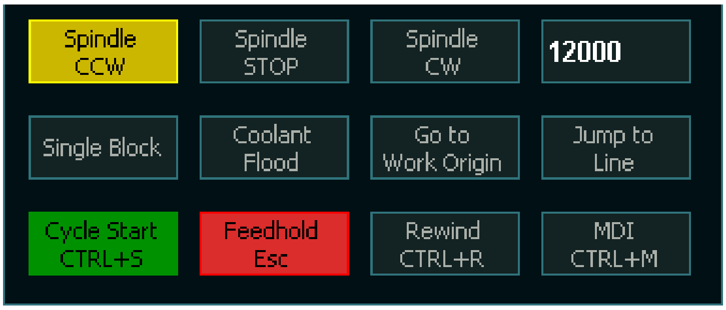
[How to replace a faulty Optocouples on MASSO G3 & MASSO Touch]()

[How to replace a faulty Optocouples on MASSO G2]()

If after replacing the Optocouple it continues to drop the voltage when you connect the VFD please contact MASSO support for further troubleshooting.

Step 2

If the voltage is correct, Enter a spindle speed of 50% of the maximum spindle speed and press the Spindle CCW button.



Measure the voltage across Spindle control Pins 6 & 7 and this time it should read less than 0.3 volts.

If the voltage shows 0.3v or less, the clockwise signal is correct and the problem is with the VFD. Please consult your VFD supplier for further assistance.

If the voltage drops when the Spindle is set to CCW but does not get as low as 0.3v, this may indicate a wiring issue between MASSO and the VFD or a faulty optocouple.

For example a drops from 24v to 5v

Please check the wiring between MASSO and the VFD to ensure that you do not have a high resistance connection.

If the voltage does not change then the Optocouple in MASSO is faulty and needs replacing.

[How to replace a faulty Optocouples on MASSO G3 & MASSO Touch]()

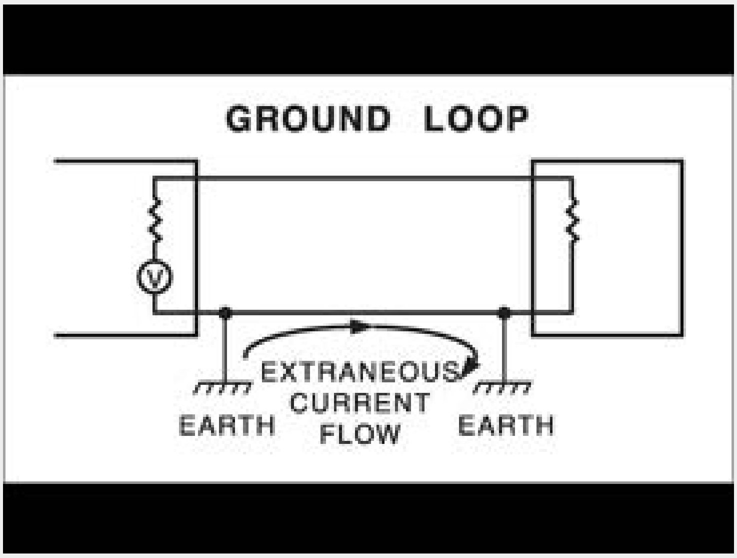
[How to replace a faulty Optocouples on MASSO G2]()

If after replacing the Optocouple and turning on the spindle the voltage from the VFD does not fall to 0.3v or less, please contact MASSO support for further troubleshooting.

If the voltage between Spindle control pins 6 & 7 shows 0.3v or less, the clockwise signal is correct and the problem is with the VFD.

Please consult your VFD supplier for further assistance.

Video Guide Step by Step



Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Troubleshoot your VFD - MASSO Top Tip

9.5. Axis Testing

INFORMATION: This Test feature is for the MASSO G3 and MASSO Touch. It available in the Beta version 5.100b and can be downloaded from MY WORKSHOP, see the note in the Introduction section for more information.

Introduction

This guide outlines the procedure for troubleshooting an axis that is not working to determine if the axis output has been damaged.

It shows how to test the Step and Direction outputs of an axis using the built in STEP and DIRECTION test function.

Please Note: This feature is only available in the Beta test version 5.100b which can be downloaded from MY WORSKOP.

Backup all settings before loading this software as you will need them to return to your original software version after testing is complete

After you load v5.100b you will be able to use the test feature on the X Y & Z axis to do the testing using the step by step instructions below.

Once you are finished reload your original software version and load back the settings file you saved.

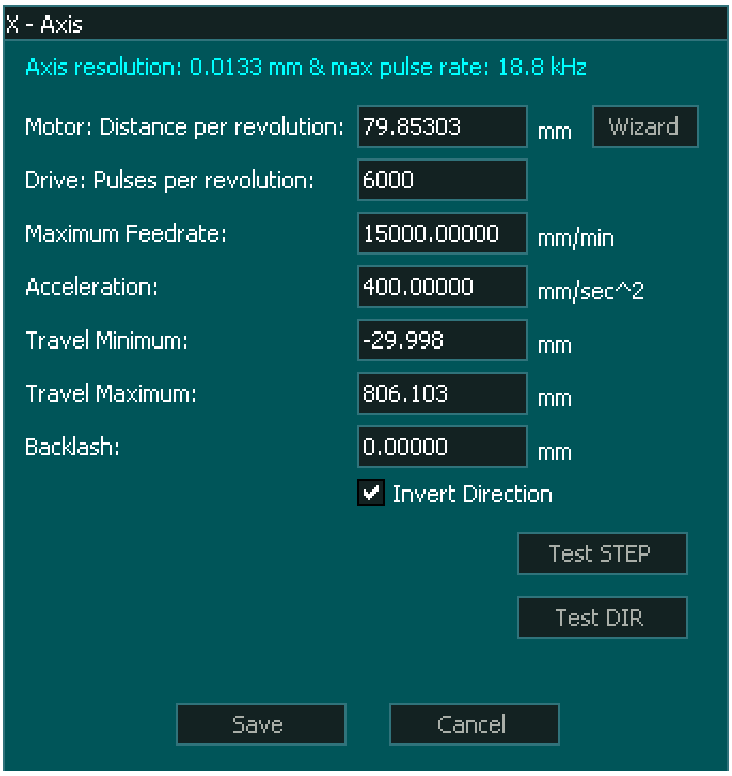
Do not continue with v5.100b for setting up or running your machine.

Test Equipment

- Multi-meter

Testing Method

Each axis has a Test Step and Test Dir button



Pressing the 

button will toggle the Step output from High to Low or from Low to High

Pressing the 

button will toggle the Direction output from High to Low or from Low to High

Testing Axis Step Differential Output

Symptom of a faulty Step output is the axis will not move in either direction.

> **INFORMATION:** For the purposes of this testing document a voltage between 3.6v and 4v is referred to a 4 volts and is considered a good test.

- Disconnect all wires from the step and direction of the axis you want to test. This can be done by removing the Axis connector.
- Open the page of the Axis you want to test in the F1 Screen
- Connect your Multi-meter to the S+ & S- of the axis under test. Put the Multi-meter positive lead on the S+ and the negative lead on the S-.
- Read the voltage and you should see 4 volts
- Note the polarity of the measured voltage.
- Press the 

button.
- Read the voltage and you should see between 4 volts
- The polarity of the measured voltage should be now be reversed to the original reading.

Each time you press the Test STEP button the voltage reading of 4 volts should remain but polarity will reverse.

This is a good test and the differential output is working correctly.

If the differential output is not working correctly please follow the instructions below for the Common Ground Output test.

This will determine the extent of the axis damage.

Testing Axis Step Common Ground Output

Symptom of a faulty Step output is the axis will not move in either direction.

- Disconnect all wires from the step and direction of the axis you want to test. This can be done by removing the Axis connector.
- Open the page of the Axis you want to test in the F1 Screen
- Connect your Multi-meter Negative lead to MASSO GND
- Connect the Meter Positive lead to The Axis S+ and you will see either 4 volts or 0 volts.
- Press the Test STEP button.
- If you saw 4 Volts on the S+ you will now see 0v
- If you saw 0 volts on the S+ you you will see 4 volts

Each time you press the Test STEP button the voltage will toggle between 0 and 4 volts This is a good test result.

If you do not see the voltage toggle between 0 & 4 volts each time you press the Test STEP button you have a damaged S+ output, continue to test S-

- Connect the Meter Positive lead to The Axis S- and you will see either 4 volts or 0 volts.
- Press the Test STEP button.
- If you saw 4 Volts on the S- you will now see 0v
- If you saw 0 volts on the S- you you will see 4 volts

Each time you press the Test STEP button the voltage will toggle between 0 and 4 volts This is a good test result.

If you do not see the voltage toggle between 0 & 4 volts each time you press the Test STEP button you have a damaged S- output

Testing Axis Direction Differential Output

Symptom of a faulty direction output is the axis travels in one direction only.

> **INFORMATION:** For the purposes of this testing document a voltage between 3.6v and 4v is referred to a 4 volts and is considered a good test.

- Disconnect all wires from the step and direction of the axis you want to test. This can be done by removing the Axis connector.
- Open the page of the Axis you want to test in the F1 Screen
- Connect your Multi-meter to the D+ & D- of the axis under test. Put the Multi-meter positive lead on the D+ and the negative lead on the D-.
- Read the voltage and you should see 4 volts
- Note the polarity of the measured voltage.
- Press the Test DIR button.
- Read the voltage and you should see between 4 volts
- The polarity of the measured voltage should be now be reversed to the original reading.

Each time you press the Test DIR button the voltage reading of 4 volts should remain but polarity will reverse.

This is a good test and the differential output is working correctly.

If the differential output is not working correctly please follow the instructions below for the Common Ground Output testing

This will determine the extent of the axis damage.

Testing Axis Direction Common Ground Output

Symptom of a faulty direction output is the axis travels in one direction only.

- Disconnect all wires from the step and direction of the axis you want to test. This can be done by removing the Axis connector.
- Open the page of the Axis you want to test in the F1 Screen
- Connect your Multi-meter Negative lead to MASSO GND
- Connect the Meter Positive lead to The Axis D+ and you will see either 4 volts or 0 volts.
- Press the Test DIR button.
- If you saw 4 Volts on the D+ you will now see 0v
- If you saw 0 volts on the D+ you you will see 4 volts

Each time you press the Test DIR button the voltage will toggle between 0 and 4 volts. This is a good test result. Repeat for the D-

If you do not see the voltage toggle between 0 & 4 volts each time you press the Test DIR button you have a damaged D+ output, continue to test D-

- Connect the Meter Positive lead to The Axis D- and you will see either 4 volts or 0 volts.
- Press the Test DIR button.
- If you saw 4 Volts on the D- you will now see 0v
- If you saw 0 volts on the D- you you will see 4 volts

Each time you press the Test DIR button the voltage will toggle between 0 and 4 volts This is a good test result.

If you do not see the voltage toggle between 0 & 4 volts each time you press the Test DIR button you have a damaged D- output

Interpreting Test Results

If the results of the Step and Direction differential tests are all good the MASSO axis is working ok.

You may have a problem with the axis configuration, the motor, driver, or the wiring.

If the Step differential test does not show 4 volts and the polarity reversing between S+ & S- when the Test STEP button is pressed you have a faulty Step output.

The axis may still be usable if either of the S+ or S- outputs tests ok in the Common ground test.

It is possible to damage the S+ and still have a functioning S- or visa versa which will allow you to run the axis in common ground mode.

The Step Common ground output test will tell you which of the Step outputs is faulty and which is good.

If the Direction differential test does not show 4 volts and the polarity reversing between D+ & D- when the button is pressed you have a faulty Direction output.

The axis may still be usable if either the D+ or D- outputs tests ok in the Common ground test.

It is possible to damage the D+ and still have a functioning D- or visa versa which will allow you to run the axis in common ground mode.

The Direction Common ground output test will tell you which of the Direction outputs is faulty and which is good.

Important!

> **WARNING:** If you determine that you have a damaged axis output please test and locate the actual cause of the damage as continuing without addressing the root cause will only cause further damage.

If you require assistance please contact MASSO Support

10. Supported G-codes

Read other subtopics below:

10.1. G00 - Rapid Motion

This command is used to move one or more axis at the maximum feedrate to a specified location. If multiple axis are called they will all move together to the desired location in a straight line and arrive at the same time. The axis can be linear, angular or a combination of both.

Syntax & Parameters

G00 followed by the axis you wish to move and it's coordinate. Multiple axis may be specified on the same line.

X, Y, Z, A, B Value – specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.

U, V, W Value – specifies an incremental move of the X,Y or Z axis while the machine is in G90 Absolute mode. U moves the X axis, V moves the Y axis, W moves the Z axis All U, V & W moves are incremental regardless of whether the machine is in Absolute (G90) or Incremental (G91) mode

Example program

```
N10 G21  N20 G00 X10 Y20 Z30
```

In the above program the first line command G21 will first set the controller units to millimetres, then it will move the axis from its current location to next position of X 10mm, Y 20mm, & Z30 mm in a straight line at the maximum speed the machine axis will allow.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

INFORMATION: The motion can be either in G90 Absolute or G91 Incremental mode.

10.2. G01 - Linear Interpolation Motion

This command is used to move one or more axis at the specified feedrate to a specified location. If multiple axis are called they will all move together to the desired location in a straight line and arrive at the same time. The axis can be linear, angular or a combination of both.

Syntax & Parameters

G01 followed by the axis you wish to move and it's coordinate. Multiple axis may be specified on the same line.

X, Y, Z, A, B Value – specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.

U, V , W Value – specifies an incremental move of the X,Y or Z axis while the machine is in G90 Absolute mode. U moves the X axis, V moves the Y axis, W moves the Z axis All U, V & W moves are incremental regardless of whether the machine is in Absolute (G90) or Incremental (G91) mode

F Value – The F value defines the feedrate at which the axis will move at. If the F value is not specified then the feed rate used from the last G01 command is used.

Example program

```
N10 G21  N20 G01 X10 Y20 Z30 F100  N30 G01 X0 Y0 Z0
```

In above program the first line command G21 will first set the controller units to millimetres, then it will move the axis to next position of X 10mm, Y 20mm, & Z 30mm in a straight line at 100mm/min feedrate. In the last line the axis will move to X 0mm, Y 0mm, & Z 0mm at 100mm/min feedrate.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

INFORMATION: The motion can be either in G90 Absolute or G91 Incremental mode.

10.3. G02 – Circular Interpolation (Clockwise)

This command runs a circular motion in a clockwise direction. The arc starts at the current position and the center is defined by the I, J, K values as an offset of the current position or R for radius. The X, Y & Z values define the finish point. Masso uses Incremental I, J, K values for Arcs

Syntax & Parameters

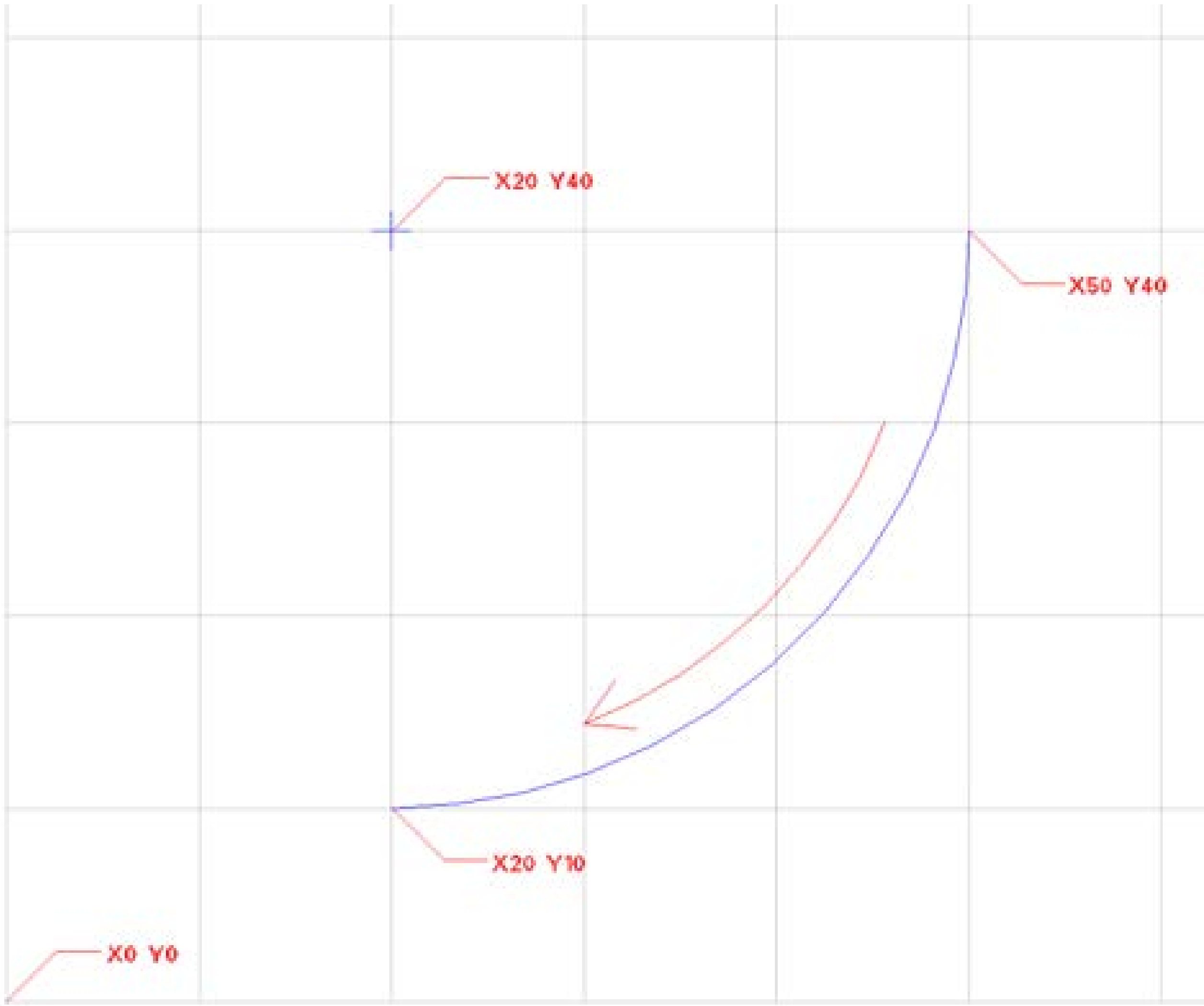
- **G02** starts an arc movement beginning at the X, Y, Z coordinate location where the G02 was issued.
- **X Value** – This is the X coordinate defining the end point
- **Y Value** – This is the Y coordinate defining the end point
- **Z Value** - This is the Z coordinate defining the end point
- **I Value** – are relative coordinates and define the X center coordinate as an offset of the starting point X coordinate. (Valid in G17 & G18 planes)
- **J Value** – are relative coordinates and define the Y center coordinate as an offset of the starting point Y coordinate. (Valid in G17 & G19 planes)
- **K Value** – are relative coordinates and define the Z center coordinate as an offset of the starting point Y coordinate. (Valid in G18 & G19 planes)
- **R Value** - Is used to define the arc radius for arcs up to 90 degrees.

> Caution: The use of R Value for arcs greater than 90 degrees does not work as it defines multiple center points. For arcs greater than 90 degrees use IJK values for G02 commands.

Example program for making an Arc

```
N10 G00 X50 Y40 Z-1  N20 G02 X20 Y10 I-30 J0
```

- In the above example in the first line moves to position X50 Y40 Z-1
- An arc is made starting at position X50 Y40 and ending at coordinate X20 Y10 with the center at position X20 Y40 moving in a clockwise direction. The Z height does not change.
- The Arc center is calculated as follows
- Starting position X50 + I-30 = Center X coordinate X20
- Starting position Y40 + J0 = Center Y coordinate Y40



Example program for making a Spiral

```
N10 G00 X50 Y40 Z0  N20 G02 X20 Y10 Z-3 I-30 J0
```

- By adding a Z height into G02 you can create a spiral arc.
- In the above example in the first line moves to position X20 Y10 Z0
- An arc is made starting at position X50 Y40 and ending at coordinate X50 Y40 with the center at position X20 Y40 moving in a counterclockwise direction. The arc is the same as in the diagram above but the Z axis will descend from its current height to -3 units at a uniform rate over the arc to form a spiral path.
- The Arc center is calculated as follows
- Starting position X50 + I-30 = Center X coordinate X20
- Starting position Y40 + J0 = Center Y coordinate Y40

INFORMATION: Units are defined as either inches or mm depending on your machine's setup or G20 or G21 command in use.

10.4. G03 – Circular Interpolation (Counter Clockwise)

This command runs a circular motion in a counterclockwise direction. The arc starts at the current position and the center is defined by the I, J, K values as an offset of the current position or R for radius. The X, Y & Z values define the finish point. Masso uses Incremental I, J, K values for Arcs

Syntax & Parameters

- **G03** starts an arc movement beginning at the X, Y, Z coordinate location where the G03 was issued.
- **X Value** – This is the X coordinate defining the end point
- **Y Value** – This is the Y coordinate defining the end point
- **Z Value** - This is the Z coordinate defining the end point
- **I Value** – are relative coordinates and define the X center coordinate as an offset of the starting point X coordinate. (Valid in G17 & G18 planes)
- **J Value** – are relative coordinates and define the Y center coordinate as an offset of the starting point Y coordinate. (Valid in G17 & G19 planes)
- **K Value** – are relative coordinates and define the Z center coordinate as an offset of the starting point Y coordinate. (Valid in G18 & G19 planes)

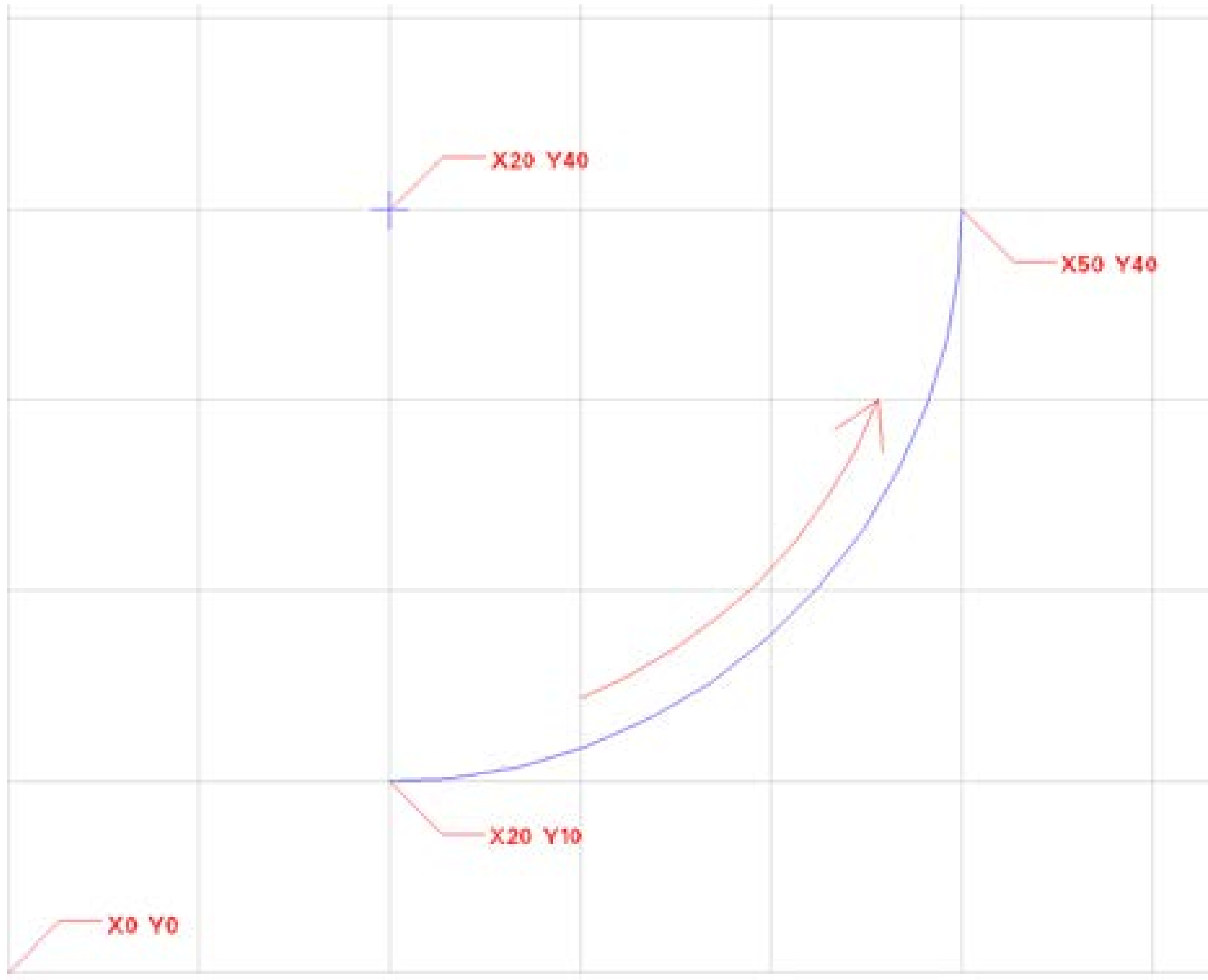
- **R Value** - Is used to define the arc radius for arcs up to 90 degrees.

> Caution: The use of R Value for arcs greater than 90 degrees does not work as it defines multiple center points. For arcs greater than 90 degrees use IJK values for G03 commands.

Example program for making an Arc

```
N10 G00 X20 Y10 Z-1  N20 G03 X50 Y40 I0 J30
```

- In the above example in the first line moves to position X20 Y10 Z-1
- An arc is made starting at position X20 Y10 and ending at coordinate X50 Y40 with the center at position X20 Y40 moving in a counterclockwise direction. The Z height does not change.
- The Arc center is calculated as follows
- Starting position X20 + I0 = Center X coordinate X20
- Starting position Y10 + J30 = Center Y coordinate Y40



Example program for making a Spiral

```
N10 G00 X20 Y10 Z0  N20 G03 X50 Y40 Z-3 I0 J30
```

- By adding a Z height into G03 you can create a spiral arc
- In the above example in the first line moves to position X20 Y10 Z0
- An arc is made starting at position X20 Y10 and ending at coordinate X50 Y40 with the center at position X20 Y40 moving in a counterclockwise direction. The arc is the same as in the diagram above but the Z axis will descend from its current height to -3 units at a uniform rate over the arc to form a spiral path.
- The Arc center is calculated as follows
- Starting position X20 + I0 = Center X coordinate X20
- Starting position Y10 + J30 = Center Y coordinate Y40

INFORMATION: Units are defined as either inches or mm depending on your machine's setup or

G20 or G21 command in use.

10.5. G04 – Dwell

This command is used to Dwell (pause) the execution of the next CNC program block by the specified time.

A program dwell time can be created at any point within a program.

Syntax & Parameters

- **P Value** - The P value is required with G04 and it defines the time to dwell/pause. This value is in milliseconds.

Example program

```
N10 G04 P2000
```

The above program will pause the program for 2 seconds.

10.6. G10 – Set Work Offset Values

This command is used to set work offsets values to different offset locations.

Syntax & Parameters

Work Offsets G54 to G59

- **L2 Value** - Write the machine coordinate value specified in this command to the F4work offset table defines by the P value
- **L2.1 Value** - Write the Current work offset position into F4 work offset table offset by the amount specified in the axis value of this command
- **P Value** - The P value is required with G10 and it defines the work offset number to change between G54 and G59.
- P0 is used to set the current / active work offset.
- P1 is used to set G54 work offset
- P2 is used to set G55 work offset.
- P3 is used to set G56 work offset.
- P4 is used to set G57 work offset.
- P5 is used to set G58 work offset.
- P6 is used to set G59 work offset.
- **X, Y, Z, A, B Value** - specifies the axis you wish to offset following the distance value. The distance value will be the current machine units in use.

Extended Work offsets G54.1 P1 to G54.1 P100

These extended work offsets are available only on MASSO G3 & MASSO Touch in v5.100b or higher

The extended work offsets can be seen by using the slider on the right hand side of the Work offset list.

- **L20 Value** - Write the machine coordinate value specified in this command to the F4work offset table defines by the P value
- **L20.1 Value** - Write the Current work offset position into F4 work offset table offset by the amount specified in the axis value of this command
- **P Value** - The P value is required with G10 and it defines the work offset number to change between G54.1 P1 and G54.1 P100.
- P0 is used to set the current / active work offset.
- P1 to P100 Work offsets G54.1P1 to G54.1 P100
- **X, Y, Z, A, B Value** - specifies the axis you wish to offset following the distance value. The distance value will be the current machine units in use.

Example program

```
N10 G10 L2 P1 X10 Y10
```

The above program line will set the X and Y axis G54 offset to 10.

```


N10 G10 L2.1 P2 X10 Y20
```

This will set the X and Y axis G55 offset to the current work offset position offset by the value specified in this command.

```
In this example the X axis is offset by 10 and the Y axis is offset by 20.
```

Example program

```
N10 G10 L20 P1 X10 Y10
```

The above program line will set the X and Y axis G54.1 P1 offset to 10.

```
N10 G10 L20.1 P56 X10 Y20
```

This will set the X and Y axis G54.1 P56 offset to the current work offset position offset by the value specified in this command.

```
In this example the X axis is offset by 10 and the Y axis is offset by 20.
```

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

WARNING: This function does not overwrite G54 - G59 G54.1 P1 to G54.1 P100 offset values saved to backup memory through the F4 screen, although the F4 screen will display the updated offset values. When restarting a job check the F4 table to ensure the work offsets are correct for your job.

10.7. G17 – XY Plane Selection

This command is used to set current work plane to XY. This is the default work plane on power up.

Syntax & Parameters

- **G17**

Example program

```
N10 G17
```

The above gcode will set the system to XY work plane.

INFORMATION: This is the default work plane on power up.

10.8. G18 – ZX Plane Selection

This command is used to set current work plane to ZX.

Syntax & Parameters

- **G18**

Example program

```
N10 G18
```

The above gcode will set the system to ZX work plane.

10.9. G19 – YZ Plane Selection

This command is used to set current work plane to YZ.

Syntax & Parameters

- **G19**

Example program

```
N10 G18
```

The above gcode will set the system to YZ work plane.

10.10. G20 – Set Machine Units To Inches

This command is used to set machine units to Inches. All gcode values after this command will be processed as inches.

Syntax & Parameters

- **G20**

Example program

```
N10 G20
```

The above gcode will set the machine units to Inches.

10.11. G21 – Set Machine Units To Millimetres

This command is used to set machine units to Millimetres. All gcode values after this command will be processed as Millimetres.

Syntax & Parameters

- **G21**

Example program

```
N10 G21
```

The above gcode will set the machine units to Millimetres.

10.12. G28 – Return To Machine Home

CAUTION: This command can be used in different combinations and wrong command can result in unexpected rapid motion. Depending if the machine is in **Absolute** or **Incremental** mode the behavior of **G28** command will be very different, extra caution should be used when using this command.

This command is used to move the axis back to the home position of the axis after the machine was homed. Further axis commands can also be combined with G28 to achieve intermediate position.

Syntax & Parameters

- **G28** - Only G28 can be used, this will move all axis at rapid back to the home position.
- **X, Y, Z, A, B Value** - specifies the intermediate position you wish to move following the distance to move. The distance value will be the current machine units in use.
- Combining the G28 with a rotary axis in incremental mode G91 will allow the axis to unwind in 1 revolution or less. See example below.

Example program for moving all together axis to home position

```
N10 G28
```

The above gcode will move all axis of the machine at rapid back to the home position.

Example program all axis to machine 0.00

```
N10 G28 X0 Y0 Z0
```

The above gcode will move all axis to working coordinates X0 Y0 Z0 before moving to home position.

Example program all axis to machine 0.00

```
N10 G91 G28 X0 Y0 Z0  N20 G90
```

The above gcode will move all axis to home position as there is no intermediate position to go to first.

Example program to move Z axis first

```
N10 G91 G28 X0 Y0 Z8  N20 G90
```

The above gcode will first move the Z axis 8.00 units and then move all axis to their home positions

Rotary Axis Unwind within one rotation

```
G00 A900 (Rapids the A axis to A900 (2.5 turns))  G91 (Change to Incremental m
ode)  G28 A0 (Moves Axis by 0 degrees then moves to A0 within one rotation)  G
90 (Return to Absolute mode)
```

- In the above example if you specify another coordinate eg: G28 A360 it will move an additional 360 degrees taking the axis to A1260 (3.5 turns) then move to A0 in less than 1 rotation.
- In this case it would be an additional 1/2 rotation to be back to home.

INFORMATION: If you do not change to incremental mode before the G28 A0 the axis will unwind the full 2.5 revolutions to A0 and then move to the home position. In this case no further move is needed.

10.13. G30 - Move to Parking Position

CAUTION: This command can be used in different combinations and wrong command can result in unexpected rapid motion. Depending if the machine is in **Absolute** or **Incremental** mode the behavior of **G30** command will be very different, extra caution should be used when using this command.

This command is used to move the Machine to the defined Parking position

- At times users may wish to have a dedicated park location to move the Spindle to, so that it is out of the way when loading and unloading material.

Syntax & Parameters

- **G30** - This first rapids the Z axis to its specified parking position and then the remaining axis will simultaneously move to their parking positions.
- The Park position is defined in the F4 Screen

Example program for moving all axis to Parking position

```
N10 G30
```

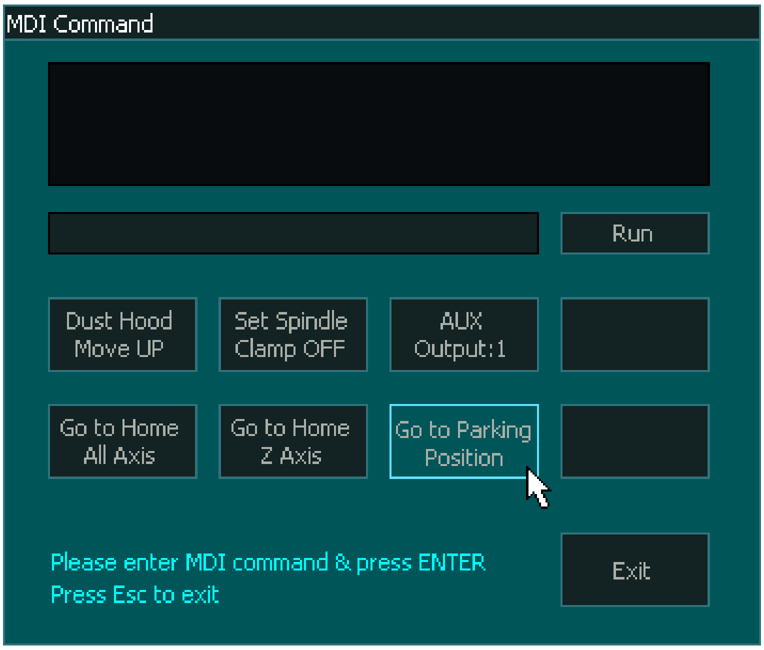
Defining the Parking Position

The Parking Position is defined in the F4 Screen using Machine Coordinates.

Work Offset	Work Offset Name	X	Y	Z	A	B
G 54		0.00000	202.42500	-5.44250	0.00000	0.00000
G 55		0.00000	0.00000	0.00000	0.00000	0.00000
G 56		0.00000	0.00000	0.00000	0.00000	0.00000
G 57		0.00000	0.00000	0.00000	0.00000	0.00000
G 58		0.00000	0.00000	0.00000	0.00000	0.00000
G 59		0.00000	0.00000	0.00000	0.00000	0.00000
Parking	Parking Position	100.00000	250.00000	-1.00000	2.00000	0.00000

Parking Commands

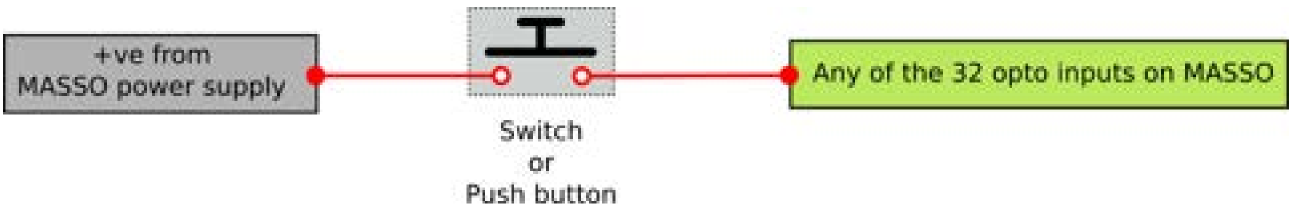
- **G30**
- **CTRL + ALT + P**
- **Click the Go to Parking Position button in the MDI Screen**
- **Go to Parking Position Button**



Go to Parking Position Button

- Configure an input as a Go to Parking Position Input

> Hold the button for 1 second to activate the feature.



10.14. G32 – Threading Cycle

This command is used on Lathe machines for running threading cycle synchronised with the spindle.

INFORMATION: Taper threading is not supported.

Syntax & Parameters

- **Z Value (required)** - specifies the end location of the Z axis for threading. The distance value will be the current machine units in use.
- **F Value (required)** - this is the thread pitch value. The distance value will be the current machine units in use.

Example program

```
N10 G21  N20 G00 Z0  N30 G32 Z-10 F1.5
```

- In the above program the first line sets the machine units to millimetres.
- The second line command moved the Z axis to work 0.00 millimetres.
- The third line starts the threading cycle to thread to Z -10 millimetres location while threading at 1.5 millimetre pitch.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

10.15. G38.2 – Straight Probe Cycle

This command is used for probing parts or fixtures. The axis specified in the G38.2 command will move until the probe touches, if the probe does not touch within the specified distance then the program stops and an alarm is displayed on the screen.

To use this G38.2 requires a Probe input be assigned which changes from Low to High when the probe is triggered.

Syntax & Parameters

- X, Y, Z, A, B Value - specifies the axis you wish to move for probing and the maximum machine coordinate to move towards when probing. The distance value will be the current machine units in use.
- F Value - The F value defines the feed rate at which the axis will move at.

Example program

```
N10 G38.2 Z-10 F100
```

In the above program the Z axis will move towards machine coordinate Z -10 and wait for the probe to touch. Once the probe touches, the Z axis will stop and the program will move to the next gcode line. If the probe is not touched before it reaches Z -10 location then the program stops and an alarm is displayed on the screen.

INFORMATION: The coordinate value specified is a machine coordinate.

A common use of **G38.2** is in conjunction with G92 to set the initial torch height in Plasma

```
N10 G38.2 Z-50   N20 G92 Z0    N30 G0 Z1
```

In this example the **G38.2** probes Z axis toward the surface of the material and when the touch input is triggered it will stop

G92 Z0 applies a Temporary work offset to the Z axis to set the working coordinate to Z0

G0 Z1 moves the Z axis 1 unit above the material surface.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

10.16. G38.6 - Digitizing Probing Cycle

WARNING: The incorrect use of this Gcode can cause damage to your probing equipment, the item being probed and personal injury. Please understand and exercise care.

This command is used for digitizing parts using a touch probe or similar. Typically used to create a cloud point capture of a 3d object or to map uneven material surface for engraving with the use of auto leveling software.

- The axis specified in the G38.6 command will move until the probe touches.
- The X,Y & Z touchpoint data is saved to "MASSO Probe data.txt"
- If the "MASSO Probe data.txt" does not exist then the MASSO will create a new file.
- If the "MASSO Probe data.txt" exists then the data will be added to the end of the existing file.
- If the probe does not touch within the specified distance then a "Probing error at:" entry is made in the "MASSO Probe data.txt" file, the program will Stop and a Probing Error Alarm will be displayed.
- All coordinates used with G38.6 are working coordinates.
- All recorded coordinates in the "MASSO Probe data.txt" file are working coordinates.
- To use this G38.6 requires a Probe input be assigned which changes from Low to High when the probe is triggered.

INFORMATION: This Gcode is not available for MASSO G2

Syntax & Parameters

- X, Y, Z Value - specifies the axis you wish to move for probing following the coordinate to move to. The coordinate value is a working coordinate.
- F Value - The F value defines the feed rate at which the axis will move.

Example program

```
N10 G1 X20 Y10 F1000  N20 G38.6 Z-3 F100  N30 G0 Z2
```

In the above example the machine moves to X20 Y10

The Z axis will probe down to working coordinate -3 and if the probe detects a touch it will stop and record the X, Y & Z working coordinates in the "MASSO Probe data.txt" file.

If the probe does not record by the time it reaches Z -3 it will stop and record Probing error at: 20.00000, 10.00000 in the "MASSO Probe data.txt" file. A Probing error Alarm will display in the screen.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

Sample Data File

0.00000, 0.00000, -0.88750

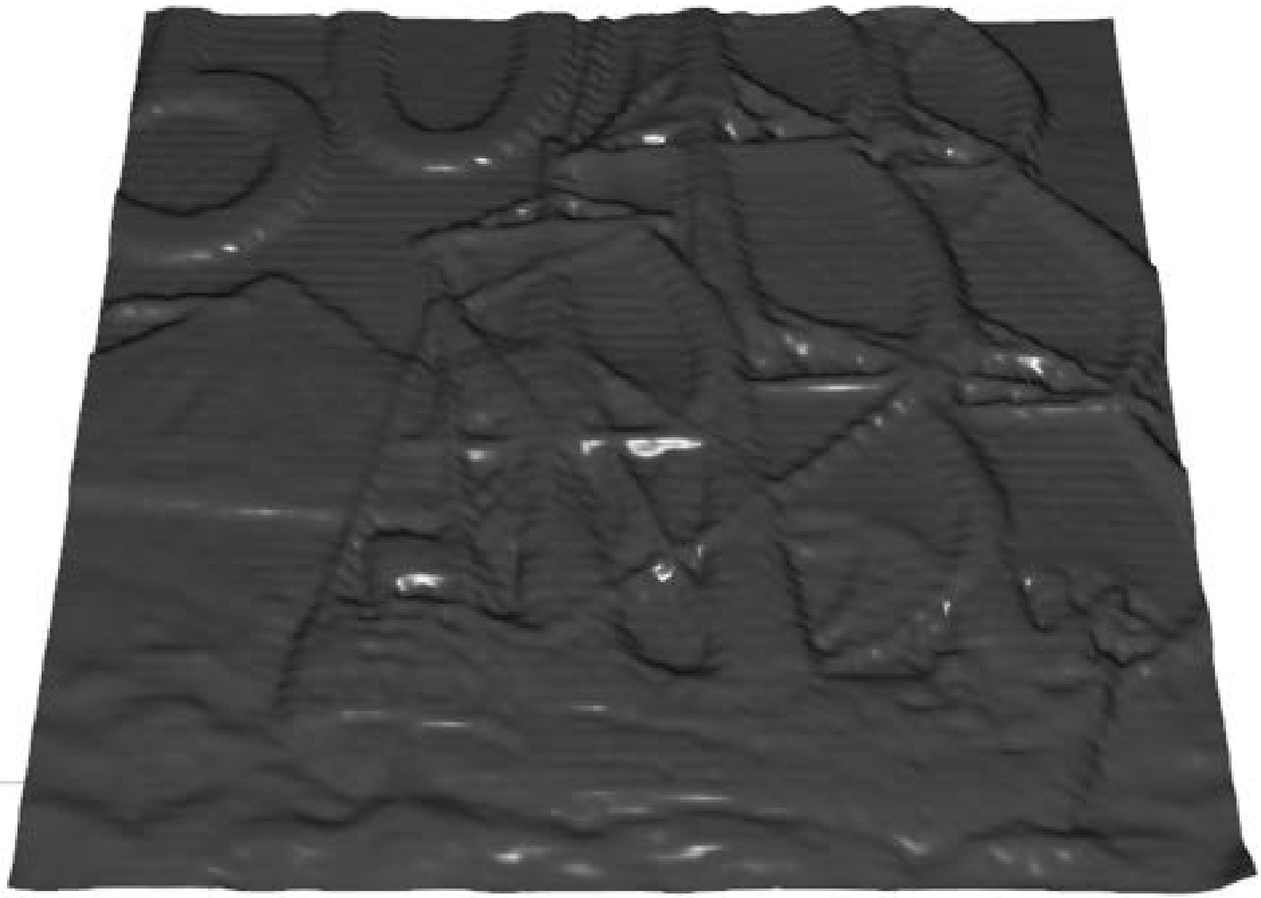
0.13310, 0.00000, -0.90749

0.26619, 0.00000, -0.91750

0.38597, 0.00000, -0.92249

Probing error at: 0.00000, -0.92000

Sample Digitized item



Read other subtopics below:

10.16.1) Auto Levelling using G38.6

10.16.1. Auto Levelling using G38.6

About Auto Levelling

Auto leveling allows you to map the surface of your material and then by probing the surface using the G38.6 digitizing probing cycle and then applying the resulting height map to adjust your original Gcode file.

This is done using 3rd party software such as AutolevellerAE

This is an open source software that can be used to generate the Gcode file to do the initial probing of the material and then the resultant MASSO Probe data.txt file can be loaded in to the software along with your project Gcode file to create a new Gcode file with the coordinates adjusted to suit the material surface.

AutolevellerAE can be down loaded here: http://www.autoleveller.co.uk

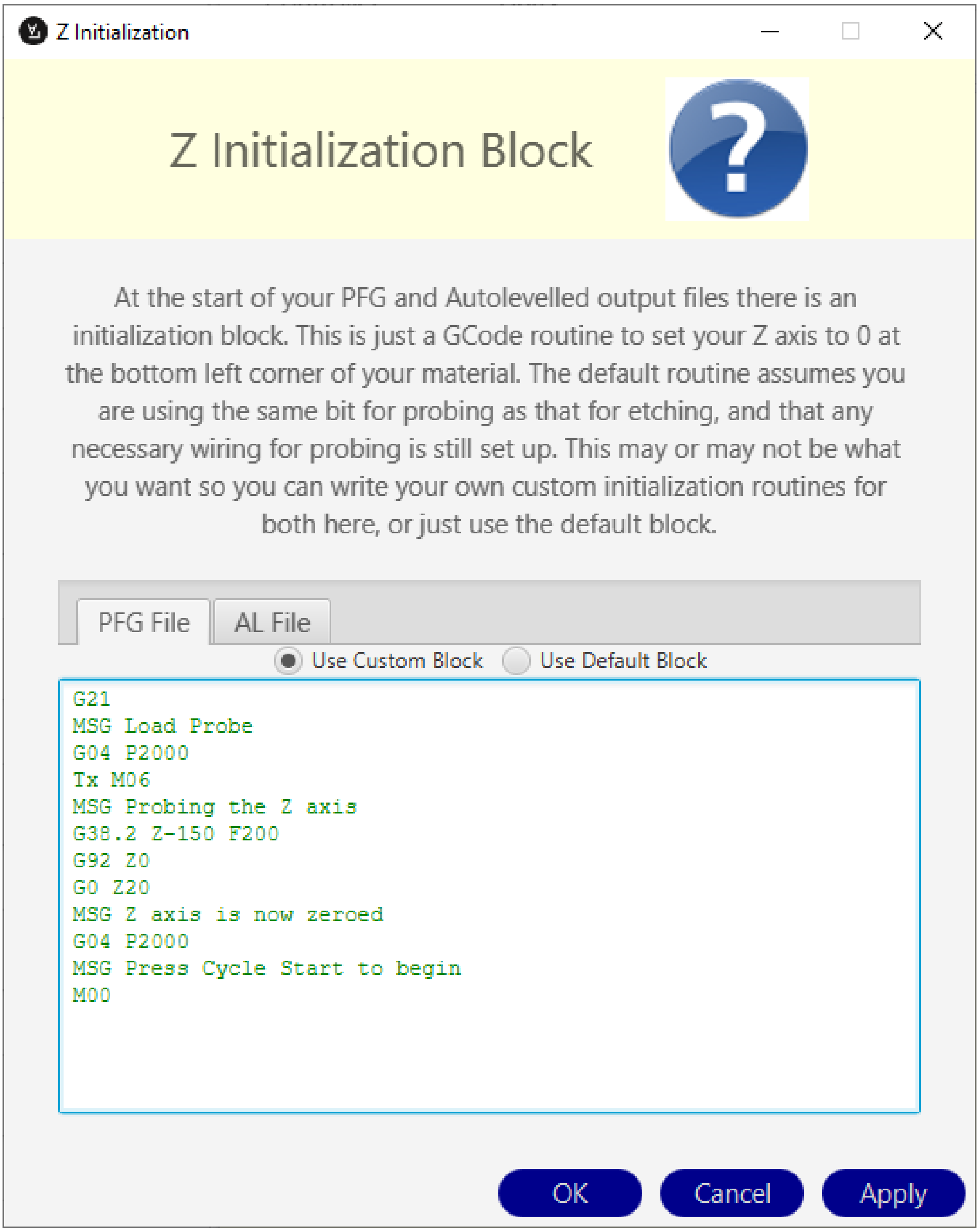
The following does not seek to teach you how to use this Auto Leveller software but how to set up the custom parameters to use it with MASSO.

MASSO has no association with this software.

Setting up the Z initialization routine

Under **Options** menus at the top of the screen select Z initialization routine

-



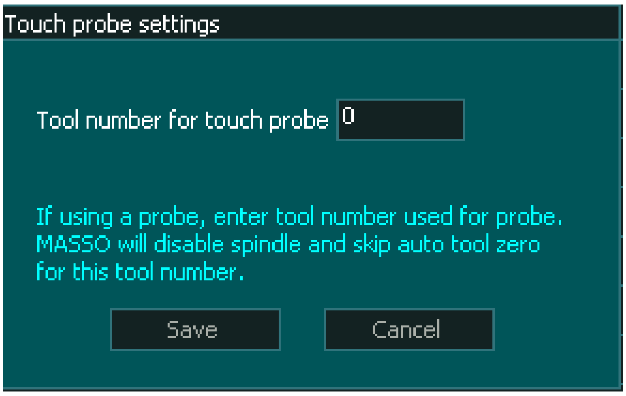
- Under **Options** menus at the top of the screen select Z initialization routine
- Select **Use Custom Block**
- Enter your start up routine in here.

In this example

- Machine is set to Metric (G21)
- Message is displayed "Load Probe"

- 2 second delay
- Tool change command to executed.
- Replace Tx with the tool number defined in the F1 screen Touch Probe setting. In the example below the touch probe is Tool 0 so you would replace Tx M06 with T0 M06
- Message is displayed "Probing the Z axis"
- The Z axis probes down to the surface at 200mm/min. When the probe touches the surface it stops. (You may need to change the Z-150 value to suit your machine. The Z value in the G38.2 probing cycle is a Machine Coordinate)
- The Z axis coordinates are set to Z0 using G92 temporary work offset.
- The Z axis moves 20mm up from the surface to Z20
- Message is displayed "Z axis is now zeroed"
- 2 second delay
- Message is displayed "Press Cycle Start to begin"
- M00 Program stop and wait for cycle start.

- After you have a entered your initialization Gcode press Apply followed by OK



INFORMATION: It is important to define a touch probe tool and use this tool while probing even if you do not have an auto tool changer. The Touch Probe tool disables the spindle while it is selected and is an important safety feature

Custom Z Initialization Block

Please change to suit your machine.

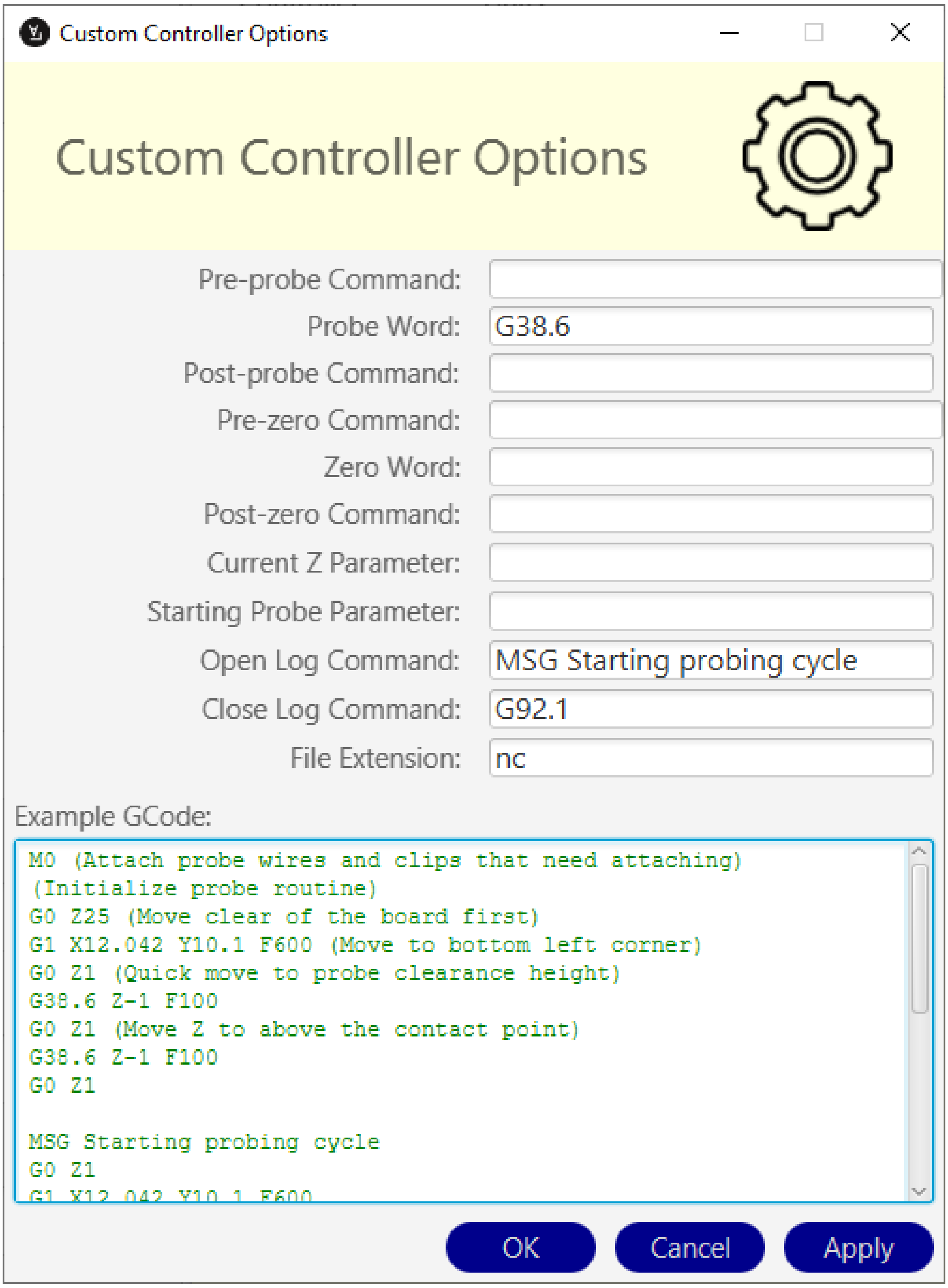
This routine will automatically change your tool to the Probing tool and will automatically use the G38.2 probing routine to zero the Z axis to the correct starting height.

```
G21  MSG Load Probe  G04 P2000  Tx M06  MSG Probing the Z axis  G38.2 Z-150 F200  G92 Z0  G0 Z20  MSG Z axis now zeroed  G04 P2000  MSG Press Cycle Start to begin  M00
```

INFORMATION: The auto zero probing routine uses G92 to set Z zero. If you stop the file before it finishes you can remove the temporary work offset by going to MDI and issue a G92.1

Custom Controller Options

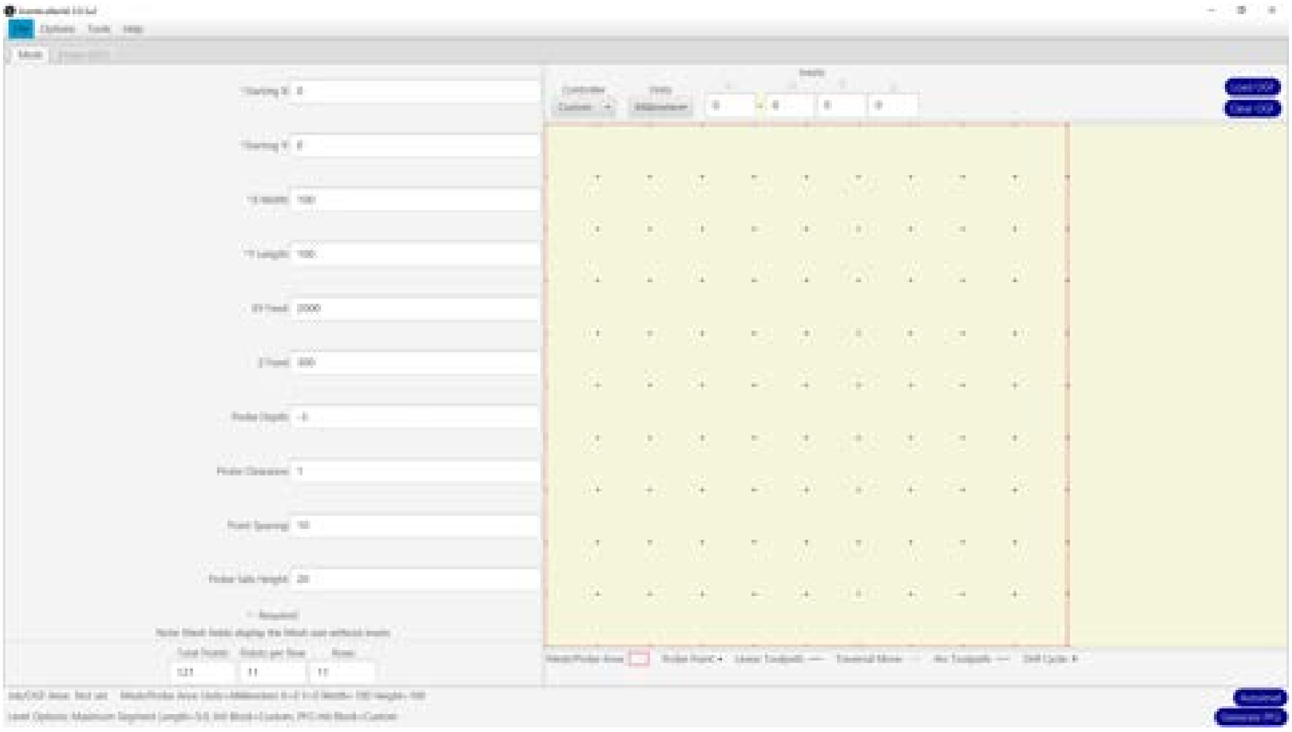
From the **Options** Menu at the top of the screen select Custom Controller Options



- From the **Options** Menu at the top of the screen select Custom Controller Options
- **Probe Word:** G38.6
- **Open Log Command:** MSG Probing Complete
- **Close Log Command:** G92.1
- **File Extension:** Enter nc

INFORMATION: If you have values showing in the parameter fields that are grayed out they can be ignored.

Create a Probing Mesh



- Starting X: Enter the X working coordinate you wish to start probing from.
- Starting Y: Enter the Y working coordinate you wish to start probing from.
- X Width: Enter the X working coordinate you wish to finish probing.
- Y Length: Enter the Y working coordinate you wish to finish probing.
- XY Feed: Enter the feed rate you wish to travel between probing locations.
- Z Feed: Enter the feed rate you wish to prove the Z axis.
- Probe Depth: Enter the Z axis working coordinate for the end of probing. This is the depth that probing will stop and a "Probing error at:" entry is made in the "MASSO Probe data.txt" file before moving to the next coordinate.
- Probe Clearance: Enter the Z height working coordinate that the Z axis will rise up to after each probe. If you make this too high probing will take longer than needed and if you make it too low you may hit the part while moving to the next probing position.
- Point Spacing: Enter the distance between the probing locations.
- Probe Safe Height: This is used at the end of the probing cycle to rise the Z axis above the surface.

Once you are happy with the parameters press **Generate PFG** to create the probing Gcode file.

INFORMATION: This software can also be used to create cloud point captures of 3D objects using the same process. Select a point spacing that suits the item you are probing. A finer Point

> Spacing will render a more detailed data capture which you can pass to other software for rendering to a 3D model.

Create an Auto Leveled file

Basic overview

- Load your Gcode file Called OGF in the software.
- Load the Captured MASSO Probe Data.txt File saved to your MASSO Flash drive under the File Menu Raw Data File (RPF)
- Adjust parameters as needed. Please see the Autoleveller software manual for full details on how to use this aspect of the software.
- Press Autolevel to generate adjusted Gcode file to run on MASSO.

> **WARNING:** The incorrect use of this Gcode can cause damage to your probing equipment, the item being probed and personal injury. Please understand and exercise care.

Probing Check sheet

Setting up the PFG File

- Set your X & Y start coordinates of the probe to match the X & Y position where the cutting takes place or you will scan the wrong position.
- Set the Probing depth to be sufficient to probe the full depth of the surface. Where possible stay within the travel of your touch probe to reduce the chance of damage to the probe.
- Set the Probe clearance height to the minimum needed to clear any part of the surface being probed for the most efficient probing cycle.
- Set the Point Spacing to suit the type of surface you are mapping. Course for Auto levelling and fine for 3d rendering.
- Set the Safe probe height high enough to clear clamps and other obstructions at the end of the file.

Getting Ready to probe

- Load the probing PFG File
- Load the Probing tool. Tx M06 where Tx is the tool number defined in the MASSO F1 Screen Touch probe parameter.
- Set your X & Y zero position of the probe to match the X & Y zero point of the cutter or you will scan the wrong position.
- Move to the Start X Y position you selected for probing. This may not be X0 Y0
- Set the Z zero point of the probe above the surface of the subject being probed if you are using the auto zero probing routing shown in the example above.
- Run the Gcode file.

10.17. G38.7 - Center Probing Cycle

This tool changer is available in MASSO G3 & MASSO Touch - **v5.06** or higher.

WARNING: The incorrect use of this Gcode can cause damage to your probing equipment, the item being probed and personal injury. Please understand and exercise care.

This command is used for locating the center of a feature.

- The probing limits are defined by the machine soft limits. If the edge of the probed feature are not located before the soft limit is reached a probing alarm occur.
- The feature will be probed in the + X,-X,+Y and -Y direction before moving to the center of the feature and stopping.
- Work offsets are not updated by this Gcode however it can be used in conjunction with G92 or G10 as required.
- Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

INFORMATION: This Gcode is not available for MASSO G2

Syntax & Parameters

- F Value - The F value defines the feed rate at which the axis will move.

Example program

```
N10 T100 M06  N20 G0 X20 Y30  N30 G1 Z-2 F500  N40 G38.7 F100  N50 G92 X0 Y0
N60 G0 Z10
```

In this example

N10 The Probing tool is loaded.

N20 The probe moves to the inside of the feature that needs to be probed

N30 The Probe is lowered into the feature

N40 The feature is probed using **G38.7** at the specified feed rate of 100 and at the end of the probing cycle the probe will move to the center of the feature.

N50 The X & Y axis working coordinates to X0 Y0 using temporary work offsets.

The X & Y values can be used to define the offset of the probe if the probe is offset from the spindle or other head.

N60 Probe raised above feature

Example program

```
N10 G55  N20 T100 M06  N30 G0 X20 Y30  N40 G1 Z-2 F500  N50 G38.7 F100  N60 G1
0 L2.1 P0 X0 Y0  N70 G0 Z10
```

In this example

N10 Set G55 as the current working coordinate.

N20 The Probing tool is loaded.

N30 The probe moves to the inside of the feature that needs to be probed

N40 The Probe is lowered into the feature

N50 The feature is probed using **G38.7** at the specified feed rate of 100 and at the end of the probing cycle the probe will move to the center of the feature.

N60 The Current work offset (G55) is updated in the F4 work offset table to the current position offset by the amount specifies by the X & Y values.

The X & Y values can be used to define the offset of the probe if the probe is offset from the spindle or other head.

N70 Probe raised above feature

WARNING: G10 does not overwrite G54 - G59 offset values saved to backup memory through the F4 screen, although the F4 screen will display the changed offset values. When restarting a job check the F4 table to ensure the work offsets are correct for your job.

10.18. G40 - Cutter Compensation Off

This feature is for MASSO G3 & MASSO Touch only and is currently undergoing Beta testing in version 5.100b available for download in MY WORKSHOP

Turns off G41 or G42 cutter compensation

Syntax

- G40

Example Program

```
N10 G40  N20 X20 Y15
```

After leaving cutter compensation both the X & Y coordinates of the next move must be specified to a safe location.

10.19. G41- Cutter Compensation Left

This feature is for MASSO G3 & MASSO Touch only and is currently undergoing Beta testing in version 5.100b available for download in MY WORKSHOP

The cutter will move to the left side of the original tool path by the amount specified by the compensation parameters.

The compensation parameters are made up of 3 values which work together to specify the offset value.

The tool path offset is calculated as follows:

Toolpath Offset = (Tool Diameter + Wear Diameter) / 2 + P Value

Tool diameter - This is the nominal diameter of the cutter eg 10mm and is located in the F4 screen Tool table. If tool compensation is done in CAM then this can be left as 0

Wear diameter - This is the wear adjustment of the cutter over or undersized and is located in the F4 screen Tool table.

P value - This is the radius to offset the tool path by and is typically used in hand coded Gcode.

For a more detailed explanation of managing tools in the F4 tool table please see the section managing Tool Diameter and Wear values at the bottom of the page.

Syntax & Parameters

- **G41** - MASSO uses the Diameter and Wear values specified for the current tool
- **P value** - This is the radius to offset the toolpath by and is added to the Wear diameter offset. If no P Value is specified it will use the Wear Diameter in the F4 tool table.
- **Tool diameter** - This is the diameter of the cutter and is a positive value.
- **Wear Diameter** - This is how much wear there is on the tool diameter. This value is entered as a negative number for an undersized tool while a positive value can be used for an oversized tool.

Example Program

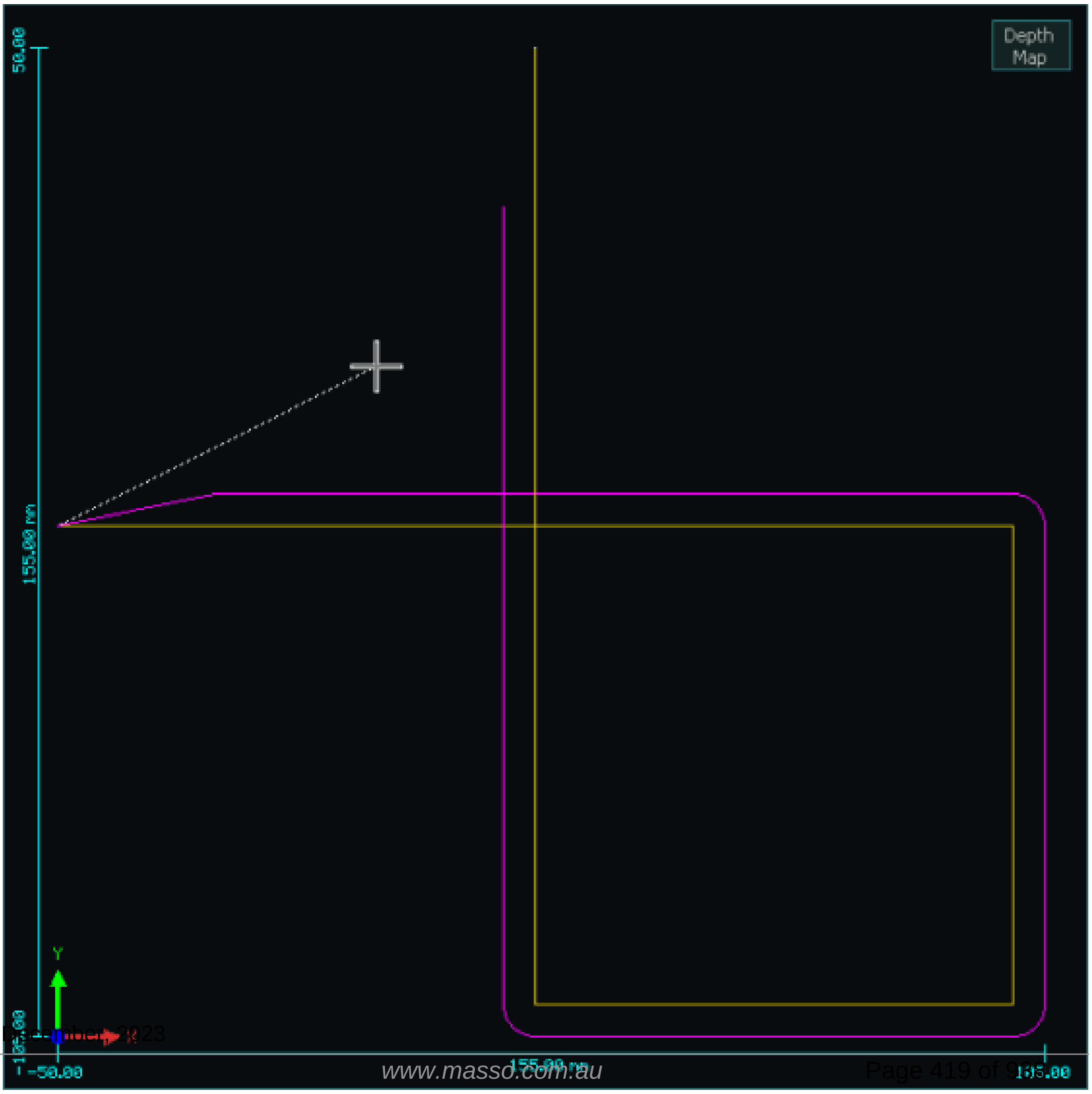
```
N10 T1 M06  N20 G41
```

This will off set by the amount specified in the Tool diameter and Wear diameter for tool 1 assigned in the F4 tool table.

```
N10 T1 M06  N20 G41 P5
```

A P value of 5mm will offset the cutter by 5mm from the original toolpath. Please note that if you have a Tool diameter and Wear diameter for tool 1 assigned in the F4 tool table these will be included in the offset calculation.

```
N10 T1 M06  N20 G00 X-50 Y-25 Z25  N30 G01 Z-5 F250  N40 G41  N50 X-25 (lead in)  N60 X100  N70 Y-100  N80 X25  N90 Y25  N100 G40  N110 X25 Y50 (Lead out)  N120 G00 Z25
```



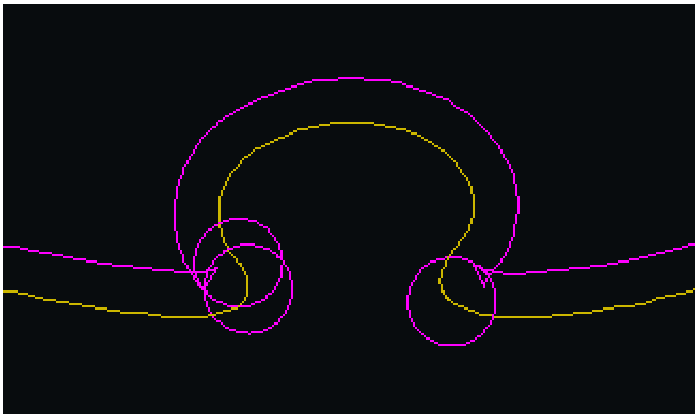
Compensated Toolpath shown in RED

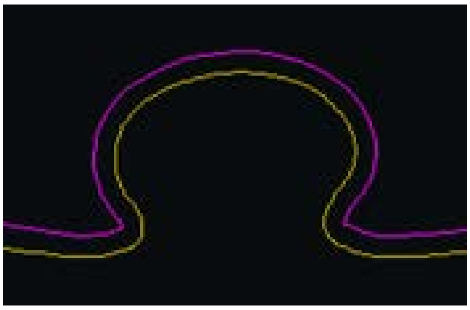
Note: The final move is not shown in the compensated tool path after the cutter Compensation is turned off.

Troubleshooting

If your compensated toolpath shows loops as shown in the example below it means that the compensated cutter size is too large for the purpose and is causing toolpath lines to cross one another.

Select a smaller cutter more suited to the job.





Cutter too large

Cutter size correct

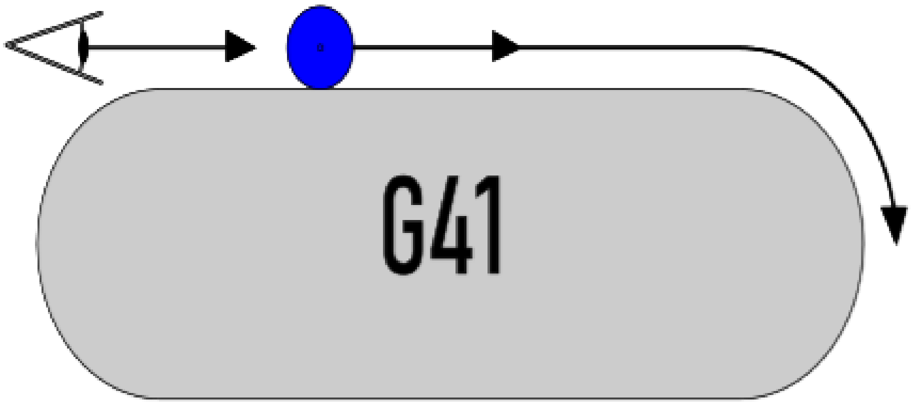
> WARNING: The following Cutter Compensation rules are important and not adhering to them may cause unpredictable results, damage to the part being machined or to the machine itself.

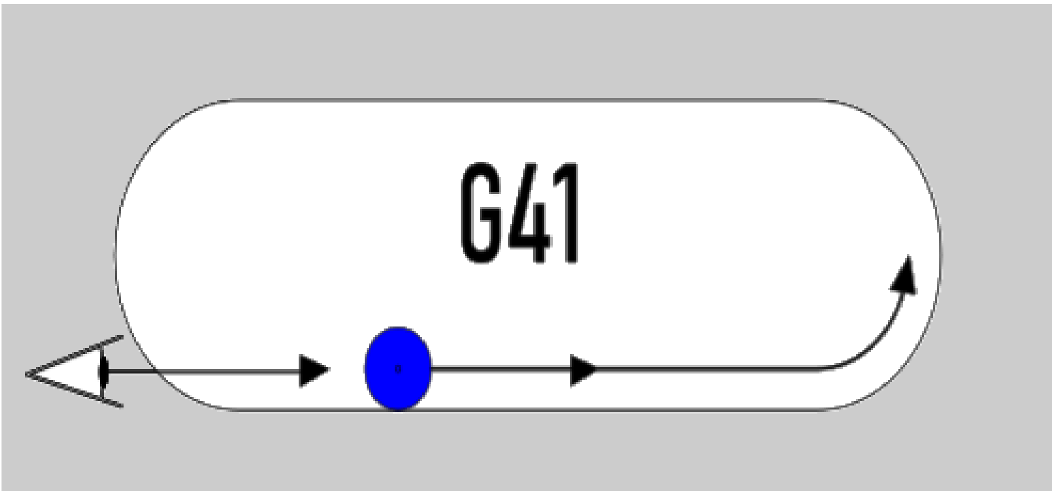
Cutter Compensation Rules

- Cutter compensation paths are calculated and displayed when the Gcode file is loaded.
- Outside corners are automatically radiused.
- Valid in the G17 XY Plane only
- Only valid for X & Y axis moves.
- Do not include Z, A or B axis moves in the compensated section of your Gcode file as this may cause unpredictable results.
- Move to the required cutting height before turning on cutter compensation.
- Do not include non cutting moves in the compensated section of your Gcode file as this may cause unpredictable results. eg Turning coolant on or off.
- A lead in move is required to a safe location at the start of compensation.
- A lead out is required to a safe location at the end of the compensation.
- The lead out move is not shown on screen as a compensated move.
- Use linear moves for both Lead in and lead out.
- The lead in and out distance must be greater than the cutter radius.
- Specify both the X & Y coordinates on the first move after leaving Cutter compensation or you may experience an unpredictable move.

The best way to think of G41 is that you are standing behind the cutter as it moves away from you.

The cutter will move to the Left side of the original tool path





Managing Tool Diameter, Wear Diameter and P Value

MASSO cutter compensation has been designed for maximum flexibility and compatibility.

There are several different ways that users can manage their tools in the tool table depending on what works best for them and what what they may already be used to.

The Tool Diameter and Wear Diameter values specified for the current tool is automatically applied whenever G41 is turned on

Tool Offset Calculation

The Compensation value used to off set the cutter is made up of 3 parameters.

Tool Diameter, Wear Diameter and P Value

The tool path offset is calculated as follows:

Toolpath Offset = (Tool Diameter + Wear Diameter) / 2 + P Value

P Value

The P value is used to specify a cutter offset in Gcode and is the radius to offset the tool path by. eg a 10mm cutter would use a P Value of 5mm

It is typically used in hand coded Gcode where you can hand code a simple toolpath and want to offset the cutter to account for the tool radius instead of having to take it into account in the Gcode itself.

It is a lot easier to hand code a 100mm square without taking the cutter into account and then use a P value to offset the cutter than to work out the coordinates for a particular tool.

This would be used on a machine where the Tool Diameter is set to 0 in the F4 tool table which would be typical where Tool offset is calculated in CAM or you do not use Cutter compensation.

If you have a Wear diameter assigned to the tool then this will be taken into account when the offset is calculated.

It would not be common for the P Value to be used with the Tool Diameter but you may have an application where you wish to use it.

Tool Diameter

How the Tool Diameter value is used will depend on your Gcode.

If the Tool Path offset is managed in your CAM software then the Tool Diameter will be left a 0. This would be the most common situation when using CAM software.

If the Tool Path does not already have the Tool offset included within the Gcode such as a hand coded Gcode file, then the Tool Diameter value can be used to offset the tool.

This is the same as using the P Value except the offset is stored in the F4 tool table instead of the being in the Gcode itself.

The Tool Diameter value can be the actual diameter of the cutter taking into account the amount of wear the cutter may have.

Alternatively it can be the nominal diameter of the cutter and final adjustment of the cutter size can be done using the Wear diameter value.

Wear Diameter

The Wear Diameter is used to adjust the tool diameter as a tool wears through use.

The Wear Diameter can be used and without the Tool Diameter or a P Value

It can also be used to indicate a tool is oversized.

- A negative wear value means a tool is undersized.
- A positive wear value means a tool is oversized

Example

A 10mm tool with a -0.5mm wear indicates that the tool is undersized and is 9.5mm in diameter.

10 + (-0.5) = 9.5mm tool

A 10mm tool with a 0.5mm wear indicates that the tool is oversized and is 10.5mm in diameter.

10 + (0.5) = 10.5mm tool

10.20. G42- Cutter Compensation Right

This feature is for MASSO G3 & MASSO Touch only and is currently undergoing Beta testing in version 5.100b available for download in MY WORKSHOP

The cutter will move to the right side of the original tool path by the amount specified by the compensation parameters.

The compensation parameters are made up of 3 values which work together to specify the offset value.

The tool path offset is calculated as follows:

Toolpath Offset = (Tool Diameter + Wear Diameter) / 2 + P Value

Tool diameter - This is the specified diameter of the current cutter eg 10mm and is located in the F4 screen Tool table. If tool compensation is done in CAM then this is left as 0

Wear diameter - This is the wear adjustment of the current cutter either over or undersized and is located in the F4 screen Tool table.

P value - This is the radius to offset the tool path by and is typically used in hand coded Gcode.

For a more detailed explanation of managing tools in the F4 tool table please see the section managing Tool Diameter and Wear values at the bottom of the page.

Syntax & Parameters

- **G42** - MASSO uses the Diameter and Wear values specified for the current tool
- **P value** - This is the radius to offset the toolpath by and is added to the Wear diameter offset. If no P Value is specified it will use the Wear Diameter in the F4 tool table
- **Tool diameter** - This is the diameter of the cutter and is a positive value.
- **Wear Diameter** - This is how much wear there is on the tool diameter. This value is entered as a negative number for an undersized tool while a positive value can be used for an oversized tool.

Example Program

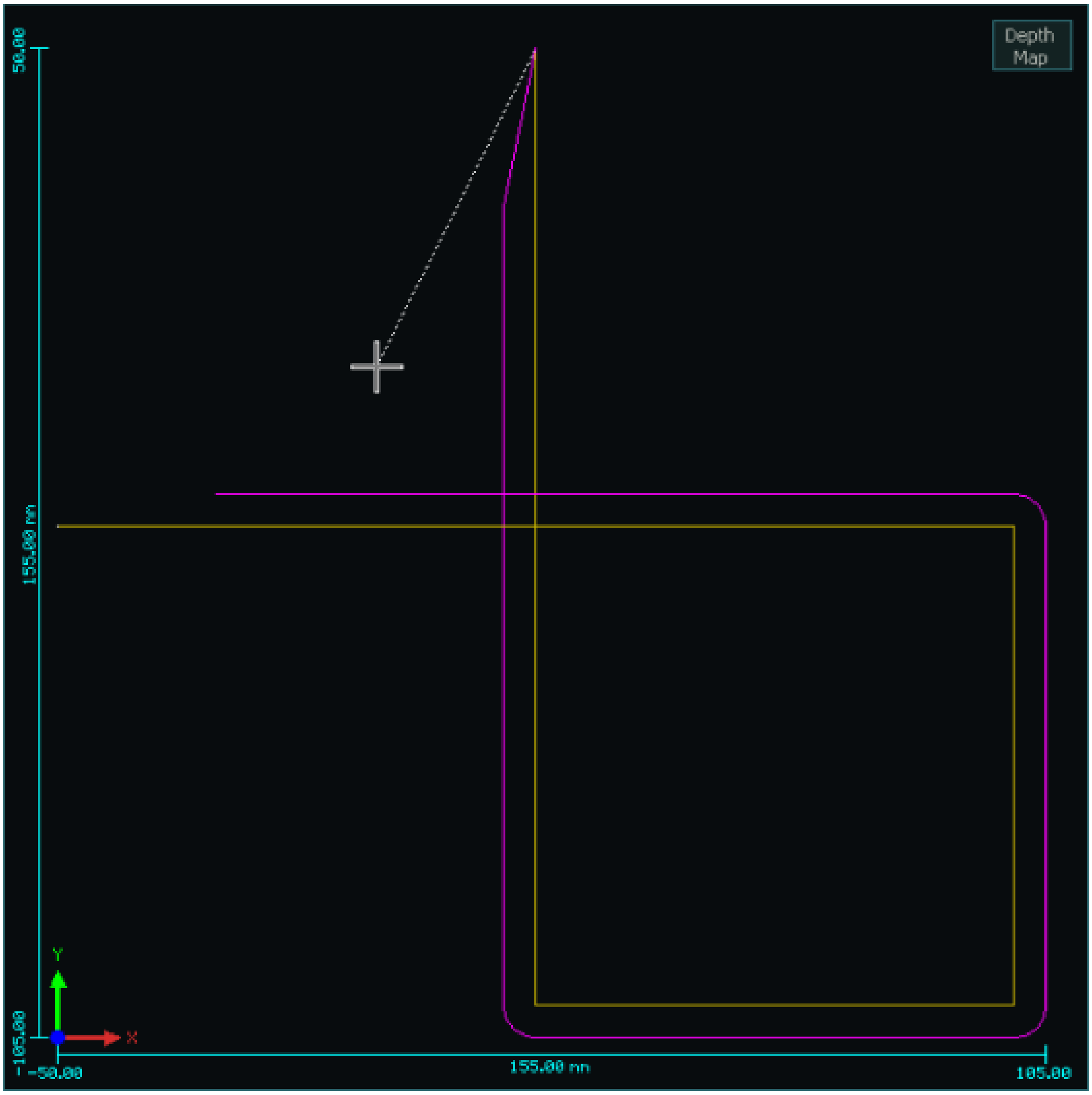
```
N10 T1 M06  N20 G42
```

This will off set by the amount specified in the Tool diameter and Wear diameter for tool 1 assigned in the F4 tool table.

```
N10 T1 M06  N20 G42 P5
```

A P value of 5mm will offset the cutter by 5mm from the original toolpath. Please note that if you have a Tool diameter and Wear diameter for tool 1 assigned in the F4 tool table these will be included in the offset calculation.

```
N10 T1 M06  N20 G00 X25 Y50 Z25  N30 G01 Z-5 F250  N40 G42  N50 Y25 (Lead in)
 N60 Y-100  N70 X100  N80 Y-25  N90 X-25  N100 G40  N110 X-50 Y-25 (Lead out)
 N120 G00 Z25
```



Compensated Toolpath shown in RED

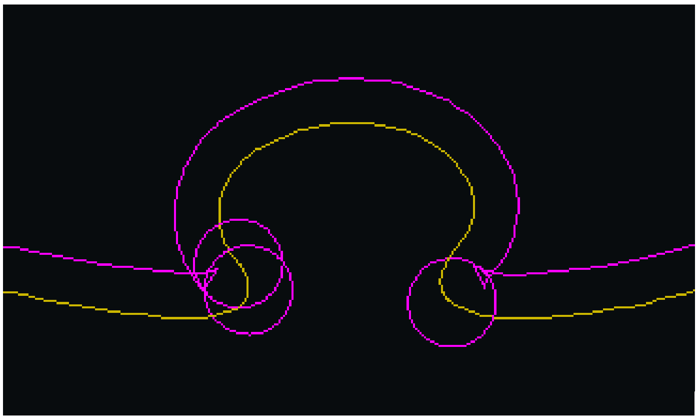
Compensated Toolpath shown in Purple

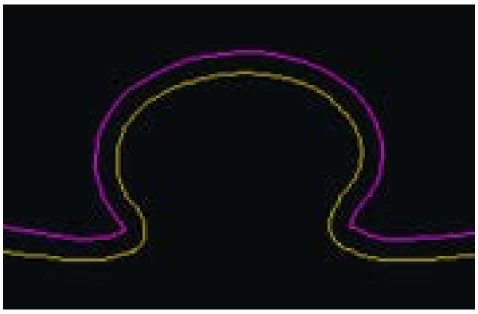
Note: The final move is not shown in the compensated tool path after the cutter Compensation is turned off.

Troubleshooting

If your compensated toolpath shows loops as shown in the example below it means that the compensated cutter size is too large for the purpose and is causing toolpath lines to cross one another.

Select a smaller cutter more suited to the job.





Cutter too large

Cutter size correct

WARNING: The following Cutter Compensation rules are important and not adhering to them may cause unpredictable results, damage to the part being machined or to the machine itself.

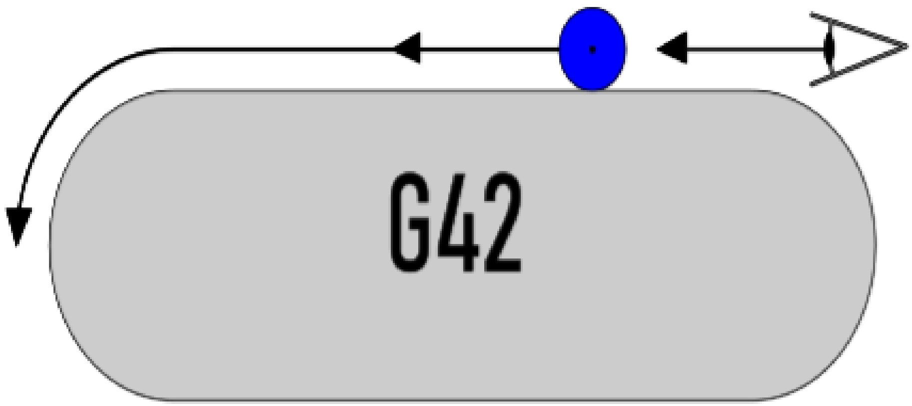
Cutter Compensation Rules

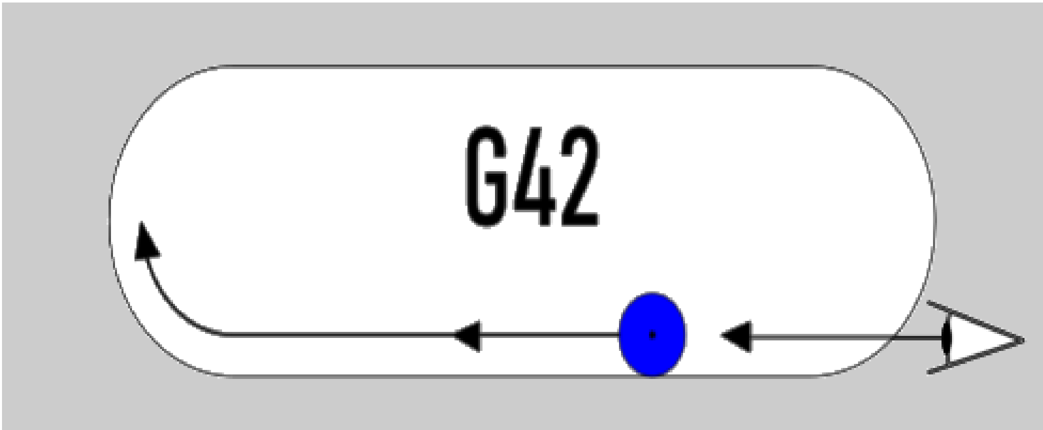
- Cutter compensation paths are calculated and displayed when the Gcode file is loaded.
- Outside corners are automatically radiused.
- Valid in the G17 XY Plane only
- Only valid for X & Y axis moves.
- Do not include Z, A or B axis moves in the compensated section of your Gcode file as this may cause unpredictable results.
- Move to the required cutting height before turning on cutter compensation.
- Do not include non cutting moves in the compensated section of your Gcode file as this may cause unpredictable results. eg Turning coolant on or off
- A lead in move is required to be a safe location at the start of compensation.
- A lead out is required to be a safe location at the end of the compensation.
- The lead out move is not shown on screen as a compensated move.
- Use linear moves for both Lead in and lead out.
- The lead in and out distance must be greater than the cutter radius.
- Specify both the X & Y coordinates on the first move after leaving Cutter compensation or you may

experience an unpredictable move.

The best way to think of G42 is that you are standing behind the cutter as it moves away from you.

The cutter will move to the Right side of the original tool path





Managing Tool Diameter, Wear Diameter and P Value

MASSO cutter compensation has been designed for maximum flexibility and compatibility.

There are several different ways that users can manage their tools in the tool table depending on what works best for them and what what they may already be used to.

The Tool Diameter and Wear Diameter values specified for the current tool is automatically applied whenever G42 is turned on

Tool Offset Calculation

The Compensation value used to off set the cutter is made up of 3 parameters.

Tool Diameter, Wear Diameter and P Value

The tool path offset is calculated as follows:

Toolpath Offset = (Tool Diameter + Wear Diameter) / 2 + P Value

P Value

The P value is used to specify a cutter offset in Gcode and is the radius to offset the tool path by. eg a 10mm cutter would use a P Value of 5mm

It is typically used in hand coded Gcode where you can hand code a simple toolpath and want to offset the cutter to account for the tool radius instead of having to take it into account in the Gcode itself.

It is a lot easier to hand code a 100mm square without taking the cutter into account and then use a P value to offset the cutter than to work out the coordinates for a particular tool.

This would be used on a machine where the Tool Diameter is set to 0 in the F4 tool table which would be typical where Tool offset is calculated in CAM or you do not use Cutter compensation.

If you have a Wear diameter assigned to the tool then this will be taken into account when the offset is calculated.

It would not be common for the P Value to be used with the Tool Diameter but you may have an application where you wish to use it.

Tool Diameter

How the Tool Diameter value is used will depend on your Gcode.

If the Tool Path offset is managed in your CAM software then the Tool Diameter will be left a 0. This would be the most common situation when using CAM software.

If the Tool Path does not already have the Tool offset included within the Gcode such as a hand coded Gcode file, then the Tool Diameter value can be used to offset the tool.

This is the same as using the P Value except the offset is stored in the F4 tool table instead of the being in the Gcode itself.

The Tool Diameter value can be the actual diameter of the cutter taking into account the amount of wear the cutter may have.

Alternatively it can be the nominal diameter of the cutter and final adjustment of the cutter size can be done using the Wear diameter value.

Wear Diameter

The Wear Diameter is used to adjust the tool diameter as a tool wears through use.

The Wear Diameter can be used and without the Tool Diameter or a P Value

It can also be used to indicate a tool is oversized.

- A negative wear value means a tool is undersized.
- A positive wear value means a tool is oversized

Example

A 10mm tool with a -0.5mm wear indicates that the tool is undersized and is 9.5mm in diameter.

10 + (-0.5) = 9.5mm tool

A 10mm tool with a 0.5mm wear indicates that the tool is oversized and is 10.5mm in diameter.

10 + (0.5) = 10.5mm tool

10.21. G53 – Move In Absolute Machine Coordinates

This command is used move one or more axis to a specified location. If multiple axis are called they will all move together to the desired location in a straight line and arrive at the same time. The axis can be linear, angular or a combination of both.

Syntax & Parameters

- **G53** followed by the axis you wish to move and it's coordinate. Multiple axis may be specified on the same line.
- **X, Y, Z, A, B Value** - specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.
- **G00** - G00 can also be used in combination to move at rapid feedrate.

Example program to move at rapid feedrate

```
N10 G00 G53 X10 Y20
```

In the above program the axis will move to X 10 and Y 20 of the absolute machine coordinates at rapid feedrate.

Example program to move at a specified feedrate

```
N10 G53 X10 Y20 F100
```

In the above program the axis will move to X 10 and Y 20 of the absolute machine coordinates at 100 millimeters/minute feedrate.

> **INFORMATION:** Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

10.22. G54 to G59 – Select Work Offset Coordinate System

The G54 to G59 commands are used to select the current work offset for use.

> The user can use the **F4** screen or **G10** command to set the offset values.

Syntax & Parameters

- **G54 to G59**

Example program

```
N10 G55
```

In the above program the work offset G55 is selected to offset the machining position.

10.23. G73 – High Speed Peck Drilling

This command is Canned Cycle used for high speed peck drilling.

Syntax & Parameters

- **G73** followed by axis, R, Q, K & F values.
- **X, Y, Z, A, B Value** - specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.
- **R Value** - This is the retract position in the Z axis above the workpiece and this is the position the Z axis will retract to after finishing the drilling cycle if using with G99.
- **Q Value** - The Q value is peck (incremental) value. A positive non-zero Q value must be specified.
- **K Value** - This is the number of time the cycle needs to be repeated. (Optional)
- **F Value** - The F value defines the feed rate at which the axis will move at.

INFORMATION: The Q value in this cycle refers to the distance that the drill cuts between each peck. The retract distance is fixed at 1.0mm between pecks.

Example program

```
N10 G99 G73 X10 Y10 Z-8 R2 Q1 K2 F100  N20 X20  N30 X30  N40 G80
```

- The first line moves the X & Y axis to 10mm position with retract plane set to 2mm, drilling to Z -8mm, peck of 1mm at 100 mm/minute feed rate and starts drilling.
- The K value of 2 will cause the drill cycle to repeat a 2nd time drilling the hole again before moving on to the next line of Gcode.
- The second line moves X axis to 20mm position and drills a hole as per the same values.
- The third line moves X axis to 30mm position and drills a hole as per the same values.
- G80 cancels the canned cycle

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

WARNING: Before a new canned cycle can be used the previous one must be cancelled with a G80

10.24. G80 – Cancel Modal Motion

This command is used to cancel Canned Cycles such as G73, G81, G82 & G83.

Syntax & Parameters

- **G80**

Example program

```
N10 G99 G73 X10 Y10 Z-8 R2 Q1 F100  N20 X20  N30 G80
```

- The first line moves the X & Y axis to 10mm position with retract plane set to 2mm, drilling to Z -8mm, peck of 1mm at 100 mm/minute feedrate and starts drilling.
- The second line moves X axis to 20mm position and drill a hole as per the same values.
- The third line cancels the G73 canned cycle.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or if G20 or G21 command in use.

INFORMATION: After using G80 the current mode is cancelled and replaced with G00 Rapid motion until it is changed in Gcode.

10.25. G81 – Drilling Cycle

This command is Canned Cycle used for drilling cycle.

Syntax & Parameters

- **G81** followed by axis, R & F value.
- **X, Y, Z, A, B Value** - specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.
- **R Value** - This is the retract position in the Z axis. This value must be specified.
- **K Value** - This is number of time the cycle needs to be repeated. (Optional)
- **F Value** - The F value defines the feed rate at which the axis will move at.

Example program

```
N10 G99 G81 X10 Y10 Z-8 R2 K2 F100  N20 X20  N30 X30  N40 G80
```

- The first line moves the X & Y axis to 10mm position with retract plane set to 2mm, drilling to Z -8mm at 100 mm/minute feed rate and starts drilling.
- The K value of 2 will cause the drill cycle to repeat a 2nd time drilling the hole again before moving on to the next line of Gcode.
- The second line moves X axis to 20mm position and drill a hole as per the same values.
- The third line moves X axis to 30mm position and drill a hole as per the same values.
- G80 cancels the canned cycle.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or if G20 or G21 command in use.

WARNING: Before a new canned cycle can be used the previous one must be cancelled with a G80

10.26. G82 – Drilling Canned Cycle With Dwell

This command is Canned Cycle used for drilling cycle with dwell (pause) at the bottom of hole.

Syntax & Parameters

- **G82** followed by axis, R, P & F values.
- **X, Y, Z, A, B Value** - specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.
- **R Value** - This is the retract position in the Z axis. This value must be specified.
- **K Value** - This is number of time the cycle needs to be repeated. (Optional)
- **P Value** - This is the dwell (pause) at the bottom of hole. This value is in milliseconds.
- **F Value** - The F value defines the feed rate at which the axis will move at.

Example program

```
N10 G99 G82 X10 Y10 Z-8 R2 K2 P1000 F100  N20 X20  N30 X30  N40 G80
```

- The first line moves the X & Y axis to 10mm position with retract plane set to 2mm, drilling to Z -8mm with 1 second dwell at bottom of the hole at 100 mm/minute feed rate and starts drilling.
- The K value of 2 will cause the drill cycle to repeat a 2nd time drilling the hole again before moving on to the next line of Gcode.
- The second line moves X axis to 20mm position and drill a hole as per the same values.
- The third line moves X axis to 30mm position and drill a hole as per the same values.
- G80 cancels the canned cycle.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

WARNING: Before a new canned cycle can be used the previous one must be cancelled with a G80

10.27. G83 – Peck Drilling For Deeper Holes

This command is Canned Cycle used for peck drilling deeper holes.

Syntax & Parameters

- **G83** followed by R, Q, K & F values.
- **X, Y, Z, A, B Value** - specifies the axis you wish to move following the distance to move. The distance value will be the current machine units in use.
- **R Value** - This is the retract position in the Z axis. This value must be specified.
- **Q Value** - The Q value is peck (incremental) value. A positive non zero Q value must be specified.
- **K Value** - This is number of time the cycle needs to be repeated. (Optional)
- **F Value** - The F value defines the feed rate at which the axis will move at.

Example program

```
N10 G99 G83 X10 Y10 Z-8 R2 Q1 K2 F100  N20 X20  N30 X30  N40 G80
```

- The first line moves the X & Y axis to 10mm position with retract plane set to 2mm, drilling to Z -8mm, peck of 1mm at 100 mm/minute feed rate and starts drilling.
- The K value of 2 will cause the drill cycle to repeat a 2nd time drilling the hole again before moving on to the next line of Gcode.
- The second line moves X axis to 20mm position and drill a hole as per the same values.
- The third line moves X axis to 30mm position and drill a hole as per the same values.
- G80 cancels the canned cycle.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

WARNING: Before a new canned cycle can be used the previous one must be cancelled with a G80

10.28. G90 – Set Distance Mode To Absolute

This command is used to set mode to absolute. This is the default mode on power up.

Syntax & Parameters

- **G90**

Example program

```
N10 G90
```

The above gcode will set the machine units to absolute.

10.29. G91 – Set Distance Mode To Incremental

This command is used to set mode to incremental.

Syntax & Parameters

- **G91**

Example program

```
N10 G91
```

The above gcode will set the machine units to incremental.

10.30. G92 – Temporary Work Offset

This command is used set temporary work offset values. The temporary work offsets are used in combination to the main work offsets G54 to G59.

Applying a temporary work offset to an axis will change the working coordinate of the axis to the specified value.

When a temporary work offset is applied it is shown on the F2 screen as the current work offset + G92 Offset: G54+G92

A temporary work offset is applied to all work offsets G54 to G59 until cancelled.

Syntax & Parameters

- **G92** followed by axis values.
- **X, Y, Z, A, B Value** - specifies the axis you wish to offset and the new working DRO value

INFORMATION: G92 work offsets are be cancelled by G92.1

Example program

```
N10 G92 X10 Y20
```

In this example the X and Y axis will not move and a temporary work offset will be applied the the X & Y axis.

The X axis working DRO will display 10 and the Y axis working DRO will display 20.

The amount of the offset is automatically calculated to give the required working coordinate.

A common use of temporary work offsets is in with probing cycles such as setting the torch height in Plasma

```
N10 G38.2 Z-50   N20 G92 Z0     N30 G0 Z1
```

In this example the G38.2 probes Z axis toward the surface of the material and when the touch input is triggered it will stop

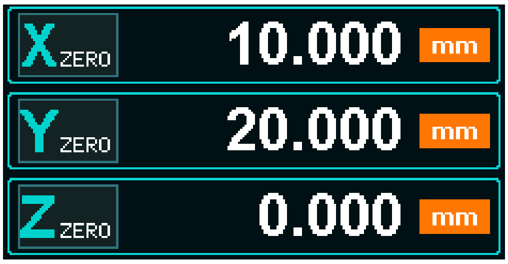
The G92 Z0 sets the working coordinate to Z0

G0 Z1 moves the Z axis 1 unit above the material surface.

> **INFORMATION:** Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

Zeroing Axis with Temporary Work Offsets Applied

- DRO's with Temporary work offsets cannot be zeroed by pressing the X, Y or Z Zero buttons on the DRO.
- When a G92 work offset is applied to an axis and the DRO is zeroed the offset value will be applied show and on the DRO instead of 0.
- If you click on an axis DRO with a Temporary Work Offset applied and enter a new value, the Temporary Work Offset value will be applied to it and a new working coordinate will be displayed.
- Use G92.1 to cancel the temporary work offset.



10.31. G92.1 – Cancel Temporary Work Offset

This command is used cancel the G92 temporary work offset values.

Syntax & Parameters

- **G92.1**

Example program

```
N10 G92.1
```

The above program cancels the temporary work offset values.

10.32. G93 – Inverse Time Mode

This command is used set the current feed rate mode to Inverse Time Mode.

Syntax & Parameters

- **G93**
- **X, Y, Z, A & B** These are the destination coordinates of the axis.
- **F** Value This is the Feedrate. The move will be completed it 1/F minutes or 60/F seconds.
- **G01, G02 and G03** It is Mandatory to include a Feedrate for these commands
- **G00** No Feedrate is required

Example program

```
N10 G93  N20 G01 X1 A1 F30      #This will move TO position X1 A1 in 2 seconds
   N30 G00 X0 A0          #This will Rapid to X0 A0
```

The above program sets the feedrate mode to Inverse Time Mode.

10.33. G94 – Units Per Minute Mode

This command is used set the current feed rate mode to Units per Minute Mode. When in this mode the feedrate F value is in units per minute.

Syntax & Parameters

- **G94**

Example program

```
N10 G94
```

The above program sets the feedrate mode to Units per Minute Mode.

10.34. G95 - Feed Per Revolution

G95 (Feed Per Revolution) is a modal G-code that instructs the control to interpret feed commands as mm per revolution (mm/rev) or inches per revolution of the spindle.

Syntax & Parameters

- **G95**
- **F Value** The F value specifies the distance travelled per revolution of the spindle used to calculate the G95 feed rate.
- **S Value** This specifies the spindle speed used to calculate the G95 feed rate

Example program

Metric

```
N10 G21  N20 S800 M3  N30 G95  N40 G01 Z20 F0.1
```

The above program code tells the Z axis to advance 0.1mm for every revolution of the spindle until the Z axis reaches 20mm.

The Feed rate will be 80mm per minute

G95 feed rate above is calculated as follows

(Spindle speed) x (Specified Distance per Revolution) = G95 feed rate

800 x 0.1 = 80mm per minute

Imperial

```
N10 G20  N20 S800 M3  N30 G95  N40 G01 Z2 F0.005
```

The above program code tells the Z axis to advance 0.005" for every revolution of the spindle until the Z axis reaches 2".

The Feed rate will be 4 inches per minute

G95 feed rate above is calculated as follows

(Spindle speed) x (Specified Distance per Revolution) = G95 feed rate

800 x 0.005 = 4 inches per minute

Using G95 with G96

CAUTION: Please be aware that the CSS spindle speed does not work with G95 Feed Per Revolution.

- Using G95 & G96 together may cause unexpected results if used incorrectly.
- When G95 is used with G96 an S value must be specified for G95 to work.
- The S value must be given before the G96.
- The S value as part of the G96 command is not used by G95.
- The spindle speed calculated by G96 is not used by G95.

10.35. G96 – Turn on Constant Surface Speed (CSS)

This command is used to enable Constant Surface Speed (CSS) mode in lathe version.

Syntax & Parameters

- **G96** followed by D & S values.
- **D Value** - This is to set the maximum spindle RPM that the spindle can achieve in CSS mode as the tool gets closer to the center.
- **S Value** - To set surface speed value. The units will be the current machine units in use. Metric uses meters per minute. Imperial uses feet per minute.

Example program

```
N10 G21  N20 G0 X50  N30 G96 D12000 S200  N40 M3  N50 G1 X1 F80
```

- In the above example CSS mode is enabled with a surface speed of 200 meters per second and the maximum RPM is set to 12000.
- The X axis starts at X 20 from the center and moves towards the center at a feed rate of 80mm/min. Spindle speed starts at a calculated 3185 rpm and the speed increases the closer it moves to the spindle center. It reaches the specified maximum of 12000 rpm 5.2mm from the center at which time the speed remains at 12000rpm until the X axis reaches the final position of 1mm.

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

CAUTION: Please be aware that the CSS spindle speed does not work with G95 Feed Per Revolution. Using G96 & G95 together may cause unexpected results if used incorrectly. For more information please see G95

INFORMATION: When CSS turned on in your Gcode program and Auto Spindle ticked in the F1 screen, pressing feed hold will not stop the spindle and it must be stopped and restarted manually.

10.36. G97 – Turn off Constant Surface Speed (CSS)

This command is used to disable Constant Surface Speed (CSS) mode and set to RPM mode in lathe version.

Syntax & Parameters

- **G97**

Example program

```
N10 G97
```

- In the above example CSS mode is disabled and the system is set back to RPM mode.

10.37. G98 – Canned Cycle – Retract Back To The Initial Z

This command is used in combination with canned cycles to retract Z axis to the position before canned cycles was started.

Syntax & Parameters

- **G98**

Example program

```
N10 G98 G73 X10 Y10 Z-8 R2 Q1 F100
```

- In the above program, after finishing the drilling cycle the Z axis will retract back to the position before the drilling cycle.

10.38. G99 – Canned Cycle – Retract Back To R Plane

This command is used in combination with canned cycles to retract the Z axis to the R plane value.

Syntax & Parameters

- **G99**

Example program

```
N10 G99 G73 X10 Y10 Z-8 R2 Q1 F100
```

- In the above program, after finishing the drilling cycle the Z axis will retract to the value defined by the R word.

10.39. G200 - Plasma Parameters

This command defines the parameters for Plasma.

It can be placed at the start of the Gcode file and will populate the Plasma parameters shown on the Plasma Tab in the F2 screen

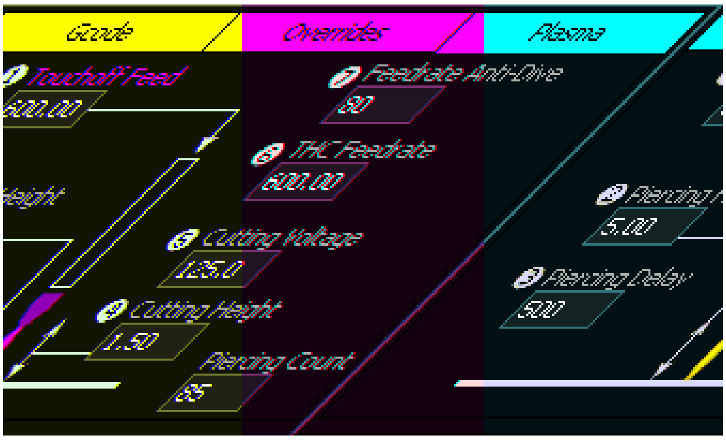
To access the Plasma screen you must select Tool 112. In MDI enter T112 M6 to change to the Plasma screen.

It is good practice to add T112 M6 to your Gcode files.

INFORMATION: This Gcode is not available for MASSO G2

Syntax & Parameters

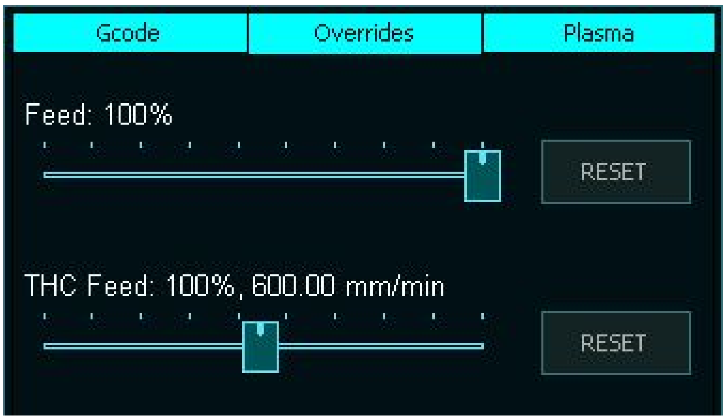
- **G200** uses the values to populate the Plasma parameters tab
- **F Value** – Touch off feed rate
- **P Value** – Piercing Height
- **D Value** – Piercing delay This value is defined in Milliseconds
- **C Value** –Cutting height
- **V Value** - Cutting voltage , if set to "0" then the system goes into the "Auto Voltage" option where the system samples the voltage at cutting height and then maintains this voltage for the rest of that cut. To make use of this parameter the MASSO DTHC module is required.
- **A Value** - Feed rate Anti Dive **, (Please note that this parameter has not yet been implemented)** This value is a percentage of the X & Y axis feed rate below which the Z-axis will lock when under THC control to prevent the torch from moving into the material. The axis will unlock and the THC resume operation once the feed rate increases above this value.
- **O Value** - Ohmic ON/OFF. 0 is Ohmic OFF, 1 is Ohmic ON.
- **S Value** - Stop after piercing and wait for Cycle start. 0 is do not stop, 1 is Stop and wait for Cycle Start.



> **INFORMATION:** If the Cutting voltage is set to 0 in G200 MASSO will use "Auto Voltage" option where the system samples the voltage at cutting height and then maintains this voltage for the entire cut. Should you find that the torch height is too high or too low you can type in a new value in the on screen cutting voltage box or use the on screen Torch up or Torch Down button to adjust the torch height in real time.

> **INFORMATION:** The THC Feed rate parameter is specified using the **M667 F** Gcode. If you find that the THC feed rate is too fast or too slow you can manually adjust the feedrate on the Override page using the THC Feed: slider.

> **Caution:** The **A Value** - Feed rate Anti Dive has not been implemented at this time but will be added in the future and this documentation updated.



Example program

```
N10 G200 F150 P5.5 D500 C3.1 V116 A50 O1 S0
```

G200

G200 defines how your plasma will operate.

A G200 with no parameters after it will turn off the G200 operation and the plasma will work in a legacy mode where all operations need to be done manually using Gcode.

The default setting for G200 when MASSO is powered on is G200 is turned on so if running old files a G200 command should be added to the start of the file to switch MASSO to legacy mode.

This can also be done by issuing a G200 in MDI but adding it to the file better.

Once G200 is turned off it will remain off until turned on again or MASSO is repowered.

G200 can be used with an external THC unit such as a Proma 150 and is mandatory when using the MASSO DTHC unit.

When G200 is active many of the standard plasma operations are automated which greatly simplifies the Gcode required.

When an M3 is issued the following start sequence will happen automatically.

- Probing will start automatically using the F parameter as the probing feed rate. once the touch off been triggered the torch height will be set.
- The torch will automatically move to piercing height defined in parameter P
- The torch will start the arc
- On receipt of the Arc ok signal the piercing Delay timer defined in parameter D will start.
- At the end of the delay time the Torch will automatically move to the cutting height defined in parameter C

> **INFORMATION:** It is recommended that GCode use the G200 features whether you are using a DTHC or an older Legacy THC unit.

F - Touch off feed

This is the Touch off feed rate used in the automatic probing as part of G200 when it is active

P - Piercing height

This defines the Piercing Height used as part of G200 when it is active.

It is the height the torch will move to perform the piercing.

D - Piercing delay

This is the piercing delay used as part of G200 when it is active.

This is the time the torch will wait for the material to be pierced before continuing to cutting height.

This value is defined in mS eg a value of 2000 is 2 Seconds

C - Cutting height

This is the cutting height used as part of G200 when it is active.

This is the height the torch will automatically move after the piercing is complete.

V - Cutting voltage

This defines the cutting voltage that the MASSO DTHC uses to set the torch height when cutting.

If a voltage is defined it will maintain this voltage while cutting.

The voltage can be altered in real-time by using the Torch UP and Torch Down buttons on the F2 screen

Each press will change the voltage by 1 volt.

A new value can be typed into the cutting Voltage box on the Plasma tab on the F2 screen 

If the V Value is set to 0 in G200 MASSO will use the “Auto Voltage” option where the system samples the voltage at cutting height each time the plasma starts and then maintains this voltage for the rest of that cut.

A - Anti-dive

Please note that this parameter has not yet been implemented but will be added at a future date)

This defines the feed rate anti-dive percentage value. It is used to lock the Z-axis when the axis slows down to prevent the torch from dropping into the material. This normally occurs when cutting arcs.

This value is a percentage of the X & Y axis feed rate below which the Z-axis will lock when under THC control to prevent the torch from moving into the material. The axis will unlock and the THC resume operation once the feed rate increases above this value.

O - Ohmic

This is the Ohmic touch off parameter.

MASSO has 2 touch off inputs that can be used for Plasma touch off. Plasma Touch and Plasma Ohmic

When O0 is set the Plasma-Touch is used. This is usually a switch built into the torch that activates then the torch is pressed into the material surface.

Then this input is used the Torch Touch Offset is used to calculate the torch height. 

When O1 is set the Plasma-Ohmic is used. This type of touch off uses the electrical connection between the torch tip and the material itself to detect the torch height.

The Ohmic touch does not use an offset value.

You can configure both touch types on your machine and select the one best suited at the time.

Only one can be active at a time.

You can manually switch between them by using the Ohmic Button 

Ohmic is active when it is Yellow 

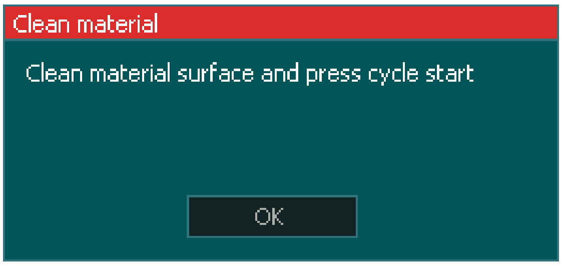
S - Stop

When piercing thicker material the molten metal is moved to the surface of the material until such time as the material is pieced.

This can cause a build up on the surface of the material that the torch can run into.

Use of the S parameter in the G200 can be used when cutting material that presents this problem.

When S1 is set, and an M3 command is issued the torch will touch off the material, move to the piercing height and after the piercing delay has finished the Plasma will turn off and the torch ascend to the Z home position.



This message is displayed on screen

The material surface can now be cleaned and when ready the Cycle Start button is pressed.

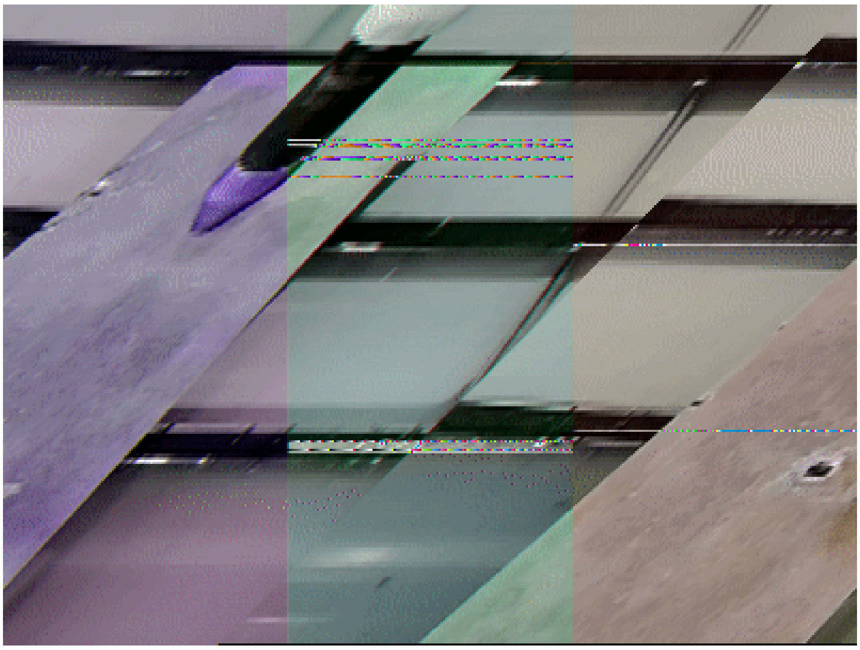
The torch will now rapid down to the cutting height, the Plasma will start and the cut will commence.

This sequence will occur on each M3 command.

If S0 is set there will be no stop between piercing and moving to cutting height.

Default is S0 when MASSO is powered on

The last S value will be remembered until it is changed or MASSO is repowered.



Build up left after piercing thick material

10.40. MSG - Print message to screen

This command allows the user to add messages to their Gcode which will be displayed on the screen in the tool path area.

These can be used as training aids, instructions or reminders of when to do something.

> **INFORMATION:** This Gcode is not available for MASSO G2

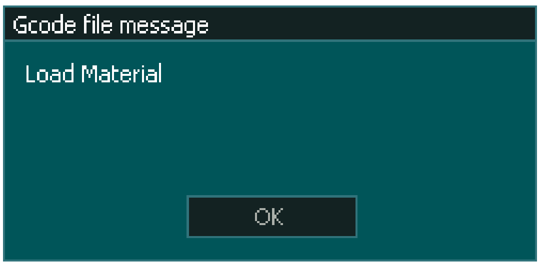
Syntax & Parameters

- **MSG** - followed by a space and then the message to be displayed on screen
- **MSG** - when no message follows the MSG command the current on screen message will be removed from the screen

Example program to display the message "**Load Material** " on the screen

```
N10 MSG Load Material
```

- Message length is limited to a single line of 34 characters and messages that exceed this length will only display the first 34 characters.
- Messages can be cancelled by pressing the OK button on the message display or using the **MSG** Gcode by itself.
- Messages will remain on screen until cancelled, overwritten by the next message or a System message.



> **INFORMATION:** messages can be cleared from the the screen using **MSG** and no following text.

```
N10 MSG Load Material  N20 G04 P3000  N30 MSG
```

- Display Load Material on screen
- Wait 3 seconds
- Remove message from screen.

> INFORMATION: Messages can be used with M00 & M01 to stop the machine so that the user can read the message before proceeding if required.

Example program to display the message "**Change tool to V-Bit {90 deg 0.5"}**" on the screen before a tool change

```
N10 MSG Change tool to V-Bit {90 deg 0.5"}  N20 M01  N30 T3 M06
```

- Messages can be written into the post processor to automatically add this type of message.
- The M01 in the example will stop the machine until the Cycle Start is pressed allowing the user time to read the message when they are ready. There is no need to press OK in this instance because it will immediately be overwritten by the system tool change message.
- If Optional Stop **CTRL+O** is turned off then the machine will not stop and the user will not see the message as it will immediately be overwritten by the System message to Change tool

> **INFORMATION:** Multiple messages can be used with G04 Pauses to display messages in a timed sequence.

Example program to display multiple messages on the screen

```
N10 MSG READ DIAL FOR BACKLASH MEASUREMENT  N20 G04 P3000  N30 MSG ENTER THIS
VALUE INTO MASSO BACKLASH  N40 G04 P3000  N50 MSG TEST COMPLETE
```

- In some applications it may be desirable to provide instructions in a timed sequence. Using a G04 pause between messages will allow them to be displayed for the specified time before it is overwritten by the next message.

The video clip below shows an example of using the MASSO MSG gcode to create a backlash test sequence with instructions for the tester to carry out at each step of the process.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Masso Message in action

10.41. F - Feed rate

This Gcode is used to set the feed rate.

It can be used as part of another Gcode command or by itself.

The specified feed rate remains in operation until overwritten

The feed rate does not override the maximum feed rate specified for any given axis.

Syntax & Parameters

- **F Value** - This defines the feed rate the machine will use for the specified operation.

Example program

```
N10 F1500
```

The machine will use a feed rate of 1500 units

INFORMATION: Units are defined as either inches or mm depending on your machines setup or G20 or G21 command in use.

10.42. N - Number

This command is used as a number within the Gcode.

Line numbers are optional and preforms no function within the Gcode other than an identifier of a particular line of Gcode for the benefit of the user.

This is not to be confused with the line number that MASSO uses when running a program

Syntax & Parameters

- **N Value** - The number that follows the N is used to denote the line number

Example program

```
N10  N20  N30
```

10.43. S - Speed / Intensity

This command is used to specify a Spindle Speed or if used with Laser specifies the Laser intensity

Syntax & Parameters

Spindle

- **S Value** - This specifies the spindle speed in RPM

Laser

- **S Value** - This specified the Laser PWM value 0-1000 which translates to 0 - 100%

Example program Spindle

```
N10 S10000

This sets a spindle speed of 10000 rpm and is usually followed by an M3 or M4
on the same line



Example program Laser

N10 S500

This set Laser intensity to 50%
```

10.44. ( ) - Comments

This command is used to allow the user to add comments into their Gcode file.

Anything written between the open and closed bracket is ignored.

Syntax & Parameters

- **(** - The open bracket is used to define the start of a comment.
- **)** - The close bracket is used to define the end of a comment.

Example program Spindle

```
N10 (My comment)
```

WARNING: Do not insert comments within comments as this is not valid. eg **(Comment 1 (Comment 2))** is not valid.

10.45. Invalid Gcode

WARNING: If a line of GCode contains unsupported Gcode commands, incorrect syntax or hidden unprintable characters, the entire line of code is ignored.

When MASSO ignores a line of code the program will move to the next valid line of Gcode and continue execution.

> WARNING: Running incorrectly written or formatted Gcode may cause unpredictable or unwanted moves and may result in damage to the work or machine.

11. Supported M-codes

Read other subtopics below:

11.25) M86 - Close Door

11.26) M98 & M99 – Sub Program Call

11.1. M00 – Program Stop

This command stops the program. Pressing cycle start will resume the program.

Syntax & Parameters

- **M00**
- **M0 -** The same as **M00**

Example program

```
N10 G00 X0 Y0  N20 G00 X10  N30 M00  N40 G00 Y10
```

- The first line will move both X and Y axis to 0.00 position.
- In line two the X axis will move to X 10 position.
- In line three the program will stop and wait for user to press cycle start.

11.2. M01 – Optional Program Stop

This command stops the program if optional stop is turned on. Pressing cycle start will resume the program. You can press CTRL + O when on the F2-Program & MDI screen page to toggle between Optional Stop ON/OFF.

The optional Stop status is displayed at the top of the screen and you can also toggle it on and off by clicking this with the mouse or using the touch screen. Optional Stop: On

Syntax & Parameters

- **M01**
- **M1 -** The same as **M01**

Example program

```
N10 G00 X0 Y0  N20 G00 X10  N30 M01  N40 G00 Y10
```

- The first line will move both X and Y axis to 0.00 position.
- In line two the X axis will move to X 10 position.
- In line three the program will stop and wait for user to press cycle start is optional stop is set to On, else will run line four and move Y axis to 10.

11.3. M02 – Program End

This command ends the program.

Syntax & Parameters

- **M02**
- **M2 -** The same as **M02**

Example program

```
N10 G00 X0 Y0  N20 G00 X10  N30 M02  N40 G00 Y10
```

- The first line will move both X and Y axis to 0.00 position.
- In line two the X axis will move to X 10 position.
- In line three the program will stop and will not run line four.

11.4. M03 – Spindle ON (Clockwise)

This command starts the spindle in clockwise direction at the RPM set by the S command

Syntax & Parameters

- **M03** - Clockwise command followed with or without S value.
- **M3** - The same as **M03**
- **S** - The S value defines the required RPM. If the S value is not given then the last S value is automatically used.

Example program

```
N10 S1200 M03
```

In this example the spindle is started in clockwise direction at 1200 RPM.

11.5. M03 – Plasma Torch ON

In plasma version this command switches On the plasma torch.

Syntax & Parameters

- **M03**
- **M3** - The same as **M03**

Example program

```
N10 M03
```

In this example the plasma torch is switched On.

11.6. M04 – Spindle ON (Counter Clockwise)

This command starts the spindle in counter clockwise direction at the RPM set by the S command

Syntax & Parameters

- **M04** - Clockwise command followed with or without S value.
- **M4** - The same as **M04**
- **S** - The S value defines the required RPM. If the S value is not given then the last S value is automatically used.

Example program

```
N10 S1200 M04
```

In this example the spindle is started in counter clockwise direction at 1200 RPM.

11.7. M05 – Spindle OFF

This command stops the spindle.

Syntax & Parameters

- **M05**
- **M5 -** The same as **M05**

Example program

```
N10 M05
```

In this example the spindle will be stopped.

11.8. M05 – Plasma Torch OFF

In plasma version this command switches Off the plasma torch.

Syntax & Parameters

- **M05**
- **M5 -** The same as **M05**

Example program

```
N10 M05
```

In this example the plasma torch is switched Off.

11.9. M06 – Tool Change

WARNING: M06 must be preceded by an **M05** or unpredictable results may occur.

CAUTION: This command can be used in different combinations and wrong command can result in unexpected loading of tool. See video below

This command is used to change tool immediately and can be used with T value.

Syntax & Parameters

- **M06**
- **M6 -** The same as **M06**
- **T Value –** specifies the tool number to change, this value can be used before M06 or after M06 but will have a very different process of tool loading.

Tool Numbers

MASSO G2 use tool numbers 0 to 31

MASSO G3 & MASSO Touch use tools 0 to 118

Tool 0 - Dry run laser

Tool 1 - 100 Main spindle tools

Tool 101 - 104 Multi-Head spindles 1 - 4

Tools 111 - Laser

Tool 112 - Plasma

Tool 113 - Oxy Torch

Tool 114 - Waterjet

Tool 115 - Scribe

Tool 116 - 117 Pen

Tool 118 - Camera

> **WARNING:** The T value must precede the **M06** or unpredictable results may occur. Please see the video below for additional information

This Video shows the importance of formatting the M6 command correctly with the tool number first.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Understanding Tool Change Command

Example program

```
N10 M05  N20 T5 M06
```

In above program the M05 stops the spindle then T5 tells the system that we would like to load tool number 5 and M06 is used to tell the system to load the tool.

Special note for Multi-Head users

When tool changes are done in conjunction with multi-head it is advisable to raise the Z axis to a safe height before performing the tool change.

This ensures that the height difference between the old and new tool will not cause any problems.

One way to do this is with a G53 Z0 or similar to raise the Z axis to the top of the machine travel to give maximum clearance.

Example program

```
N10 M05  N20 G53 Z0  N30 T5 M06
```

In above program the M05 stops the spindle.

The Z axis moves to machine coordinate Z0 to ensure clearance between the material surface and the new tool

T5 tells the system that we would like to load tool number 5 and M06 is used to tell the system to load the tool.

11.10. M06.1 - Tool Unload

This feature is currently under development

This feature allows the user to unload the existing tool from the spindle without picking up a new tool.

This can be useful if changing to a different head and you require the tool the be removed to provide extra clearance.

Currently only works in Linear tool changer in version 5.100b software

Syntax & Parameters

- **M06.1**
- **M6.1 -** The same as **M06.1**

Example program

```
N10 M05  N20 M06.1
```

In above program the M05 stops the spindle then the current tool is unloaded from the spindle automatically if using a tool changer and no new tool is picked up.

If using manual tool change the spindle will move to the tool change position for the user to remove the tool.

When a new tool is required in the spindle use the standard **Txx M06** Gcode command to load a new tool.

11.11. M07 – Turn Mist Coolant On

This command turns On the Mist Coolant output.

Syntax & Parameters

- **M07**
- **M7 -** The same as **M07**

Example program

```
N10 M07
```

In this example the Mist Coolant is turned On.

11.12. M08 – Turn Flood Coolant On

This command turns On the Flood Coolant output.

Syntax & Parameters

- **M08**
- **M8 -** The same as **M08**

Example program

```
N10 M08
```

In this example the Flood Coolant is turned On.

INFORMATION: In v5.02 and higher the use of feed hold will stop the coolant and cycle start will resume it.

11.13. M09 – To Turn All Coolant Off

This command turns Off both Mist Coolant and Flood Coolant output.

Syntax & Parameters

- **M09**
- **M9 -** The same as **M09**

Example program

```
N10 M09
```

In this example if any of the Mist Coolant or Flood Coolant was On then this code swithces them Off.

11.14. M10 – Chuck Or Rotary Table Clamp closed

This command turns the Chuck Clamp output to LOW.

This is considered in MASSO logic as the Chuck Clamp being closed.

> **CAUTION:** For safety, output LOW means the clamp is closed and an interlock signal from the spindle drive must be wired for safety so that the clamp does not open while the spindle/chuck is spinning.

Syntax & Parameters

- **M10**

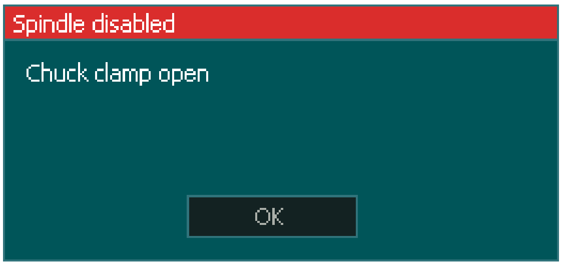
Example program

```
N10 M10
```

In this example the Chuck Clamp is closed.

If you try and start the spindle while the Chuck Clamp is open you will see the following Message.

Pressing OK will remove the message.



To continue you need to close the Chuck Clamp and manually start the Spindle before pressing Cycle Start if you are running Gcode program.

> **CAUTION:** If you run your program with the Chuck clamp open the spindle will not start and the program will continue with the spindle off. This may cause damage to your machine or work.

- The Chuck clamp can also be opened and closed from the MDI screen using the **Set Spindle Clamp OFF** and the **Set Spindle Clamp ON** buttons.
- An external Chuck Clamp/Unclamp input can be assigned to toggle the chuck clamp open and closed as needed.
- These buttons are interlocked to the spindle status and will not allow the spindle to open when the spindle is on or allow the spindle to start when the chuck clamp is open.

Example Chuck Clamp wiring

11.15. M11 – Chuck Or Rotary Table Clamp Open

This command sets the Chuck Clamp output to High.

This is considered in MASSO logic as the Chuck Clamp being open

CAUTION: For safety this output HIGH means the clamp is open and an interlock signal from the spindle drive must be wired for safety so that the clamp does not open while the chuck is spinning.

Syntax & Parameters

- **M11**

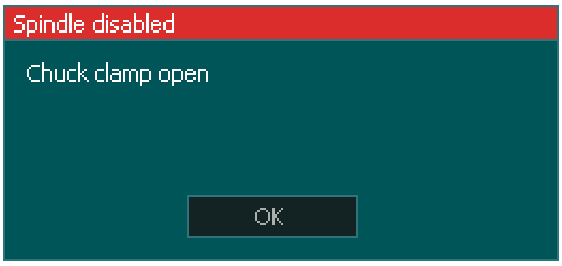
Example program

```
N10 M11
```

In this example the Chuck Clamp is opened.

If you try and start the spindle while the Chuck Clamp is open you will see the following Message.

Pressing OK will remove the message.



To continue you need to close the Chuck Clamp and manually start the Spindle before pressing Cycle Start if you are running Gcode program.

CAUTION: If you run your program with the Chuck clamp open the spindle will not start and the program will continue with the spindle off. This may cause damage to your machine or work.

- The Chuck clamp can also be opened and closed from the MDI screen using the 

 and the 

 buttons.
- An external Chuck Clamp/Unclamp input can be assigned to toggle the chuck clamp open and closed as needed.
- These buttons are interlocked to the spindle status and will not allow the spindle to open when the spindle is on or allow the spindle to start when the chuck clamp is open.

Example Chuck Clamp wiring

11.16. M30 – End The Program And Rewind

This command ends the program and moves back to the first line of the gcode file.

Syntax & Parameters

- **M30**
- **L** Value When added to the M30 command causes the program to be repeated for the specified number of cycles. L10 will run the Gcode 10 times before rewinding stopping
- **L0** Value When L0 is added to M30 the Program will rewind and repeat on an infinite loop.

INFORMATION: When a Gcode file loops the spindle does not stop on the M30 until the last cycle. This eliminates Spin up and spin down time between cycles.

Example program

```
N10 G00 X0 Y0  N20 G00 X10  N30 M30  N40 G00 Y10
```

- The **N10** line will move both X and Y axis to 0.00 position.
- In line **N20** the X axis will move to X 10 position.
- In line **N30** the program will stop and the file will rewind back to line **N10**, pressing cycle start will start the program from **N10** line.

Infinite Loop

```
N10 G00 X0 Y0  N20 G00 X10   N30 M30 L0
```

- This program executes lines N10 to N30 before rewinding back to N10 and starting again automatically. It will continue until it is manually stopped.

Repeat 20 times

```
N10 G00 X0 Y0   N20 G00 X10   N30 M30 L20
```

- This program executes lines N10 to N30 before rewinding back to N10 and starting again until it has completed 20 cycles at which time it will rewind to N10 and stop.

11.17. M62 – Turn On Digital Output Synchronized With Motion

This command is used to switched ON any of the 16 auxiliary outputs synchronized with the start of the next motion command.

INFORMATION: This Gcode is not available for MASSO G2

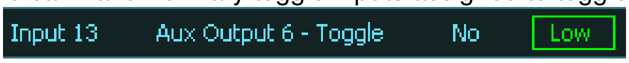
CAUTION: If no motion is commanded, the output will not turn ON. It is best to specify motion immediately following the M62 command.

Syntax & Parameters

- **M62**
- **P Value -** The P value is required and defines the auxiliary output number to switch On. This value can be between 1 to 16.

Prerequsites

- An output must be configured as an Auxiliary output 

 where the P value is the Auxiliary number. In this example P1
- Auxiliary outputs 1 to 6 can have Auxiliary toggle inputs assigned to toggle them on and off with the press of a button. eg 

- Auxiliary outputs 7 to 16 can only be changed through Gcode.

Example program

```
N10 G0 X0  N20 M62 P1  N30 X10  N40 M63 P1  N50 X20
```

- In the above example the the X axis moves to X0 position, then auxiliary output 1 is turned ON when the X axis starts to move towards X10 position. Once the axis reaches X10 position and starts moving to X20 position, the auxiliary output 1 is turned OFF.

11.18. M63 – Turn Off Digital Output Synchronized With Motion

This command is used to switched OFF any of the 16 auxiliary outputs synchronized with the start of the next motion command.

INFORMATION: This Gcode is not available for MASSO G2

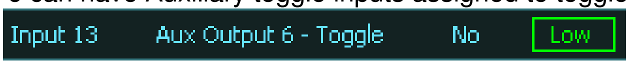
CAUTION: If no motion is commanded, the output will not turn OFF. It is best to specify motion immediately following the M63 command.

Syntax & Parameters

- **M63**
- **P Value -** The P value is required and defines the output number to switch On. This value can be between 1 to 16.

Prerequsites

- An output must be configured as an Auxiliary output 

  where the P value is the Auxiliary number. In this example P1
- Auxiliary outputs 1 to 6 can have Auxiliary toggle inputs assigned to toggle them on and off with the press of a button. eg 

- Auxiliary outputs 7 to 16 can only be changed through Gcode.

Example program

```
N10 G0 X0   N20 M62 P1   N30 X10   N40 M63 P1   N50 X20
```

- In the above example the the X axis moves to X0 position, then auxiliary output 1 is turned ON when the X axis starts to move towards X10 position. Once the axis reaches X10 position and starts moving to X20 position, the auxiliary output 1 is turned OFF.

11.19. M64 – Turn On Digital Output Immediately

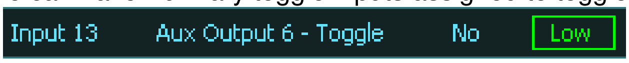
This command is used to switched ON any of the 16 auxiliary outputs. If this command is used between motion commands then the motion will come to full stop before switching ON the output.

Syntax & Parameters

- **M64**
- **P Value -** The P value is required and defines the output number to switch On. This value can be between 1 to 16.

Prerequsites

- An output must be configured as an Auxiliary output 

 where the P value is the Auxiliary number. In this example P1
- Auxiliary outputs 1 to 6 can have Auxiliary toggle inputs assigned to toggle them on and off with the press of a button. eg 

- Auxiliary outputs 7 to 16 can only be changed through Gcode.

Example program

```
N10 M64 P1  N20 M64 P4
```

- The **N10** line will switch ON the auxiliary output 1.
- The **N20** line will switch ON the auxiliary output 4.

11.20. M65 – Turn Off Digital Output Immediately

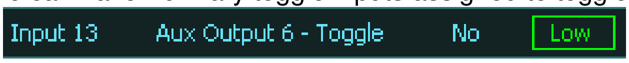
This command is used to switched OFF any of the 16 auxiliary outputs. If this command is used between motion commands then the motion will come to full stop before switching OFF the output.

Syntax & Parameters

- **M65**
- **P Value -** The P value is required and defines the output number to switch On. This value can be between 1 to 16.

Prerequsites

- An output must be configured as an Auxiliary output 

 where the P value is the Auxiliary number. In this example P1
- Auxiliary outputs 1 to 6 can have Auxiliary toggle inputs assigned to toggle them on and off with the press of a button. eg 

- Auxiliary outputs 7 to 16 can only be changed through Gcode.

Example program

```
N10 M65 P1  N20 M65 P4
```

- The **N10** line will switch OFF the auxiliary output 1.
- The **N20** line will switch OFF the auxiliary output 4.

11.21. M66 - Wait for Input

This command is used to monitor an auxiliary input.

MASSO will stop executing Gcode until the input condition is met or the timeout expires.

If the condition is met MASSO will skip the specified number of lines of Gcode and continue the program.

If the timeout expires before the input condition is met the Program will move to the next line of Gcode and continue execution of the program.

INFORMATION: M66 is not supported on MASSO G2

Syntax & Parameters

- **M66** followed by P, L, Q & S values
- **P Value** - Auxiliary input number 1 - 16
- **L Value** - Condition and action 1, 2, 3 or 4
- **L1** - Wait for input to change from Low to High. If this input is already High it will need to cycle to Low and back to High to be a valid input
- **L2** - Wait for input to change from High to Low. If this input is already Low it will need to cycle to High and back to Low to be a valid input
- **L3** - Wait for input to be High. If the input is already High the Program will continue immediately
- **L4** - Wait for input to be Low. If the input is already Low the Program will continue immediately
- **Q Value** - Timeout in milliseconds. The Q value must be 1 or higher
- **S Value** - skip the next number of lines if the input is received.

Example

This example could be starting a dust collector and at the same time the same signal opens the the blast gate which has a switch on it to indicate it is open

```
N10 M64 P2  N20 MSG Checking Blast Gate Open  N30 M66 P4 L3 Q1000 S2  N40 MSG
Blast Gate closed  N50 M00  N60 MSG  N70 G1 X10  N80   N90
```

In this example Auxiliary output 2 is turned on to start dust collector and open the Blast gate

Message displayed on MASSO screen "Checking Blast Gate Open"

MASSO looks at auxiliary input 4 to see if blast gate is open

If the input is already high it will immediately skip the next 2 lines and move to line N60 and clears message from the screen before continuing with the program.

If the input is Low it will wait 10 seconds for the input to change to High and if it goes high in that time it will skip the next 2 lines and move to line N60 clearing the message and continuing the program.

If the input remains low for 10 seconds MASSO will put message "**Blast Gate closed**" on the screen and wait for cycle start

After the problem is corrected and the user wishes to continue, cycle start is pressed, the message is removed and the program continues the program

If you require that the program execution stops when it encounters an input error please use a M00 to halt operation.

```
The user can manually press feed hold to end program execution.



It is highly recommended that using long delays that a suitable message noting
 that the machine is waiting for a condition to be met before continuing so th
at the machine operator knows why the Gcode program is halted.
```

If you want to the M66 to trigger the end of the Gcode program use an **M02** to end the program.

11.22. M666 – Plasma – Turn THC Function Off

This command is used to switch OFF the THC automatic Z axis control function in the plasma version.

Syntax & Parameters

- **M666**

Example program

```
N10 M666  N20 G1 X1 F1000
```

The above program switches Off the THC function.

This Gcode does not take effect until the next axis move.

11.23. M667 – Plasma – Turn THC Function On

This command is used to switch On the THC automatic Z axis control function in the plasma version.

Syntax & Parameters

- **M667**
- **F Value -** this is the feed rate of the Z axis that the will be used to move torch up/down when in THC mode.

INFORMATION: If no THC feed rate is specified for the M667 it will use the last feed rate specified for M667. If no previous feed rate has been specified it will use the maximum feed rate of the axis as the M667 feed rate.

Example program

```
N10 M667 F500  N20 G01 X1 F1000
```

The above program switches On the THC function and sets Z axis feed rate during THC control to 500.

This Gcode does not take effect until the next axis move.

Example program

```
N10 M667  N20 G1 X1 F1000
```

The above program switches On the THC function. The THC feed rate will use the last feed rate specified for M667. If no previous feed rate has been specified it will use the maximum feed rate of the axis as the M667 feed rate.

This Gcode does not take effect until the next axis move.

THC Feed Rate issues

The THC feed rate determines the speed at which the Z axis move to reposition the Z axis to the correct cutting height under THC control.

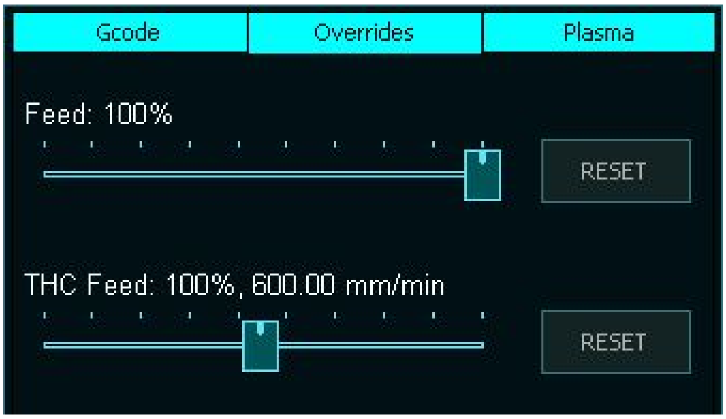
If this setting is too fast the Z axis will overshoot and the THC will reverse direction to bring it back to the correct cutting height.

In extreme cases the Z axis can end up overshooting each time it moves causing a continuous hunting for position as the Z axis bounces up and down as it moves along the cut.

If the THC feed rate is set too low the Z axis may not be able to climb fast enough to clear the material surface causing the torch to collide with the material.

Use the THC feed rate slider on the Overrides page to change the THC feed rate in real time if needed.

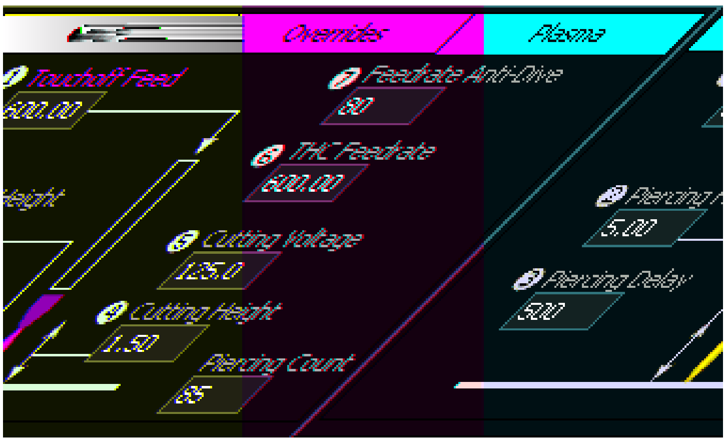
The current THC feed rate is displayed on the slider and this figure can be used as a guide to setting the THC feed rate for future cuts on this material.



THC Feed Rate override

The current THC feed can also be viewed in the Plasma page and a new value entered into the box.

The new value will be valid until it is over written by a new entry or Gcode command.



THC Feed rate parameter

11.24. M85 - Open Door

This Gcode is used to open an Automatic door on an enclosure.

The **M85** Gcode works with the Door Open / Close output on MASSO and sets the output HIGH to open the door. 

The door open is interlocked with MASSO Spindle

A sounder output is provided for the user to add the sounder of their choice to provide a warning of the door opening. 

INFORMATION: M85 is not supported in MASSO G2

Syntax & Parameters

- **M85**

Example program

```
N10 M85
```

- **M85** is called
- The Sounder output goes High for 1 second to signal door is about to open 

- Door Open/Close output is set to HIGH 

 and at the same time the Sounder output changes between HIGH and LOW every 0.5 seconds for 5 seconds to warn the user the door is opening.

INFORMATION: To close the door please see Gcode **M86**

INFORMATION: For manual opening and closing of the door you can use the Door Open Close input. 

11.25. M86 - Close Door

This Gcode is used to open an Automatic door on an enclosure.

The **M86** Gcode works with the Door Open / Close output on MASSO and sets the output LOW to close the door. 

A sounder output is provided for the user to add the sounder of their choice to provide a warning of the door closing. 

> **INFORMATION:** M86 is not supported in MASSO G2

Syntax & Parameters

- **M86**

Example program

```
N10 M86
```

- **M86** is called
- The Sounder output goes High for 1 second to signal the door is about to close. 

- Door Open/Close output is set to LOW 

and at the same time, the Sounder output changes between HIGH and LOW every 0.5 seconds for 5 seconds to warn the user the door is closing.

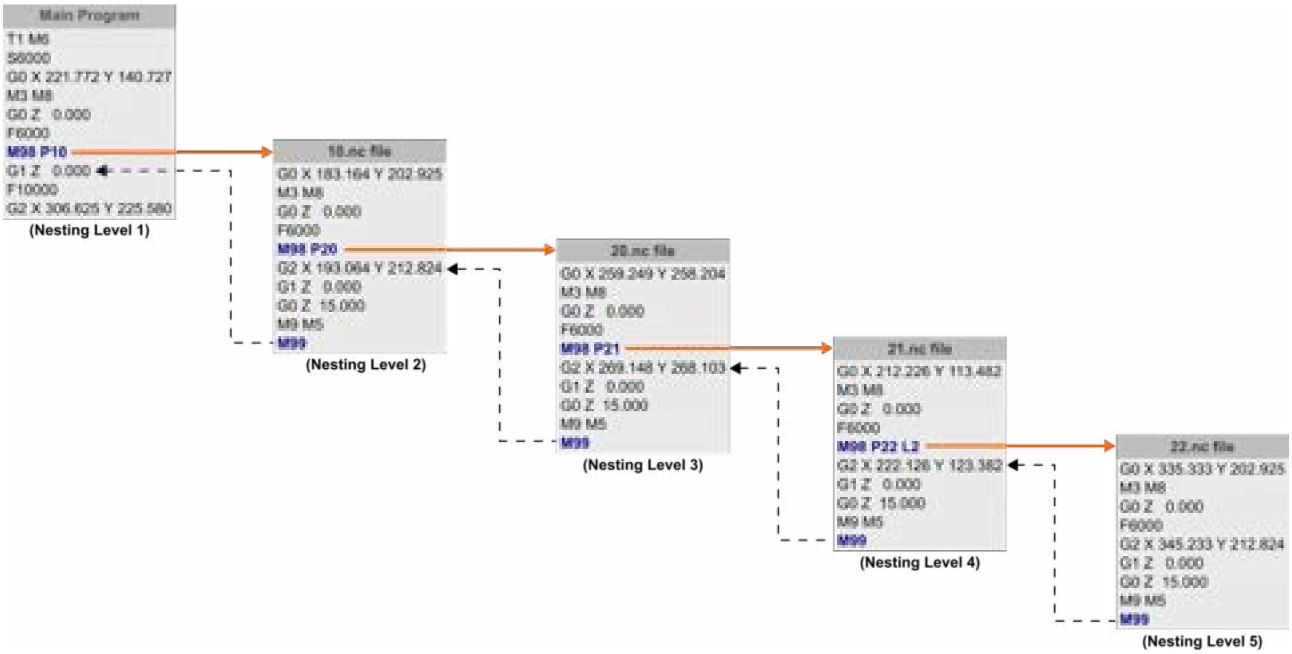
> **INFORMATION:** To open the door please see Gcode **M85**

INFORMATION: For manual opening and closing of the door you can use the Door Open Close input. 

11.26. M98 & M99 – Sub Program Call

MASSO supports Sub-Program Call using M98 & M99 codes. Subprograms with up to 5 levels of nesting is supported, with this feature sub programs can be called from the main program without the need to rewrite the same program again and again.

When a sub program is called, MASSO looks for a separate **".nc"** file and runs that as a sub-program. Having a separate file approach means that programs that have common features can now be used used with other programs.



INFORMATION: The Main program and all sub-program files must be located in the same folder on the USB Flash drive. All subprogram files must be **.nc** files. For software versions prior to v5.03 the main and sub programs must reside in the root directory of your Flash Drive.

INFORMATION: Sub-program names can be single digit, but you must not prefix the name with a 0. **1.nc** is valid **01.nc** is not valid

INFORMATION: Subroutine toolpaths are not drawn on the screen during program load.

M98 Sub-Program Call

Syntax & Parameters

- **M98**
- **P Value** - The P value is used to define the sub program file name.
- **L Value** - The L value can be used to run the sub program multiple times.

Example program

```
N10 M98 P10 L5
```

The above program will look for the **10.nc** file as set by the **P** value and will run it **5** times as set by **L** value.

NOTE: If the **10.nc** file is not found an error message on the screen is displayed and program goes into feedhold. When a program is loaded from F6 screen, MASSO checks that all sub-program files are on the USB and if a file is missing an error is shown to the user

M99 End Sub-Program or Return

M99 command is used to End Sub-Program or Return back to the main program.

Syntax & Parameters

- **M99**

Example program

```
N10 M99
```

When the above line is found in a sub program file, the control returns back to the main program.

12. CAM Post Processors

Read other subtopics below:

12.1. Artcam

MASSO Post Processors for Artcam

- Artcam 2010 CLICK HERE to download **(Released: 1/11/2019)**
- Artcam 2015 - 2018 CLICK HERE to download **(Released: 1/11/2019)**

INFORMATION: These Post processors were provided by users of Artcam software. If these are not suitable for your version of Artcam please contact your Artcam provider and ask them to make one for you or you can modify an existing one.

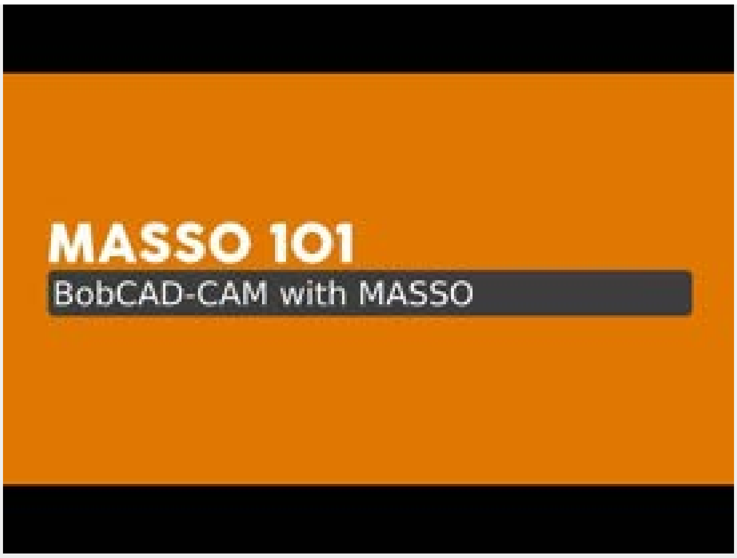
12.2. BobCAD-CAM

Masso Post Processors for Mill and Plasma

CLICK HERE to downloaded the latest Post Processor for Mill and Plasma direct from the Bobcam site. Users will need a support account for the website. Masso posts can be found under Mill_Router and under Plasma. MASSO Post Processor for Lathe

CLICK HERE to download the Lathe POST processor for BobCAD-CAM V29 **(Released: 15/05/2018)**

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video



MASSO 101 - BobCAD-CAM POST Processor for MASSO

12.3. Fusion 360

Autodesk POST Processor For Mill. Plasma and Lathe

Autodesk Mill, Plasma & Lathe Post Processors

Direct download from Autodesk website: **Goto Autodesk MASSO page**

For MASSO G3 a MASSO Touch Plasm users please use the Post Processor link below as the one provided by Autodesk at this time does not work properly.

Download Plasma Post Processor here: **Fusion 360 Plasma Post Processor**

12.4. SheetCAM

Tangential Knife POST Processor

CLICK HERE to download the POST **version 1.0 (14/02/2018)** processor file

Waterjet POST Processor

CLICK HERE to download the POST **version 0.1 (11/09/2018)** processor file with **M62 P1** / **M63 P1 turn the Water Jet on/off**

PLASMA Post Processor for Version 5 Software

This supports MASSO DTHC, Legacy Up / Down THC and machines without THC and Scribe

CLICK HERE to download the POST Processor v2.1

Plasma POST Processor without THC software version 4.01 or lower

CLICK HERE to download the POST **version 0.1 (11/09/2018)** processor file

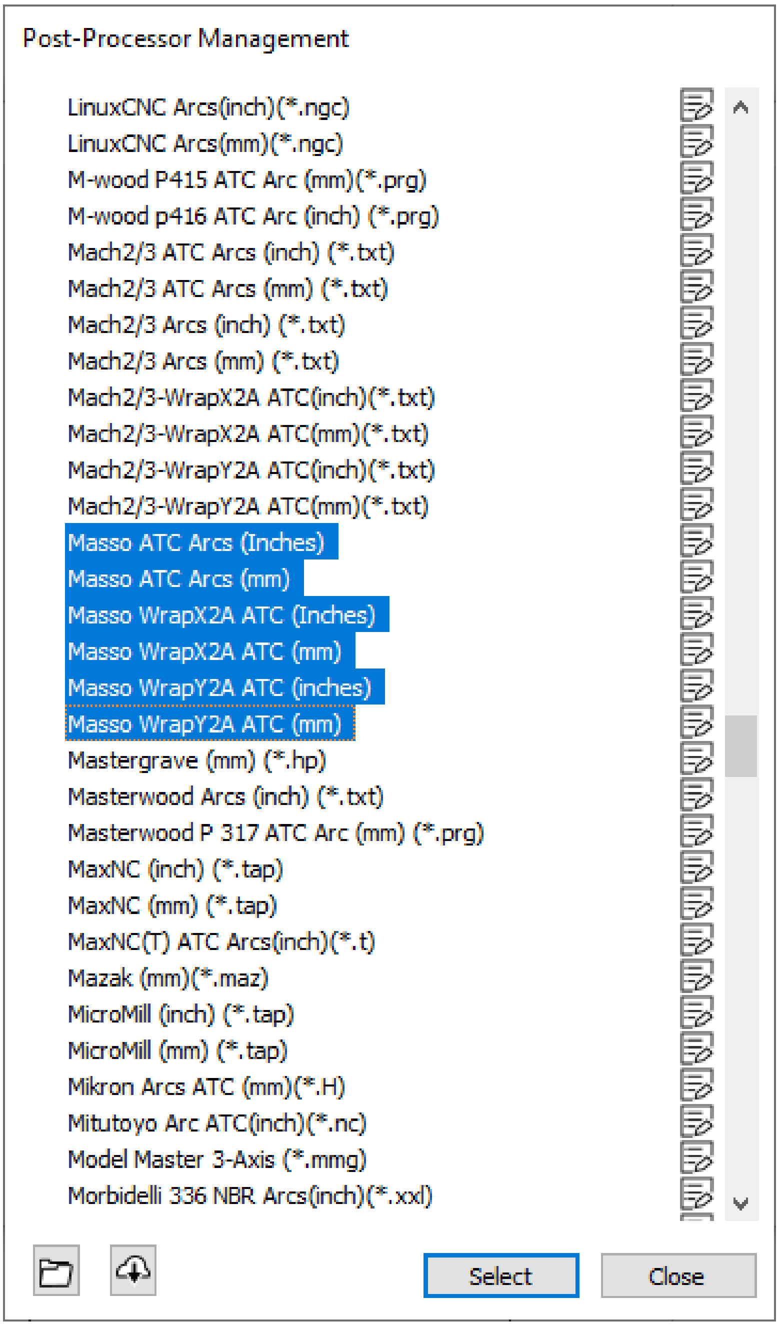
Plasma POST Processor with THC software version 4.01 or lower

CLICK HERE to download the POST **version 0.4 (09/08/2019)** processor file

12.5. Vectric VCarve and Vectric Aspire

MASSO Post Processors for Vectric software

Post Processors for Version 11 software onward is available by directly downloading them into your Vectric software using the built in Post-Processor Management feature.



v5.79 - 11 December, 2023

LASER Module

For those using the Vectric Laser module a post processor has been written and is available from the link below.

It can be used for both general machining and Laser and should be suitable for all versions of VCarve Pro and Aspire with the Laser module

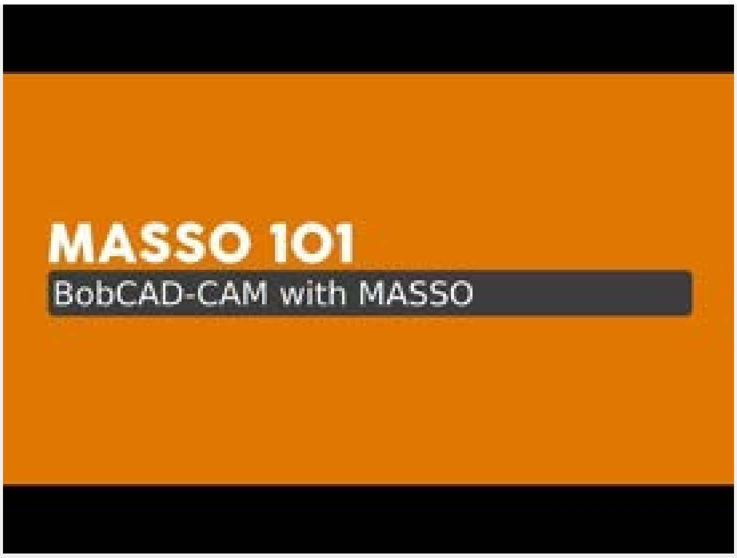
- CLICK HERE to download (**Released 11/02/2022**)

Older software versions

INFORMATION: The post processors below should also work for Vectric Cut 2d.

- Post Processors for Rotary Axis Vectric Aspire & VCave Pro all versions
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Aspire and VCarve Pro V6.5
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Aspire and VCarve Pro V7.5
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Aspire and VCarve Pro V8.5
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Aspire and VCarve Pro V9.5
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Aspire and VCarve Pro V10.5
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric Cut 3D
- CLICK HERE to download **(Released: 01/11/2019)**
- Post Processors for Vectric PhotoVCarve
- CLICK HERE to download **(Released: 01/11/2019)**

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video



MASSO 101 - Installing Vectric Post Processor

12.6. Plasma POST Processor Requirements

MASSO version5 and DTHC Plasma Post Processor Requirements

This document outlines the new requirements for a post processor to be used with Version 5 software and MASSO Plasma DTHC unit.

It is an aid to those who wish to design their own post processors.

This post processor will work for both THC and DTHC users but will not work with Version 4 plasma and below

A sample Gcode file has been added to the end of this document along with screenshots to illustrate and comments to the Gcode.

Overview

MASSO has designed an integrated THC unit for use with the MASSO CNC controller.

This requires a new Post processor as much of the normal functions carried out through Gcode is now built into MASSO simplifying the Gcode required.

To achieve this a new Gcode has been created G200

This would be placed at the start of the Gcode file and defines the various parameters that will determine how MASSO will work. This Gcode is only required once unless the cutting parameters need to change during the cut.

While G200 can be placed at the start of the file it is not mandatory for it to be in the first line.

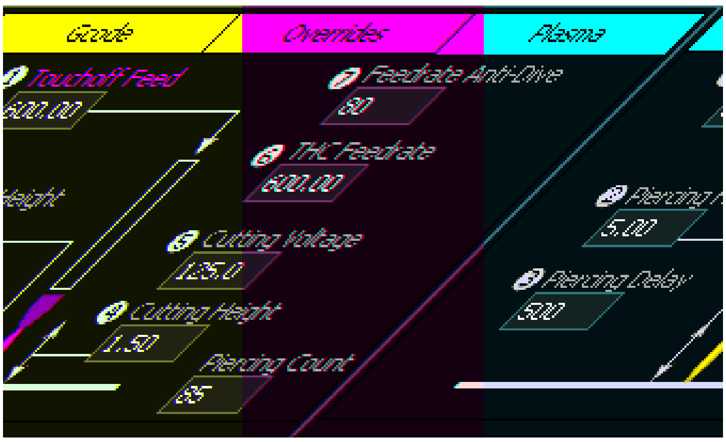
- The G200 must appear before the first M3 command in the Gcode file
- A new G200 may be issues if cutting parameters need to change during the cut.
- While in Plasma mode the tool number must remain Tool 112.

G200 Syntax & Parameters

- **G200** uses the values to populate the Plasma parameters tab
- **F Value** – Touch off feed rate
- **P Value** – Piercing Height
- **D Value** – Piercing delay This value is defined in Milliseconds
- **C Value** –Cutting height
- **V Value** - Cutting voltage , if set to “0” then the system goes into the “Auto Voltage” option where the system samples the voltage at cutting height and then maintains this voltage for the entire cut. To make use of this parameter the MASSO DTHC module is required.
- **A Value** - Feed rate Anti Dive **, (Please note that this parameter has not yet been implemented but will be added at a future date)** This value is a percentage of the X & Y axis feed rate below which the Z-axis will lock when under THC control to prevent the torch from moving into the material. The axis will unlock and the THC resume operation once the feed rate increases above this value.
- **O Value** - Ohmic ON/OFF. 0 is Ohmic OFF, 1 is Ohmic ON.
- **S Value** - Stop after piercing and wait for Cycle start. 0 is do not stop, 1 is Stop and wait for Cycle Start.

Example program

N10 G200 F150 P5.5 D500 C3.1 V116 A90 O1 S0



M667 – Plasma – Turn THC Function On

This command is used to switch On the THC automatic Z axis control function in the plasma version.

Syntax & Parameters

· M667

· F Value - this is the feed rate of the Z axis that the will be used to move torch up/down when in THC mode. If no feed rate is specified MASSO will use the maximum feed rate of the Z axis as the THC feed rate. Once a THC feed rate has been specified it will be remember until overwritten by a new F value allowing subsequent M667 commands without an F value to be used.

Example program

```
N10 M667 F500
```

The above program switches On the THC function and sets Z axis feed rate during THC control to 500.

M666 – Plasma – Turn THC Function Off

This command is used to switched OFF the THC automatic Z axis control function in the plasma version.

Syntax & Parameters

· M666

Example program

```
N10 M666
```

The above program switches Off the THC function.

Tool Change Command

- T112 M06 must appear in the Gcode file before cutting starts to put MASSO into Plasma mode. Ideally in the header of the Gcode file.
- Changing to a different tool number will cancel Plasma mode.

Example program

```
N10 T112 M06
```

· The above program Changes MASSO into Plasma mode.

G200

G200 defines how your plasma will operate.

A G200 with no parameters after it will turn off the G200 operation and the plasma will work in a legacy mode where all operations need to be done manually using Gcode.

The default setting for G200 when MASSO is powered on is G200 is turned on so if running old files a G200 command should be added to the start of the file to switch MASSO to legacy mode.

This can also be done by issuing a G200 in MDI but adding it to the file better.

Once G200 is turned off it will remain off until turned on again or MASSO is repowered.

G200 can be used with an external THC unit such as a Proma 150 and is mandatory when using the MASSO DTHC unit.

When G200 is active many of the standard plasma operations are automated which greatly simplifies the Gcode required.

When an M3 is issued the following start sequence will happen automatically.

- Probing will start automatically using the F parameter as the probing feed rate. once the touch off been triggered the torch height will be set.
- The torch will automatically move to piercing height defined in parameter P
- The torch will start the arc
- On receipt of the Arc ok signal the piercing Delay timer defined in parameter D will start.
- At the end of the delay time the Torch will automatically move to the cutting height defined in parameter C

INFORMATION: It is recommended that GCode use the G200 features whether you are using a DTHC or an older Legacy THC unit.

F - Touch off feed

This is the Touch off feed rate used in the automatic probing as part of G200 when it is active

P - Piercing height

This defines the Piercing Height used as part of G200 when it is active.

It is the height the torch will move to perform the piercing.

D - Piercing delay

This is the piercing delay used as part of G200 when it is active.

This is the time the torch will wait for the material to be pierced before continuing to cutting height.

This value is defined in mS eg a value of 2000 is 2 Seconds

C - Cutting height

This is the cutting height used as part of G200 when it is active.

This is the height the torch will automatically move after the piercing is complete.

V - Cutting voltage

This defines the cutting voltage that the MASSO DTHC uses to set the torch height when cutting.

If a voltage is defined it will maintain this voltage while cutting.

The voltage can be altered in real-time by using the Torch UP and Torch Down buttons on the F2 screen

Each press will change the voltage by 1 volt.

A new value can be typed into the cutting Voltage box on the Plasma tab on the F2 screen 

If the C Value is set to 0 in G200 MASSO will use the “Auto Voltage” option where the system samples the voltage at cutting height each time the plasma starts and then maintains this voltage for the rest of that cut.

A - Anti-dive

Please note that this parameter has not yet been implemented but will be added at a future date)

This defines the feed rate anti-dive percentage value. It is used to lock the Z-axis when the axis slows down to prevent the torch from dropping into the material. This normally occurs when cutting arcs.

This value is a percentage of the X & Y axis feed rate below which the Z-axis will lock when under THC control to prevent the torch from moving into the material. The axis will unlock and the THC resume operation once the feed rate increases above this value.

O - Ohmic

This is the Ohmic touch off parameter.

MASSO has 2 touch off inputs that can be used for Plasma touch off. Plasma Touch and Plasma Ohmic

When O0 is set the Plasma-Touch is used. This is usually a switch built into the torch that activates then the torch is pressed into the material surface.

Then this input is used the Torch Touch Offset is used to calculate the torch height. 

When O1 is set the Plasma-Ohmic is used. This type of touch off uses the electrical connection between the torch tip and the material itself to detect the torch height.

The Ohmic touch does not use an offset value.

You can configure both touch types on your machine and select the one best suited at the time.

Only one can be active at a time.

You can manually switch between them by using the Ohmic Button 

Ohmic is active when it is Yellow 

S - Stop

When piercing thicker material the molten metal is moved to the surface of the material until such time as the material is pieced.

This can cause a build up on the surface of the material that the torch can run into.

Use of the S parameter in the G200 can be used when cutting material that presents this problem.

When S1 is set, and an M3 command is issued the torch will touch off the material, move to the piercing height and after the piercing delay has finished the Plasma will turn off and the torch ascend to the Z home position.

The material surface can now be cleaned and when ready the Cycle Start button is pressed.

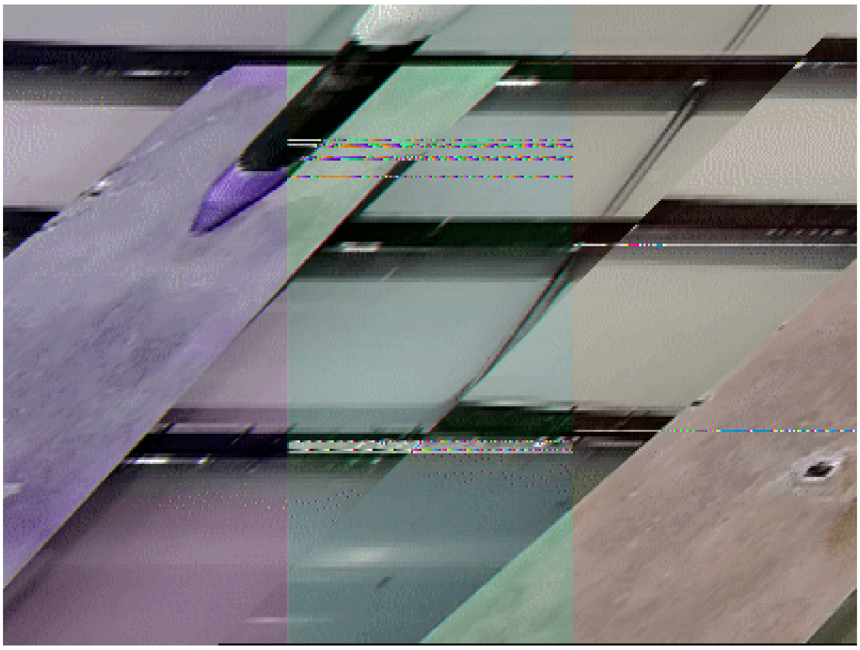
The torch will now rapid down to the cutting height, the Plasma will start and the cut will commence.

This sequence will occur on each M3 command.

If S0 is set there will be no stop between piercing and moving to cutting height.

Default is S0 when MASSO is powered on

The last S value will be remembered until it is changed or MASSO is repowered.



Build up left after piercing thick material

To automate S0 or S1 within the post processor one method is to compare the material thickness defined in the job parameter with a reference thickness stored within the post processor or within the Cam software. If the material thickness is equal to or exceeds the reference thickness then S1 is set otherwise S0 is set.

Another method is an option within the job set up is a switch to turn S on or off as needed. This relies on the user remembering to manually select the option during setup but affords more flexibility.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

G200 - Masso Top Tip

Sample Gcode file

The following is a Sample Gcode file which includes the G200, M667 and M666 Gcode commands.

Note that there is no requirement for Probing Gcode routines in this file.

The M03 will automatically perform the Probing of the material surface, the Piercing delay and setting the cutter to the cutting height using information contained in the G200 Gcode command.

Because MASSO manages all Z axis moves while cutting there only needs to moves to the Safe Z height between cuts.

Comments added in red

(Plasma Sample File)

N1 G21

N2 G17

N3 G90

N4 G80

N23 G94

N5 (Plasma)

N6 T112 M6 *(This is required to put MASSO into Plasma Mode. The Tool number must always be Tool 112)*

N7 G200 F200 P10 D500 C3.5 V116 A0 O0 S0 *(This Gcode sets the Plasma Parameters)*

N8 G00 Z20.000 (Safe Z move)

N9 G00 X70.000 Y75.000

N10 M03 (Turn Plasma on, Probe, Delay, Set cutting height)

N11 M667 F600 *(This will Turn the THC on at a Z axis feed rate of 600mm/min)*

N12 G03 X60.000 Y85.000 I-10.000 J0.000 F3000

N13 G03 X35.000 Y60.000 I0.000 J-25.000

N14 G03 X60.000 Y35.000 I25.000 J0.000

N15 G03 X85.000 Y60.000 I0.000 J25.000

N16 G03 X60.000 Y85.000 I-25.000 J0.000

N17 G03 X50.000 Y75.000 I0.000 J-10.000

N18 M666 (This Turns the THC off)

N19 M05 *(Turns Plasma Off)*

N20 G00 Z20.000 *(Safe Z move)*

N21 G00 X0.000 Y5.000

N22 M03

N23 M667 F600

N24 G03 X10.000 Y15.000 I0.000 J10.000 F3000

N25 G01 X10.000 Y105.000

N26 G02 X15.000 Y110.000 I5.000 J0.000

N27 G01 X105.000 Y110.000

N28 G02 X110.000 Y105.000 I0.000 J-5.000

N29 G01 X110.000 Y15.000

N30 G02 X105.000 Y10.000 I-5.000 J0.000

N31 G01 X15.000 Y10.000

N32 G02 X10.000 Y15.000 I0.000 J5.000

N33 G03 X0.000 Y25.000 I-10.000 J0.000

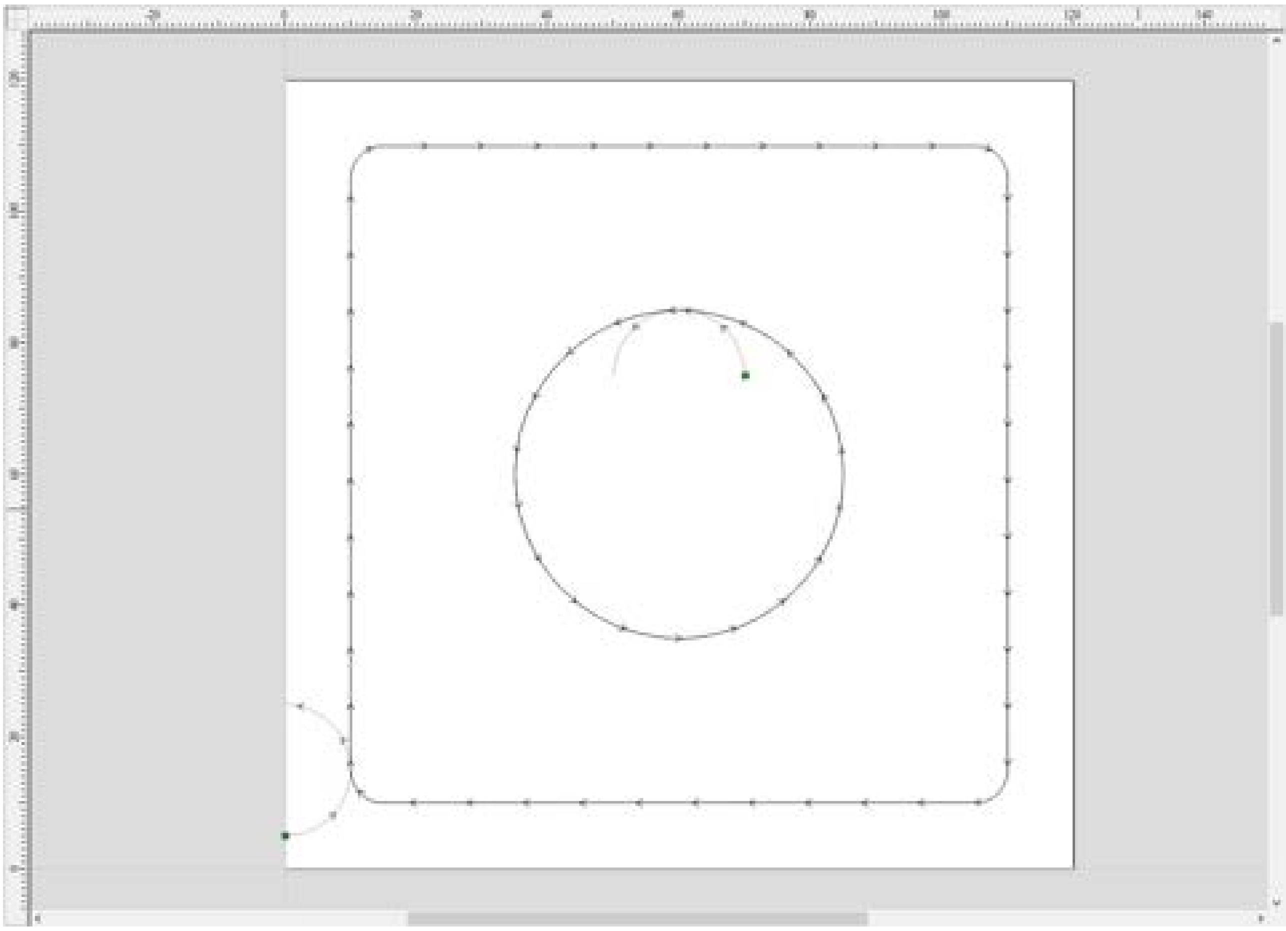
N34 M666

N35 M05

N36 G00 Z20.000 *(Safe Z move)*

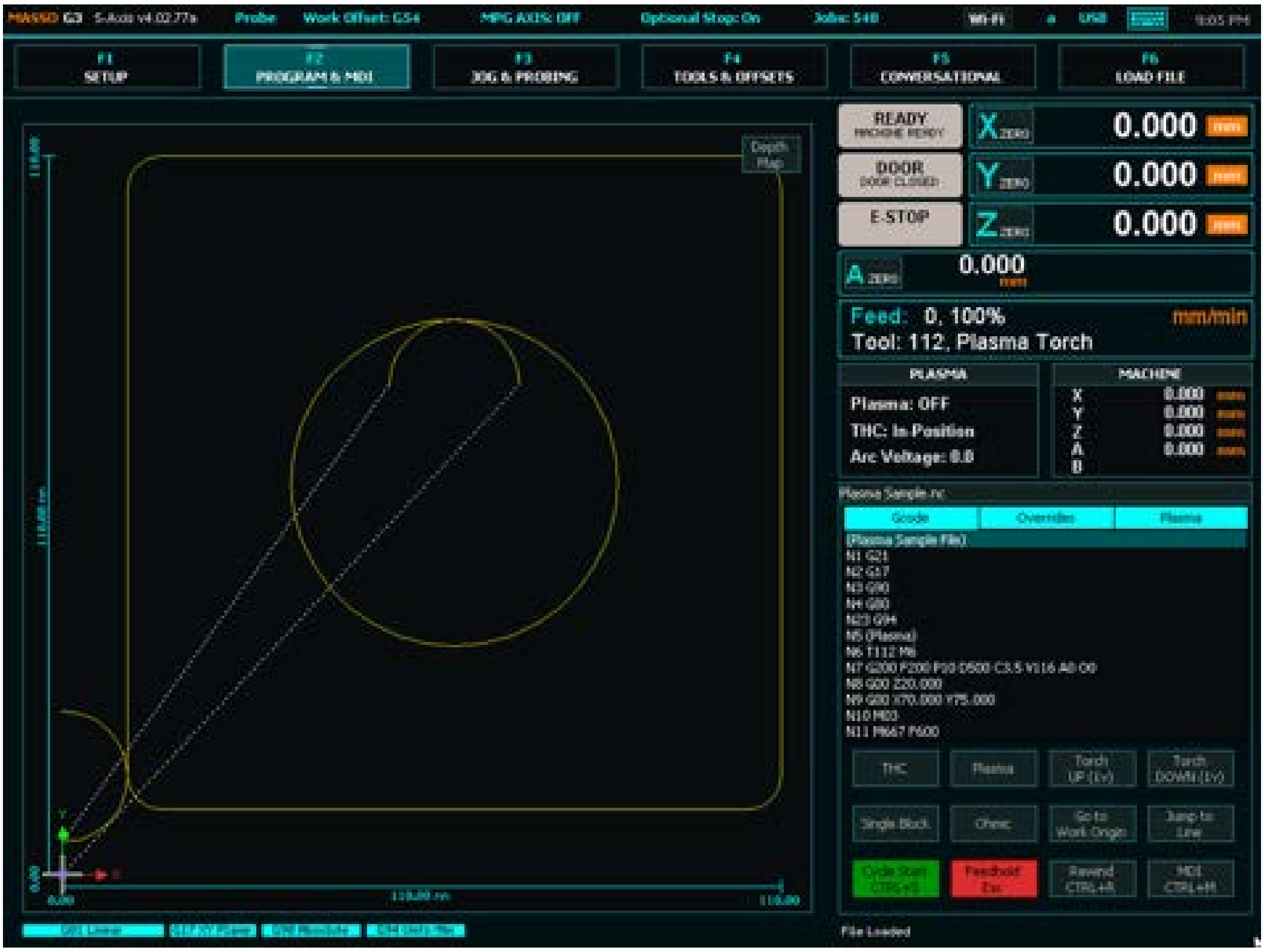
N37 M30

CAD/CAM Toolpath of Sample File with lead in and lead out



Completed cut of Sample File

Gcode file as seen on MASSO Screen



12.7. Other CAM Software

Why is my CAM software not mentioned?

There are numerous CAM software makers and it is not possible to list them all.

If you do not see your CAM software supplier listed please contact them directly and ask for a Post processor for you MASSO controller.

If they do not have one available they should be able to make one for you. Should they need assistance or have questions they can contact MASSO support and we will be happy to assist.

Who makes MASSO Post Processors?

Post Processors are made by the CAM Software supplier.

As writers of the CAM software they have the expertise in writing Post Processors to suit their product.

Should they need assistance or have questions they can contact MASSO support and we will be happy to assist.

Why does MASSO not write Post Processors?

Post Processors are made by the Cam software writers as they have the expertise in their own products.

In the past we have approached various CAM software makers and requested Post Processors for MASSO but as we do not have their product or a support contract they are not interested.

MASSO support is happy to work with CAM software makers to help with the development of Post Processors.

Why are there links to some Post processors and not others?

The Post Processors were provided by users of the various software or by the CAM manufacture themselves and linked to for convenience.

If you have a post processor you have made and wish to share please post it in the Forums Post Processor section

The person who makes the post processor is responsible for maintaining it.

Contact MASSO support and a page with link will be added the new post processor.

13. Multi-Head

Read other subtopics below:

13.1. Introduction

> **INFORMATION:** Multi-Head functionality for the MASSO G3 & G3 Touch is available in software version 5.0 or higher

What is Multi-Head

Multi-Head is a series of attachments that connect to the Head of your CNC machine.

Each head will have a dedicated tool number and work offsets coordinates from the main spindle.

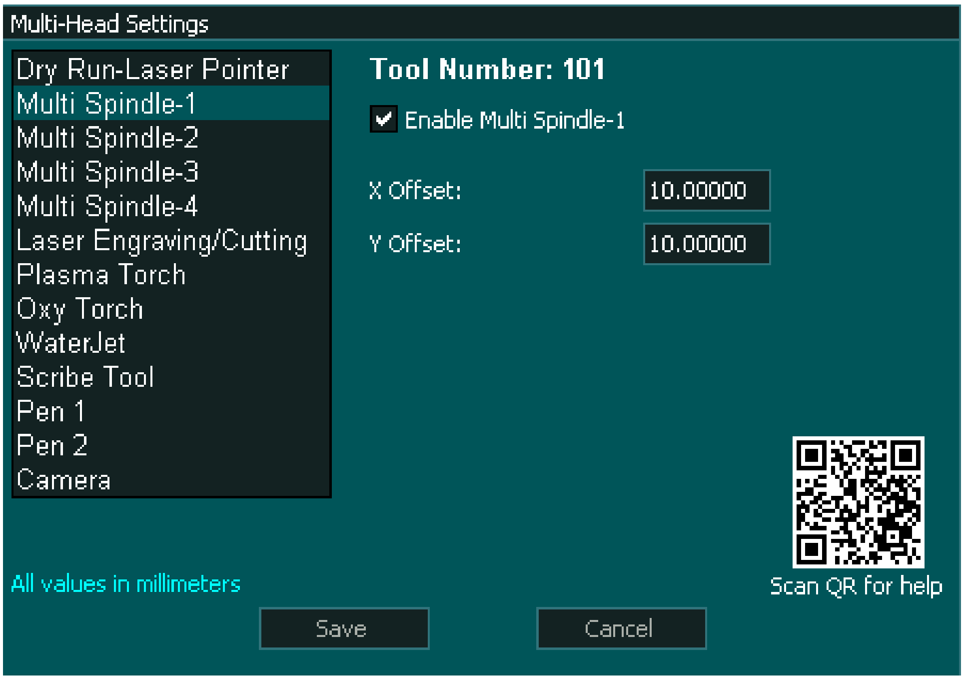
Each head is mounted to a common Z axis and is moved into position using the Up/Down signal for that head unit.

The move into position is usually done using a pneumatic cylinder.

Multi-head is not designed for machines that have individual Z axis drives

These are the features included in Multi-Head software

- Main spindle
- Dry Run Laser Pointer
- Laser engraver / cutter
- Plasma Torch
- Oxy Torch
- Water Jet
- Multi spindles 1 - 4 (Giving a total of 5 spindles)
- Scribe Tool
- Pen 1 & 2
- Camera



Changing between different heads is done using the Tool change command Txxx M06 where Txxx is the tool number found at the top of each multi-head settings page

- Dry Run Laser Pointer **Tool Number 0**
- Main spindle **Tool Numbers 1-100**
- Laser engraver / cutter **Tool Number 111**
- Multi spindles 1 - 4 **Tool Numbers101 - 104**
- Plasma Torch **Tool Number 112**

- Oxy Torch **Tool Number 113**
- Water Jet **Tool Number 114**
- Scribe Tool **Tool Number 115**
- Pen 1 & 2 **Tools Number 116 & 117**
- Camera **Tool Number 118**

13.2. Main Spindle

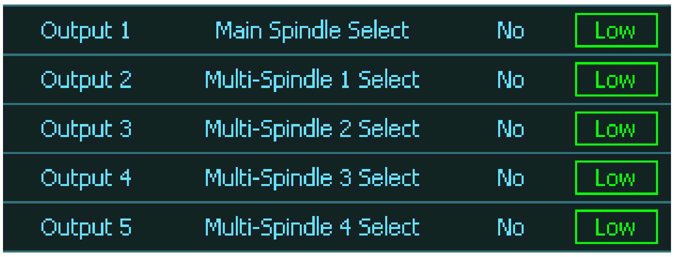
Main Spindle

- This is the Primary spindle on MASSO and is not included as part of the Multi-Head settings menu.
- This spindle is the main reference coordinate for the offset of the 4 Multi Spindles.
- The main spindle uses tools 1 to 100 and can be used with your tool changer.
- This spindle is configured under the F1 screen using the Main Spindle tab
- There is a Main spindle TTL output that can be configured when used with the Multi Spindles 1 to 4 but if this is the only Spindle installed it is not needed.

13.3. Multi Spindle 1 - 4

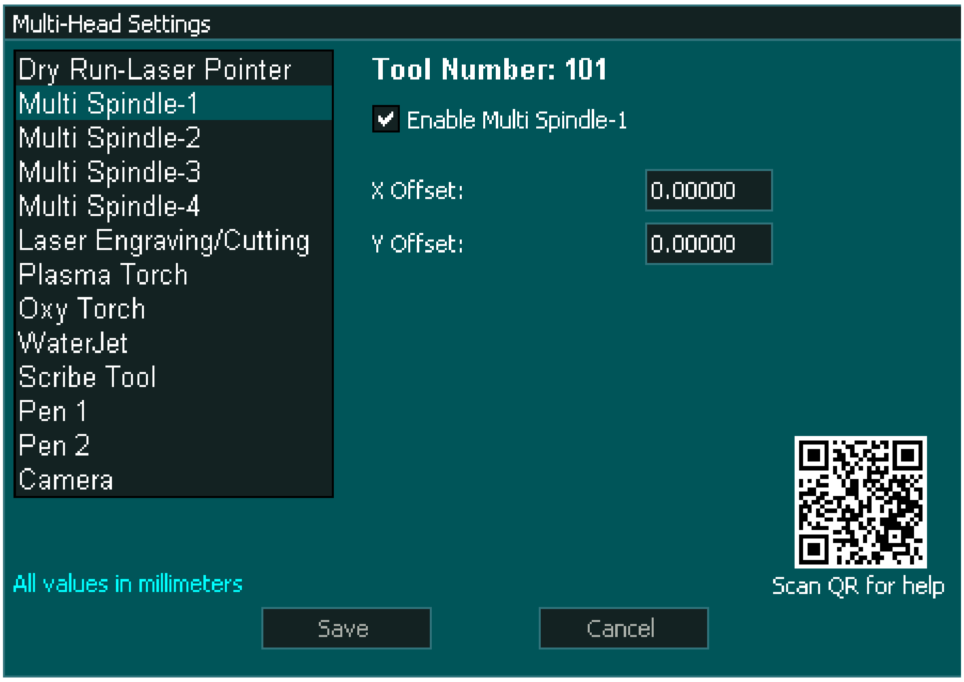
- Multi Spindle is an addon feature that can be purchased for your MASSO G3 or MASSO Touch.
- Tools 101 - 104
- Each head is mounted to a common Z axis and is moved into position using the Up/Down signal for that head unit.
- The move into position is usually done using a pneumatic cylinder.
- Multi-head Spindle is not designed for machines that have individual Z axis drives
- Multi Spindles 1 to 4 provide an additional 4 spindles to be added to the Z axis. This gives a total of 5 spindles that can be configured in MASSO
- Each spindle will be configured in the Mutli-Head Settings page and can be individually enabled or disabled as needed.
- Each Multi Spindle has defined X & Y offsets from the Main Spindle center point or some other suitable reference point of the users choosing.
- Each Multi Spindle has a dedicated tool number and a corresponding tool entry in the F4 Tools & Work Offsets table.
- Differences in Z axis Tool length is managed within MASSO F4 tool table however please be aware that your Gcode must include a move to a safe Z height before changing between spindles to ensure that the new tool does not contact the material when the spindle changes. See the special note for Multi-head users in the M06 Gcode command.
- Then tools 101 to 104 are selected using the M6 command instead of the main spindle selecting the tool, the dedicated spindle will be selected instead.
- Multi Spindle 1 - Tool 101
- Multi Spindle 2 - Tool 102
- Multi Spindle 3 - Tool 103

- Multi Spindle 4 - Tool 104
- A dedicated Spindle select is available for each spindle including the main and can be assigned to any MASSO TTL output. These are used to move the spindle into position or retract it when not needed. It also switches the Spindle control to the selected spindle.
- A spindle VFD Run status input is provided to monitor when the spindle is running and prevent it switching to a new spindle until it comes to a stop.



Multi Spindle Select Outputs

Spindle VFD Run status Input



Multi-Head Settings

Tool No	Slot No	Tool Name	Z Offset	Tool Diameter
101		Milti Spindle 1	0.00000	0.00000
102		Multi Spindle 2	0.00000	0.00000
103		Multi Spindle 3	0.00000	0.00000
104		Multi Spindle 4	0.00000	0.00000

F4 Tools & Work Offsets

Configuration

- Select Enable on each Multi Spindle that you want to use. Enable only the spindles you will be using.
- The main spindle is always used in a multi spindle setup and you can enable up to 5 spindles in total.
- Assign a TTL output for the Main Spindle select. 

- Assign a TTL output for Multi- Spindle select for each Spindle that you enable. 

- Assign an input as Spindle VFD Run Status. 

- Configure your VFD to output a signal when the VFD is running. All VFD's should have this option and can provide the output as either an Open Collector or as a relay output. Set the Spindle VFD Run status input to show logic Low when the VFD is idle and Logic High when the VFD is running. The VFD Run status input is provided to monitor when the spindle is running and prevent it switching to a new spindle until it comes to a stop.
- Under the Multi-head setting for each spindle you enable enter the X & Y offset value as referenced from the Main Spindle center point or some other suitable reference point of the users choosing.

> **INFORMATION:** When MASSO starts and homes MASSO will home the X,Y & Z axis with all Head units retracted. The Main spindle will then into position and touch off on the Auto Tool Zero if you have it enabled as part of the homing routine. With this complete the Main spindle will retract and the tool that was last loaded into position will be lowered into position.

Multi-Spindle Logic

- Gcode command issued eg. **T101 M6**
- When a Tool change command is issued MASSO will checks which spindle is required.
- Tools 1-100 will select the Main Spindle and if the spindle is an ATC spindle it will work with the tool changer in the normal manner.
- If the Tool selected is 101 to 104 then Multi-Spindle 1 to 4 is selected.
- Multi Spindle 1 - Tool 101
- Multi Spindle 2 - Tool 102
- Multi Spindle 3 - Tool 103
- Multi Spindle 4 - Tool 104
- MASSO checks to see the status of the **Spindle VFD Status Input** and will wait for it to go low before proceeding.
- Which ever spindle is selected the corresponding **Spindle Select output** will go High.
- If tool 101-104 is selected the spindle will not do an Auto Tool Zero touch off as these tools should be measured when initially installed using the F4 table.
- If tool 1-100 is selected the main spindle may do an Auto Tool Zero touch off if it is enabled in the F1 settings.

Wiring Multiple Spindles

Spindle Select output

Output 1	Main Spindle Select	No	Low
Output 2	Multi-Spindle 1 Select	No	Low
Output 3	Multi-Spindle 2 Select	No	Low
Output 4	Multi-Spindle 3 Select	No	Low
Output 5	Multi-Spindle 4 Select	No	Low

The Spindle Select output can be assigned to a spare TTL output.

This output is responsible for moving the selected spindle into position and retracting the spindle when it is no longer selected. This is normally done using Pneumatic cylinders. When the output is high the pneumatic cylinder pushed the spindle down into position and when the output goes low the cylinder retracts.

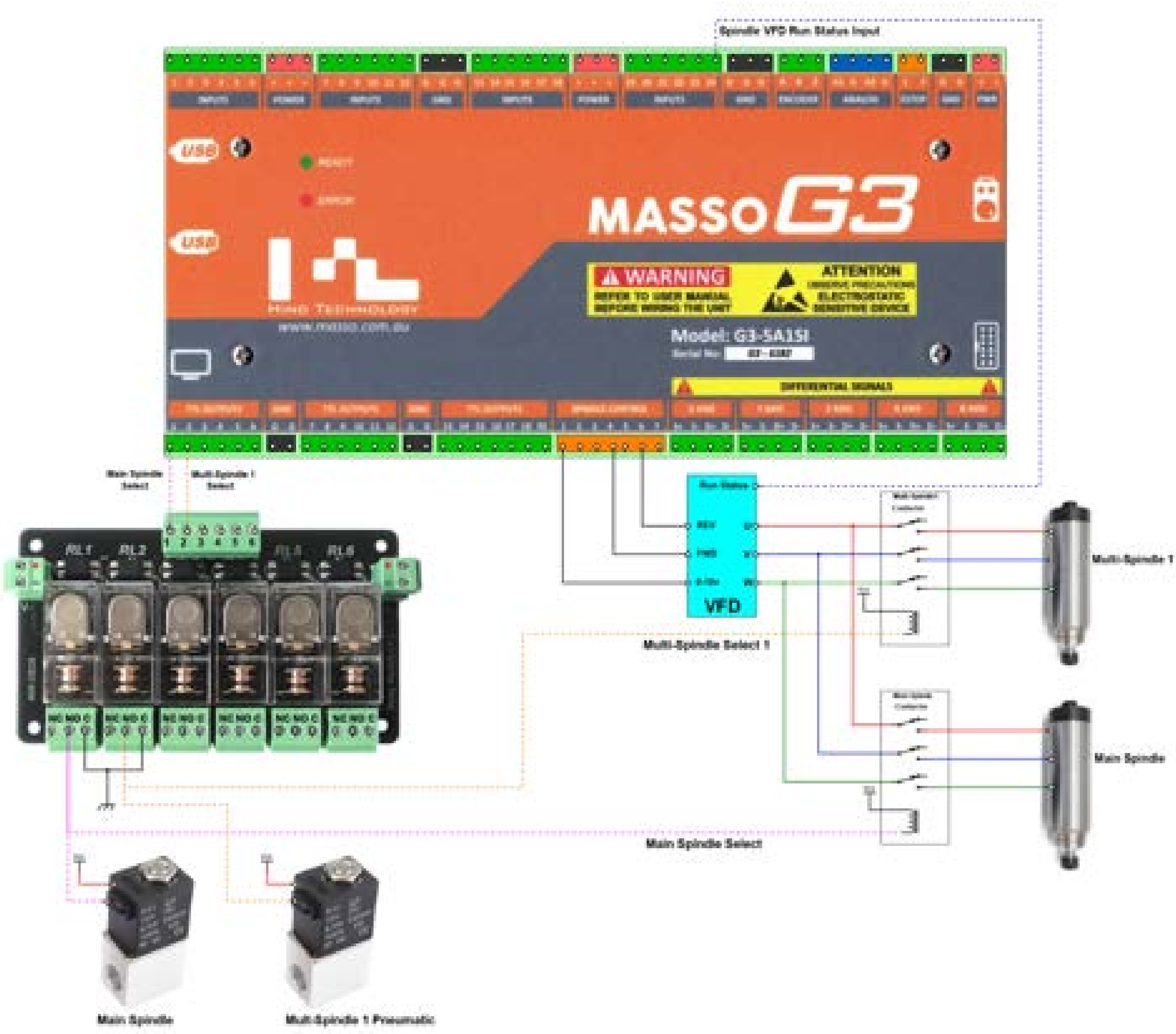
The output also directs the Spindle control to the required spindle. This can be done using 2 methods.

1. The Spindle control signals Speed, Forward & Reverse could be switched to the designated Spindle and each spindle would have it's own dedicated VFD.
2. The Machine has one VFD and the 3 Phase power is switched to the selected Spindle using a 3 Phase contactor relay unit.

> **WARNING:** When using a single VFD the **Spindle VFD Status Input** must be assigned and the VFD set to output the VFD status signal as switching loads on a running VFD may cause damage to the VFD and other equipment.

> **WARNING:** Extreme care is required when wiring a VFD. The example wiring below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your VFD and other hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.

Example wiring diagram



Setting Tool Z offset

To set the Z offset for the tool in your Multi-Spindle go to the F4 tool table and double click on the required tool 101 - 104

Multi Spindle 1 - Tool 101

Multi Spindle 2 - Tool 102

Multi Spindle 3 - Tool 103

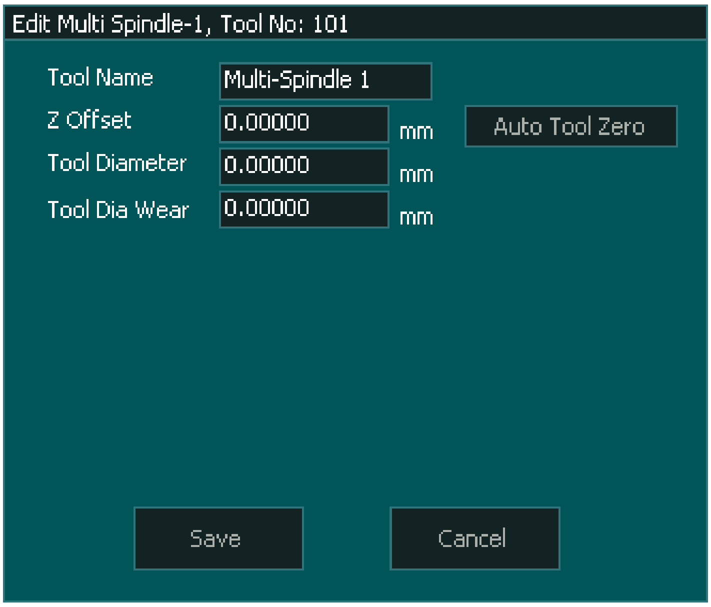
Multi Spindle 4 - Tool 104

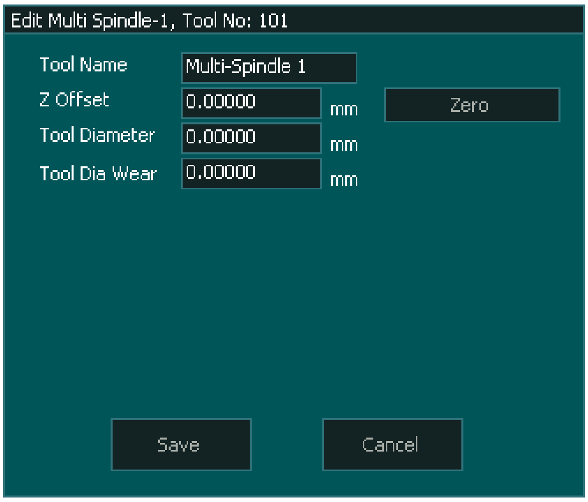
Press Auto Tool Zero and the tool in the spindle will be measured.

The tool does not need to be measured again unless you change the tool in the spindle.

If you do not have Auto tool zero set up or enabled on your machine you will not see the Auto Tool Zero option but a Zero Option instead. You will then need to manually zero the tool.

It is highly recommended that you set up and use Auto Tool zero for measuring tool lengths.



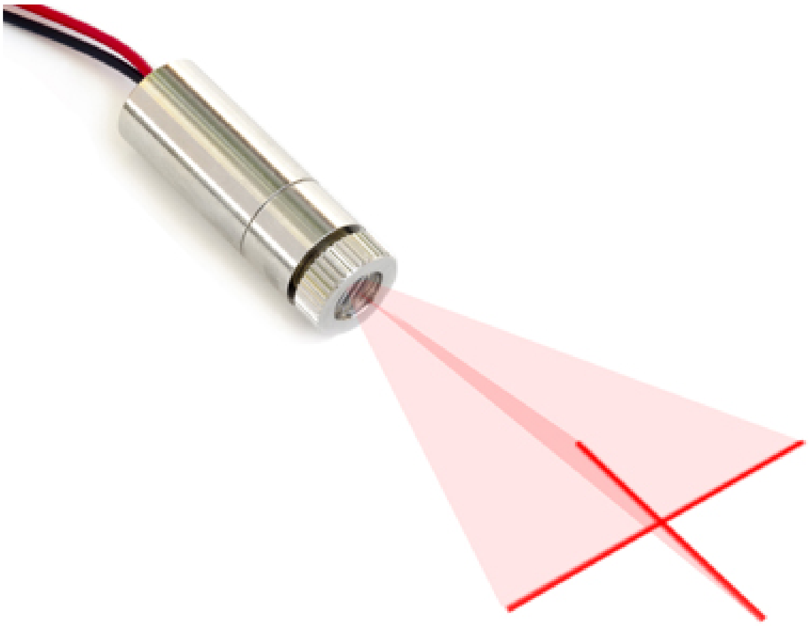


Measure tool Length

Please Note that as each of the Multi-Spindle tools are of fixed length and were measured when the tool was installed MASSO excludes these from using Auto Tool Zero on a tool change.

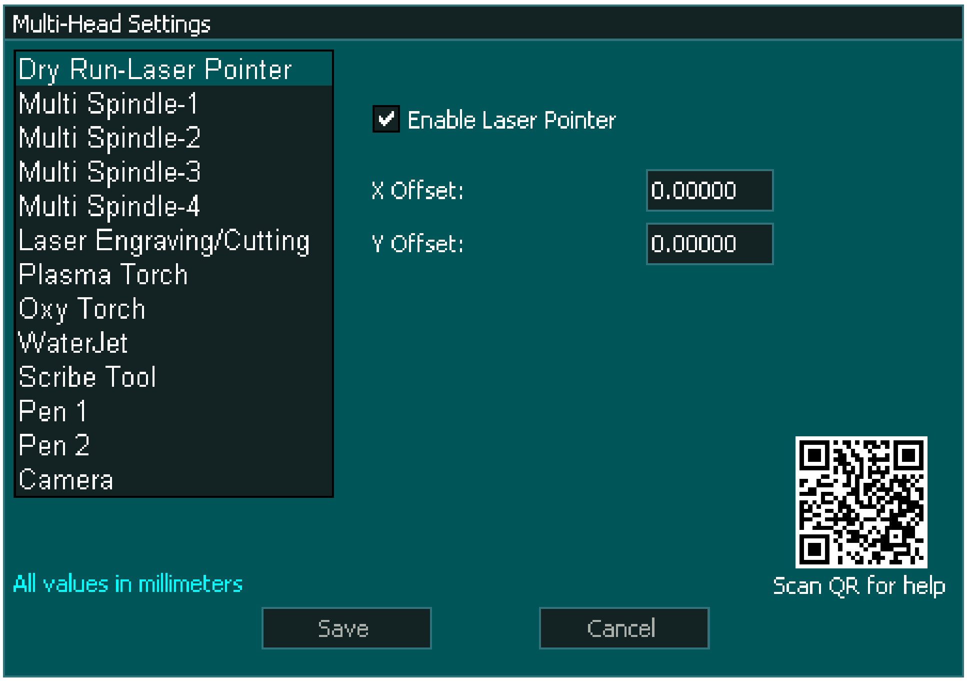
The Mains spindle will continue to use Auto Tool Zero in the normal manner if enabled.

13.4. Dry Run Laser Pointer



- Tool 0
- The laser pointer tool is used to provide a reference point to zero your X & Y axis.
- Selecting a point on your stock and zeroing your X & Y coordinates will automatically transfer them to the other spindles on your machine.
- The Dry Run laser pointer can be used to do a dry run of your machined part to ensure that it will fit on your stock.
- While performing a Dry run of your Gcode file it will ignore Coolant on / off Gcodes as well as tool changes and changes in Z axis height.
- A TTL output can be assigned to turn the laser pointer on and off and will automatically turn on when the Laser pointer is selected. This can be done using a MASSO relay module if needed.

Laser pointer Output



Multi-Head Settings

INFORMATION: To exit Dry run mode you must press the Dry Run Button 

and the laser will turn off and you will return to the previous tool. You can not exit dry run by changing to a different tool as Dry Run ignore tool change requests.

The Dry Run Laser pointer

- The Laser for this is a small low power laser typically 5mW or less and may be a spot or cross hair as required. In general the lower power the laser is the easier it is on the eyes to view however this must be balanced with ambient light levels.

Connection and configuration

- Configure a TTL output as a Laser Pointer On/Off 

- Wire as per the diagram below. Ensure that you provide the correct voltage to your Laser or you will damage it.
- Enter the X & Y Offset value from your main tool that you will be using as a reference for the

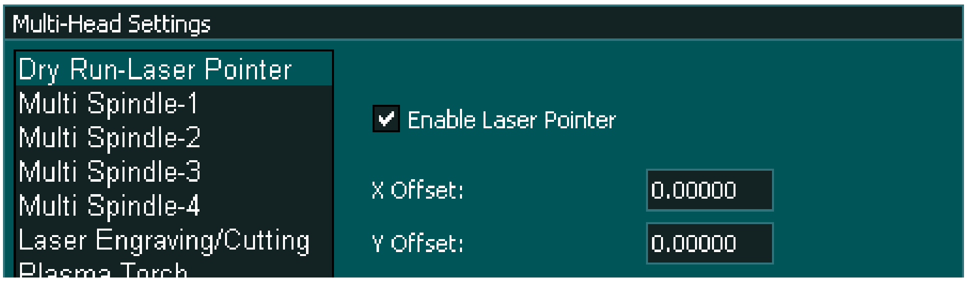
machine. This is usually the Main Spindle, Plasma head or WaterJet head.
- All Multi-head offsets must reference from the same Head.

Laser Alignment

- The Dry run laser can be mounted to either the Z or X axis.
- If the Laser is mounted on the Z axis the Laser must be aligned so that it's position does not change when the Z axis is raised and lowered.
- To align the Laser, mark a spot on the table and them raise and lower the Z axis and if the laser point moves with respect to the reference point move the laser in it's mount to bring back into alignment. This alignment needs to be done in both the X & Y axis and at completion of the alignment process the laser point will remain pointing at the reference mark over the entire Z axis range of movement
- If the laser is mounted on the X axis it must also be aligned in the X & Y axis to ensure that as the material height changes the laser points at the same spot.

Calibrate a Dry Run Laser to the Main Head

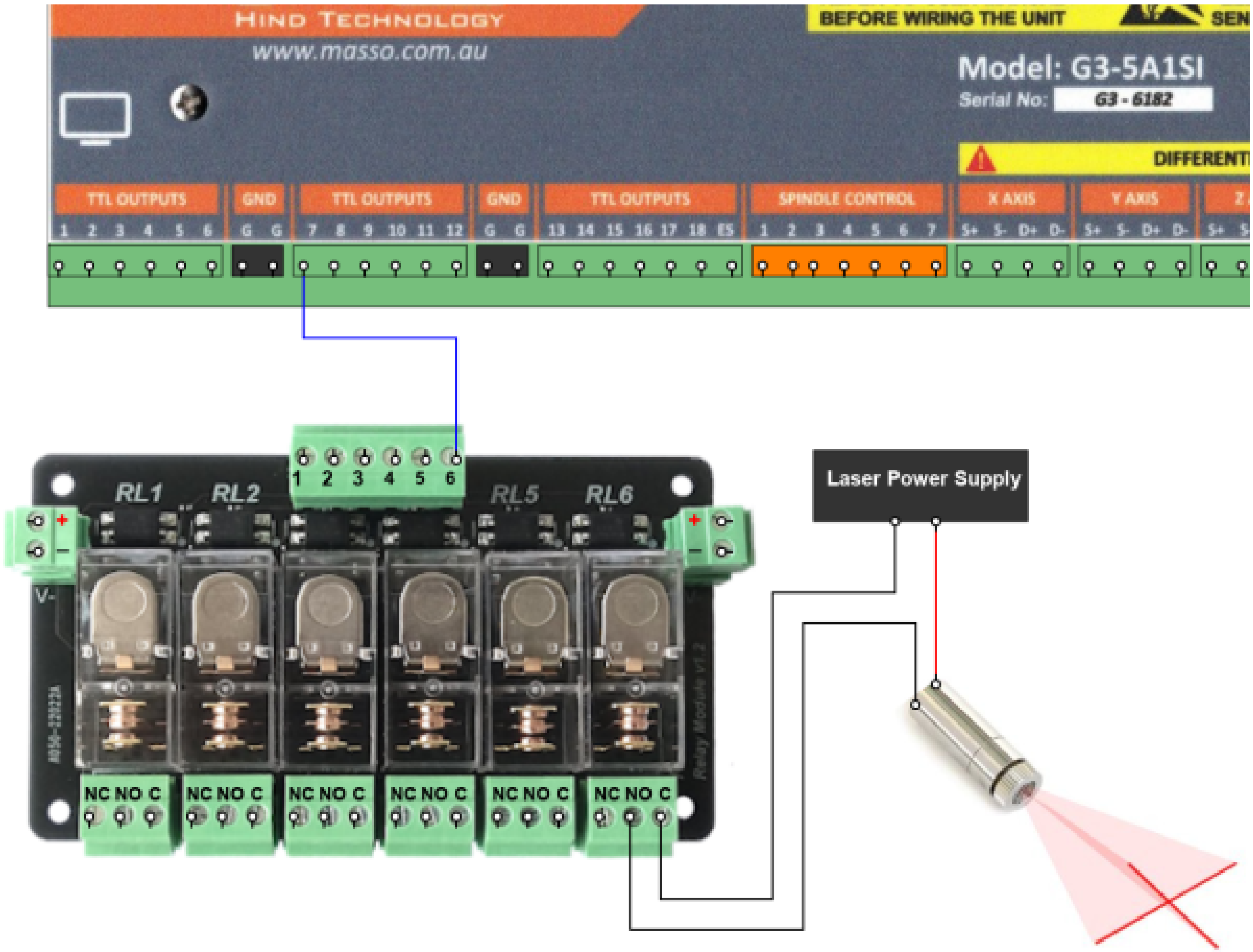
- All Multi-head offsets must reference from the same Head. This is the Main Head Eg spindle on a Mill
- Ensure the head that you are calibrating to the main head has it's offsets in the Multi-head settings page set to 0



- Home your machine.
- Ensure the current tool is your main head and if not change to it using MDI eg T1 M06
- Make a small reference mark using the main head tool. In case of a spindle a V-bit can be used to make a well defined reference mark.
- Zero the X & Y axis DRO
- Change to Dry run Laser by going to MDI and pressing the  button
- Jog the Laser pointer to the reference mark made by the main head and align.
- Read the X & Y axis DRO values and enter these values into the X & Y offset for the Dry Run Laser.
- The DRO readings will now show 0 on both the X & Y axis DRO if the correct values have been entered.
- If the values you enter doubles the DRO reading instead if making it 0, change it to a positive or negative value. eg 106.753 would become -106.753 and visa versa
- Exit Dry Run laser by pressing the MDI  button
- Your Dry Run Laser is now calibrated.

Example wiring diagram

WARNING: The example below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your selected hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.



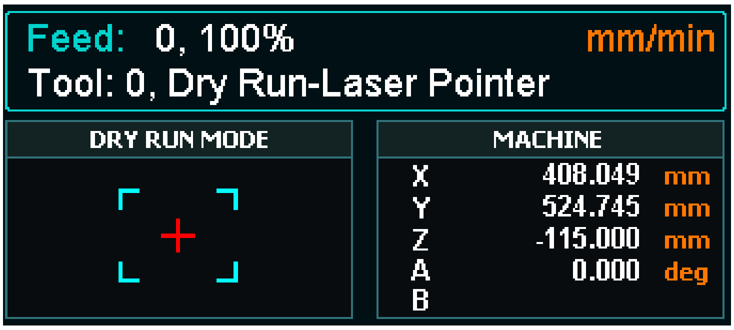
Using the Dry Run Laser Pointer

- In MDI select Dry Run 

This will Automatically turn the Laser on and put MASSO into Dry Run mode.
- While in Dry Run Mode the Dry Run Mode icon will flash on screen. 
- While in Dry Run Mode the Spindle or Plasma torch will not start, The coolant will not turn on and the Z axis will not move under Gcode control. This includes probing cycles.
- You can use the laser to Zero your X & Y axis if desired. When you leave Dry Run mode the coordinates will be offset with respect to the new selected tool.
- You can load your Gcode file in Dry Run if you have not already done so.
- Run you Gcode File as required. The laser will show the how the tool path will go when you machine the part.
- To Exit dry Run Mode Press the Dry Run Button 

and the laser will turn off and you will return to the previous tool.
- You cannot exit Dry Run mode by changing to a different tool as it ignores tool change requests.

- There are no dedicated buttons on the F2 Screen associated with this tool.



Dry Run without a Laser

Dry Run can be used without a laser pointer.

If you are not using a laser leave the X & Y axis offsets set to 0 in the Multi-Head Dry Run Laser pointer setup screen.

This will move your spindle, Plasma torch or other head around the table indication the cutting path.

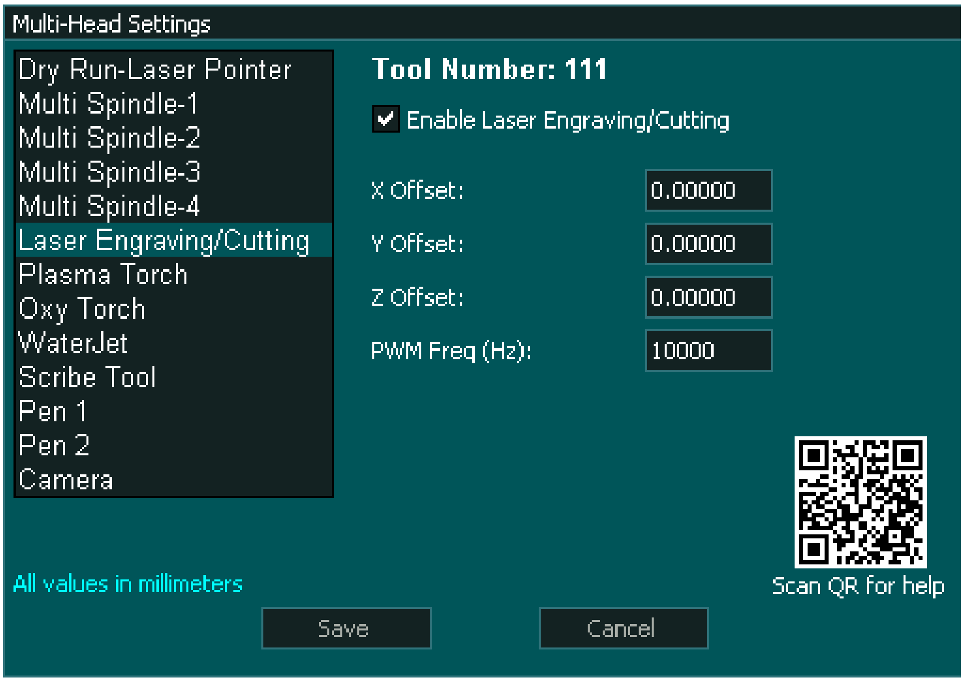
The Z axis will not move while under Gcode control.

13.5. Laser Engraving/Cutting

- Tool 111
- To change to Laser issue a **T111 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- This Laser is used for engraving and cutting and requires to be used with a laser capable of being connected to a TTL output.
- Each head is mounted to a common Z axis and is moved into position using the Up/Down signal for that head unit if needed.
- The move into position is usually done using a pneumatic cylinder.
- It's intensity is controlled by PWM
- PWM is controlled by the S command when if Laser mode.
- PWM Frequency can be set between 4Khz and 60Khz as required.
- The X, Y & Z offset relative to the main spindle can be entered in the Multi-Head Setting page
- A dedicated PWM output is provided on MASSO output 11 and must be configured as Laser Engraving/Cutting. No other output can be used for PWM output.
- An output is provided to move the Laser head into position or can be used to enable / disable the laser for additional safety. (Laser-up/Down)
- An air assist output is provided turned on and off using M8 / M9 Gcode commands.

Output 11	Laser-Engraving (PWM)	No	Low
Output 12	Laser-Up/Down	No	Low
Output 13	Laser-Air Assist	No	Low

Assigning Laser outputs



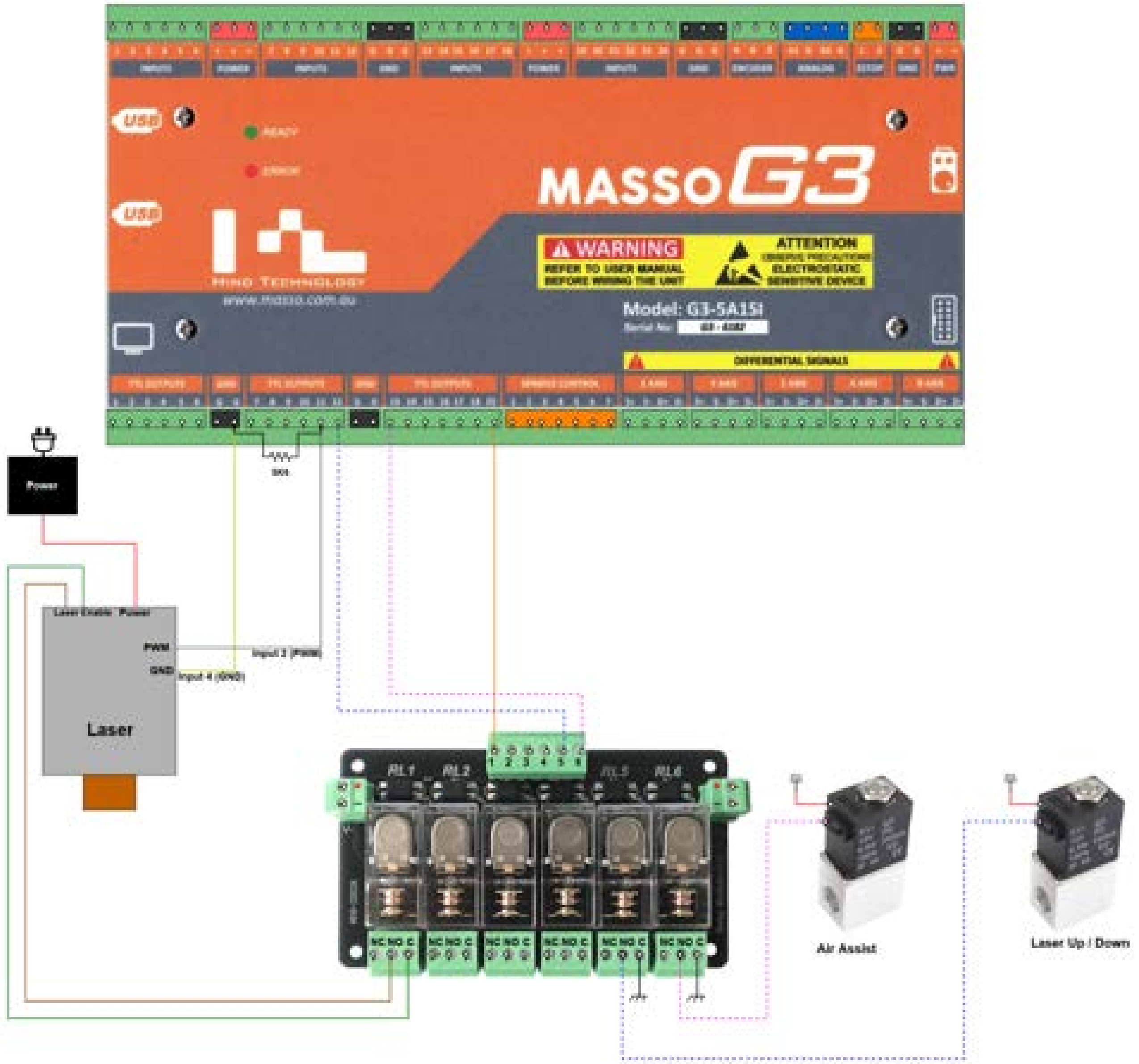
Multi-Head Setting

Installing and set up a Laser on MASSO

Information on installing and setting up a Laser on MASSO can be found here: [Quick start guides laser engraving cutting]

Generic Laser Setup

> **WARNING:** The example below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your selected hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.


MASSO G3
WARNING
REFER TO USER MANUAL BEFORE WIRING THE UNIT
ATTENTION
ELECTROSTATIC SENSITIVE DEVICE
Model: G3-5A1SI
DIFFERENTIAL SIGNALS
Power
Laser Enable
PWM
GND
Input 2 (PWM)
Input 4 (GND)
Laser
RL1
RL2
RL5
RL6
NC NO C
Air Assist
Laser Up / Down

13.6. Plasma Torch and MASSO DTHC

Plasma Torch can be used with and without the MASSO DTHC.

- Tool 112
- To change Plasma issue a **T112 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- This integrates Plasma and Mill into the same software so that a user with a dual machine does not need to switch between software to use one or the other.
- The X, Y & Z offset relative to the main spindle can be entered in the Multi-Head Setting page
- A Torch Touch offset is provided to account for the activation distance required to trigger a touch switch.
- Ohmic and touch switch can be used for setting the Plasma torch height.
- Plasma Up/Down is provided to move the Plasma torch into position if this is a multi head machine. eg Plasma and spindle.
- A Plasma On/Off is provided to turn the Plasma Arc on and Off.
- A piercing count is recorded on the F2 screen to allow the user to keep track of wear on consumables. This value is retained in memory when power is turned off.
- The Plasma Torch can be used without a THC if it is not required.
- THC support will be provided via the MASSO DTHC module and older Up / Down THC units.
- The MASSO DTHC module has been developed to work exclusively with and integrate into the Plasma Torch Multi-Head software.
- For more information on the DTHC please see MASSO_DTHC
- For more information on setting up legacy THC's please Click Here
- A dedicated input is provided on MASSO input 9 for the MASSO DTHC Input. No other input can be used for the MASSO DTHC input.
- A new Gcode **G200** has been introduced to work with Plasma and is an integral part of the MASSO

DTHC Module but will also be used with legacy THC's as well.

Input 9	Plasma-MASSO DTHC	No	Low

Assigning MASSO DTHC Input

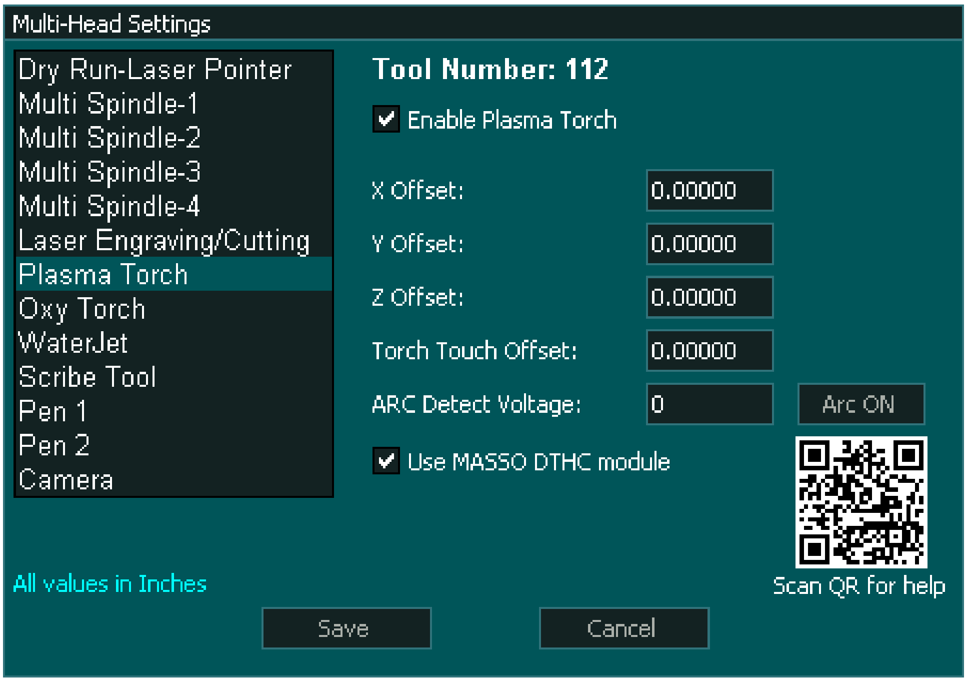
> **INFORMATION:** The normal state of the Plasma-MASSO DTHC input when working and idle is constant change between High and Low. If the input shows a constant Low state please check your connection.

Input 6	Plasma-Ohmic	Yes	Low
Input 7	Plasma-Touch	No	Low
Input 8	Plasma-Torch Breakaway	Yes	Low
Input 9	Plasma-MASSO DTHC	No	Low

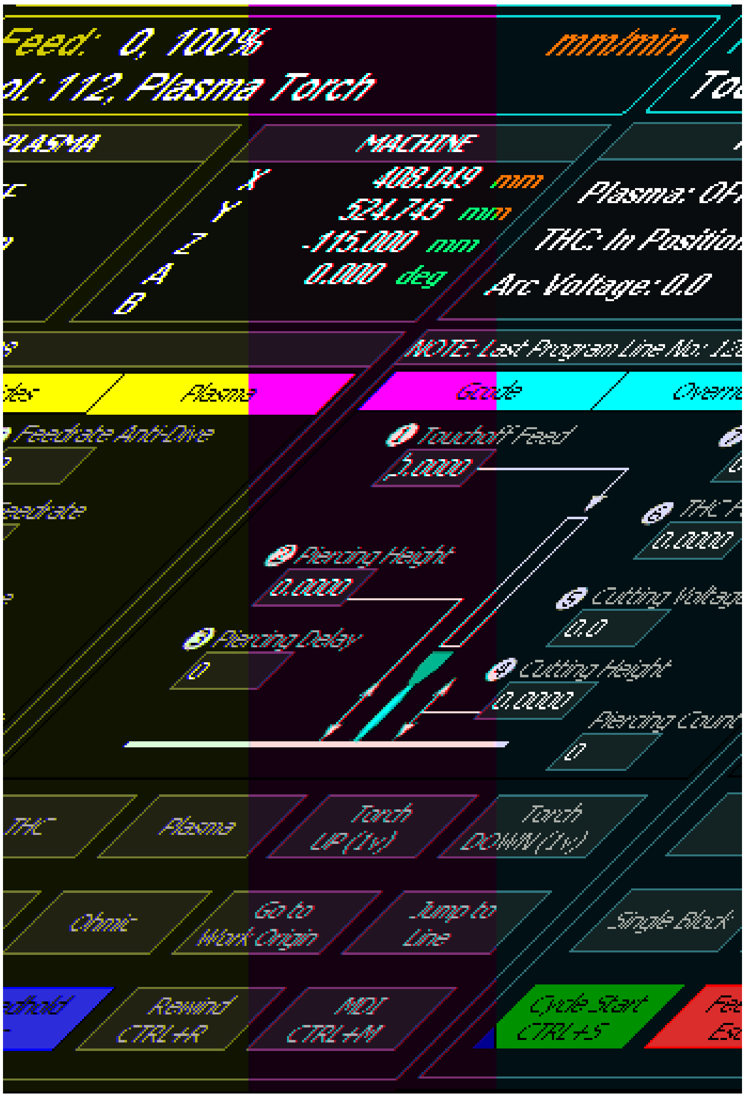
Assigning Plasma Inputs

Output 8	Plasma-On/Off	No	Low
Output 9	Plasma-Up/Down	No	Low

Assigning Plasma Outputs



Multi-Head Setting

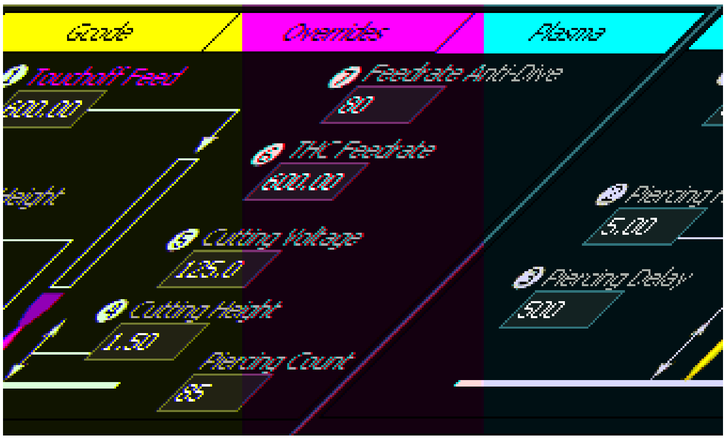


F2 Screen

- 7 Parameters are provided on the F2 Plasma tab to allow easy adjustment of the Plasma torch while it is cutting.
- Each parameter box can be clicked on and a new value entered into the box.
- Touch off and Piercing is automated in MASSO Plasma and will occur on each M3 command before moving to the cutting height and these are controlled by parameters 1 to 4
- The THC voltage can be set directly on MASSO and changed either by entering a new value or using the Torch Up / Down buttons on screen which will change the voltage by 1 volt.
- The THC feed rate can be adjusted as needed and this adjusts the speed of the Z axis when under THC control.
- Feed rate Anti dive is a percentage of the X Y axis feed rate and should it fall below this value the Z axis will lock when under THC control to prevent the torch falling and touching the material.
- Parameters 1,2,3,4,5 & 7 can be set as part of the Gcode file. Gcode command G200
- Parameter 6 is set using Gcode command M667

1. Touch off Feedrate
2. Piercing Height

3. Piercing Delay
4. Cutting Height
5. Cutting Voltage
6. THC Feedrate
7. Feedrate Antidive



Configuration

- Enable Plasma Torch in the Multi-head screen.
- Assign an input for Plasma-Ohmic id using Ohmic touch. 

- Assign an input for Plasma Touch is using a touch switch. 

- Assign an input for Plasma-Torch Breakaway. 

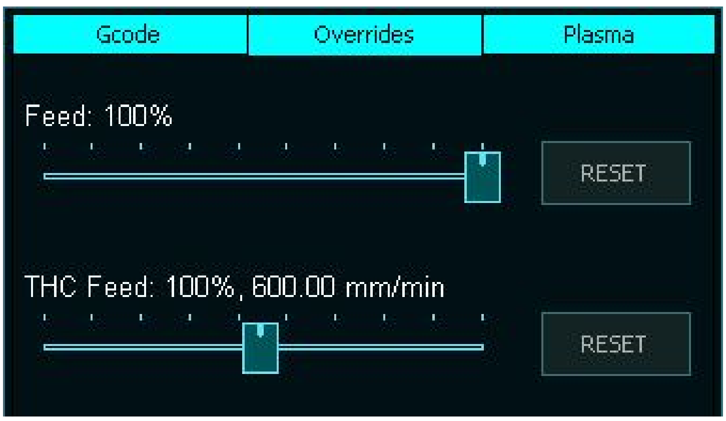
- Assign an input for Plasma-MASSO THC is using a THC. 

- Enter the X, Y and Z axis offset from the reference tool into the Plasma Torch Multi-Head setting screen. This could be the offset from the Main spindle if using one but if this is a stand alone Plasma machine them leave these values at 0
- Enter the Torch Touch Offset value if using a Plasma touch with a built in switch.
- Assign a Plasma output for Plasma-Torch On/Off. 

- Assign a Plasma-UP/Down if your Torch needs to be moved into position. 

Plasma Logic

- Gcode command issued eg. **T112 M6**
- The Plasma-Up/Down output goes high to move the Torch in to position. This is not needed is the Plasma torch is the primary head and does not need to move.
- When the Gcode file is loaded it will populate the cutting parameters into the Plasma tab
- The **M3** command will start the Plasma torch will automatically touch off on the material, then move to the piercing height, Start the Arc, wait the time specified in the Piercing Delay and then move to the specified cutting height.
- Piercing count is incremented to allow the user to track the wear on the consumable.
- MASSO will then proceed with the Gcode file.
- If the is a MASSO THC installed, when the THC is turned on using **M667 F???** the THC will assume control of the Z axis height and it will use the Cutting Voltage specified to keep a constant height above the material.
- If the X,Y Feed rate falls below the amount specified in the Anti-Dive value the Z axis will lock to prevent the Z axis crashing into the material and will resume once the feed rate returns to a valid speed.
- **M666** will turn off the THC
- Parameters 1-7 can be adjusted in the Plasma Tab by selecting the box and typing in a new value. This can be done while machining is in progress to fine tune the cutting.
- Torch up and down buttons are provided on the F2 screen to allow fine tuning to the torch height. This will adjust the cutting voltage by + or - 1 volt.
- M5 will turn off the Plasma Arc.
- Changing to a new tool will cancel Plasma mode.
- The Plasma-Up/Down output goes Low to move the Torch in to the up position.
- A THC feed rate Override is provided under the Override tab and can be adjust the THC feedrate in real time



THC feed rate override

Installing and setting up MASSO DTHC

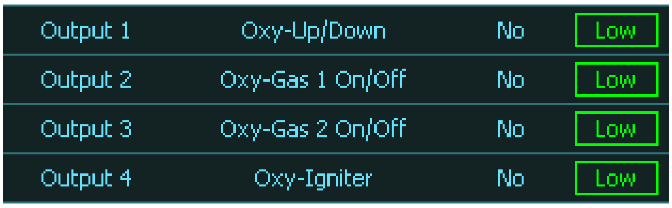
Information on installing and setting up the MASSO DTHC can be found here

Information: Older up/ down THC units can be used with the new Multihead software. Arc OK, THC Up and THC Down can be assigned as shown in the Proma THC 150 section of the documentation.

13.7. OXY Torch

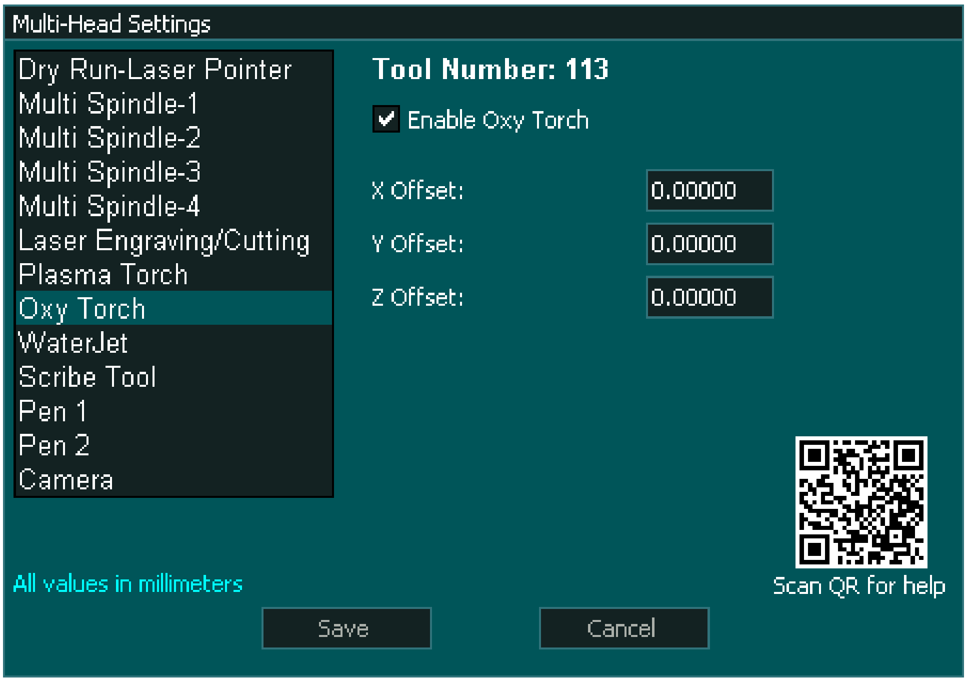
> **INFORMATION:** This feature is still in development and cannot be used at this time.

- Tool 113
- To change to Oxy issue a **T113 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- Oxy torch allows MASSO to work with a oxy torch setup.
- The X, Y & Z offset relative to the Plasma torch can be entered in the Multi-Head Setting page
- Outputs have been provided to allow control of the Gases, Torch up and down as well as ignition which can be assigned to any of the MASSO TTL outputs.
- An input to monitor the Oxy-Flame Out input has ben provided and can be assigned to any of the MASSO inputs. This will turn off the Gases if a flameout is detected.

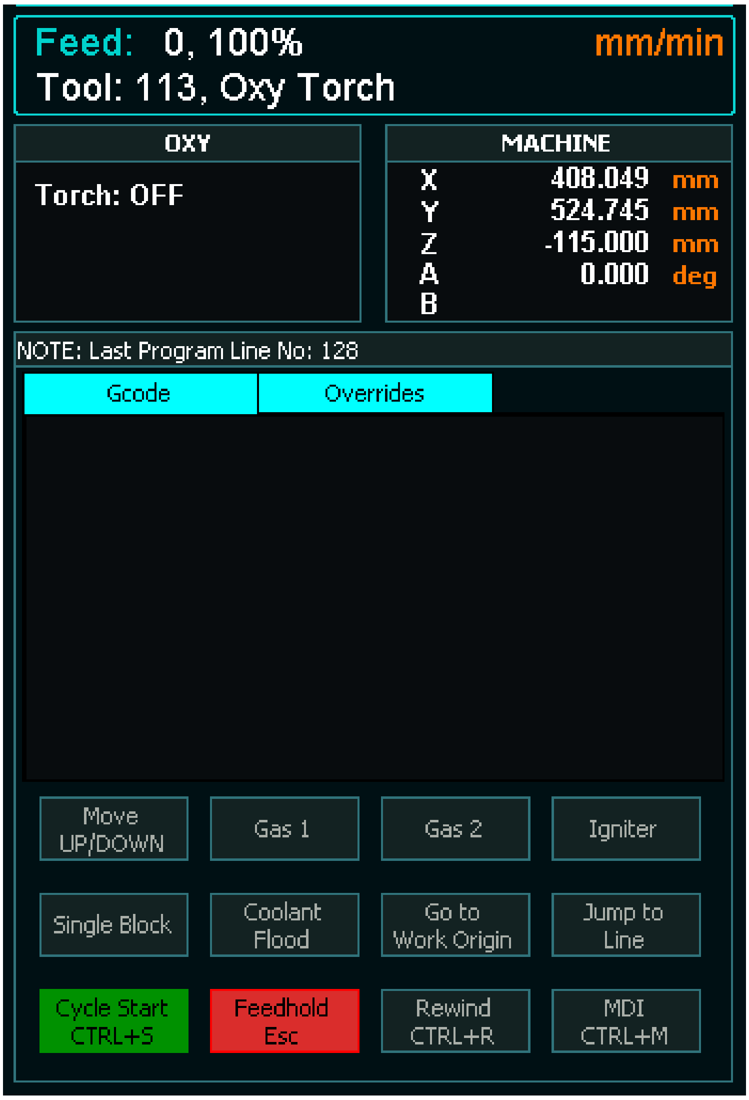


Assigning Oxy outputs

Assigning Oxy Input



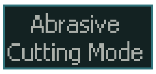
Multi-Head Setting

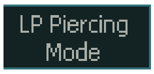

Feed: 0, 100%
mm/min
Tool: 113, Oxy Torch
OXY
Torch: OFF
MACHINE
X 408.049 mm
Y 524.745 mm
Z -115.000 mm
A 0.000 deg
B
NOTE: Last Program Line No: 128
Gcode
Overrides
Move UP/DOWN
Gas 1
Gas 2
Igniter
Single Block
Coolant Flood
Go to Work Origin
Jump to Line
Cycle Start CTRL+S
Feedhold Esc
Rewind CTRL+R
MDI CTRL+M

F2 Screen

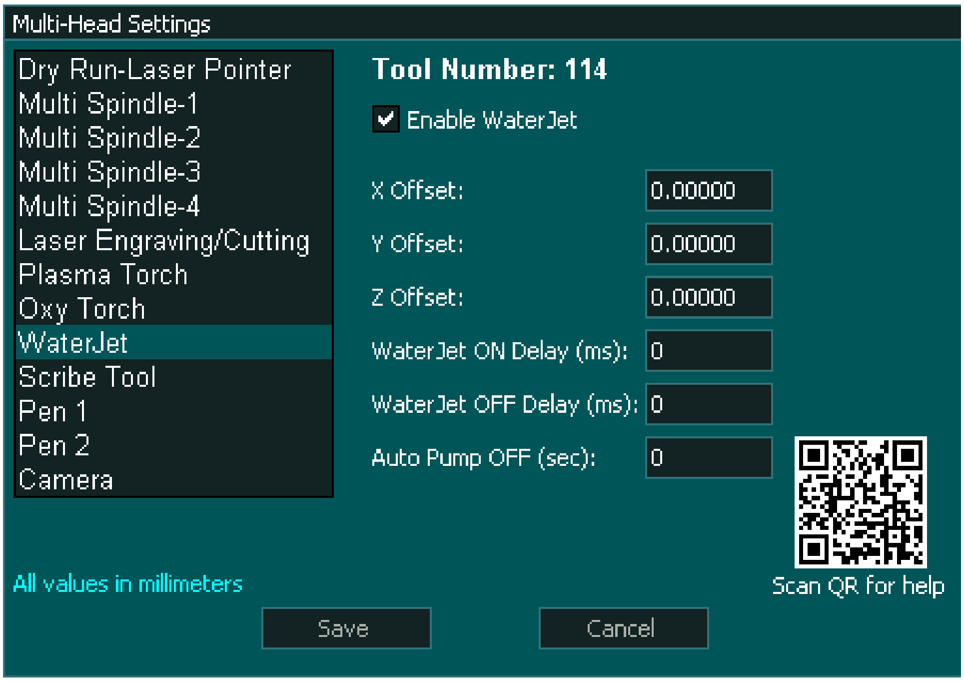
13.8. WaterJet

> **WARNING:** When using waterjet ensure that Auto Spindle Start is disabled in the F1 / Main Spindle settings screen.

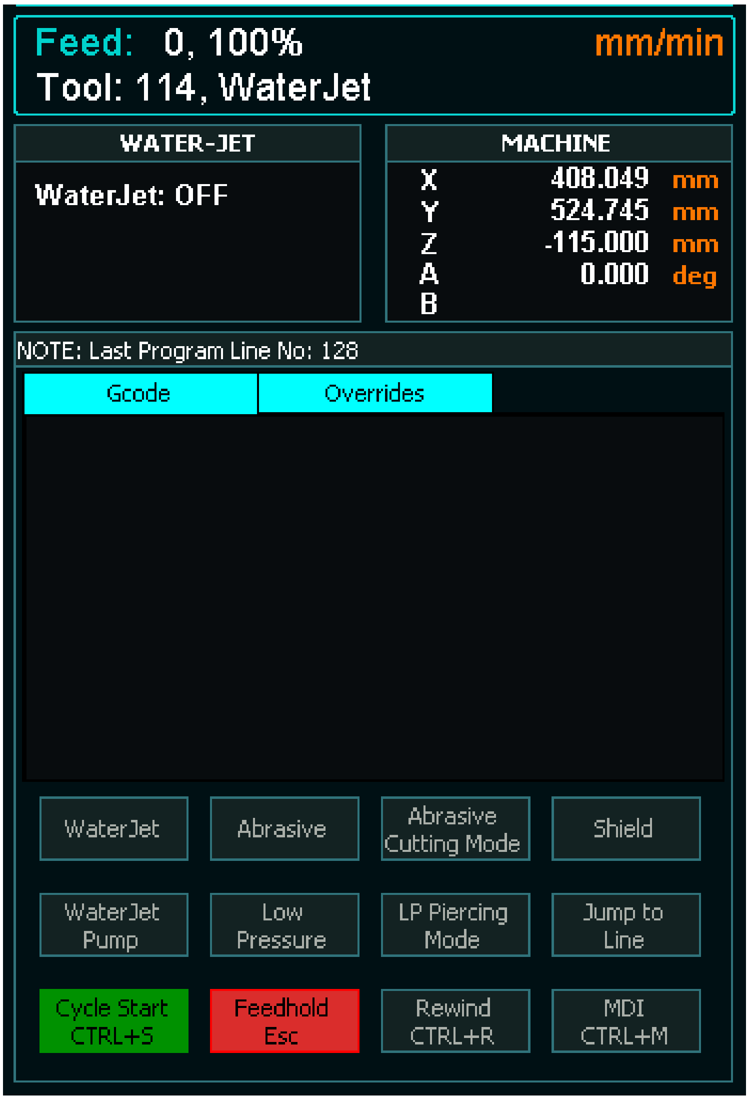
- Tool 114
- To change to Waterjet issue a **T114 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- The X, Y & Z offset relative to another head can be entered in the Multi-Head Setting page
- M03 Starts the WaterJet.
- M05 Stops the WaterJet
- There are no other GCodes associated with the WaterJet. The manner of operation is selected by use of the on screen mode buttons 

and 

- A range of WaterJet related inputs and outputs have been provided and these can be assigned to one of the inputs or TTLs outputs on MASSO as needed.



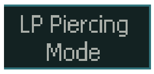
Multi-Head Setting



F2 Screen

Cutting Modes

Cut modes are selected manually from the F2 screen using the 

and 

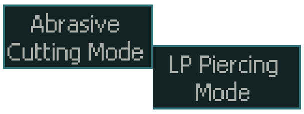
buttons

WaterJet has 3 cutting modes

- Water Only
- Abrasive Cutting
- Abrasive Cutting with LP Piercing

Water Only Mode

In this mode no abrasive is used.

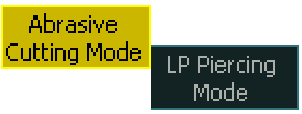


Logic

- Cycle Start to run Gcode file
- M03
- Waterjet on/off changes to High to turn on
- MASSO waits for the Waterjet Cut sense input to change to High
- Motion / Cutting from Gcode file
- M05
- Waterjet on/off changes to Low to turn off
- End

Abrasive cutting Mode

In this mode cutting is done with water and abrasive



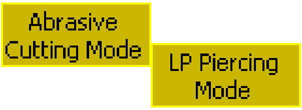
Logic

- Cycle Start to run Gcode file
- M03
- WaterJet abrasive on/off changes to High to turn on the abrasive
- MASSO waits for the WaterJet On Delay time 

- Waterjet on/off changes to High to turn on
- MASSO waits for the Waterjet Cut sense input to change to High
- Motion / Cutting from Gcode file
- M05
- WaterJet abrasive on/off changes to Low to turn off the abrasive
- Waterjet on/off changes to Low to turn off
- End

Abrasive Cutting Mode with Low Pressure Piercing

In this mode cutting is done with water and abrasive but the initial piercing is done under low pressure.



Logic

- Cycle Start to run Gcode file
- M03
- WaterJet Low Pressure on/off changes to High to enable low pressure during piercing
- WaterJet abrasive on/off changes to High to turn on the abrasive
- MASSO waits for the WaterJet ON Delay time 

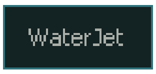
- Waterjet on/off changes to High to turn on
- MASSO waits for the Waterjet Cut sense input to change to High
- WaterJet Low Pressure on/off changes to Low to allow full pressure during cutting
- Motion / Cutting from Gcode file
- M05
- WaterJet abrasive on/off changes to Low to turn off the abrasive
- WaterJet Low Pressure on/off changes to High to enable high pressure bleed off.
- MASSO waits for the WaterJet OFF Delay time 

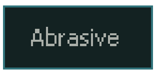
- Waterjet on/off changes to Low to turn off
- End

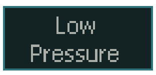
On Screen Buttons

These in on screen buttons display current status and turn Yellow when active.

Pressing these buttons toggles the status between on and off.

- 

WaterJet - on/off
- 

Waterjet - Abrasive on/off
- 

Waterjet - Low Pressure on/off

- **WaterJet Pump** WaterJet - Pump on/off
- **Shield** WaterJet - Shield on/off raises and lowers the shield manually as needed
- **Abrasive Cutting Mode** This places the Waterjet into Abrasive cutting mode
- **LP Piercing Mode** This enables Low Pressure Piercing mode
- **Air** WaterJet - Air On/Off and is available only on the MDI screen
- **Water** WaterJet - Tap Water On/Off and is available only on the MDI Screen

Inputs

Input 13	WaterJet-Cut Sense	No	Low
Input 14	WaterJet-Head Breakaway	No	Low
Input 15	WaterJet-Air Pressure Low	No	Low
Input 16	WaterJet-Water Pressure Low	No	Low
Input 17	WaterJet-Abrasive Low	No	Low
Input 18	WaterJet-Abrasive Metering	No	Low

WaterJet - Cut Sense

Monitors feedback from the Cutting Valve - Active High

If the Cut Sense input does not change to High within 5 seconds of the water jet starting or it changes to Low during the cut a Cut Sense alarm will result and the machine will stop.

If you do not have this input, do not assign it and MASSO will ignore and start cutting immediately after the WaterJet On Delay timer expires.

WaterJet - Head Breakaway

If the cutting head runs into material or comes loose this input goes High and stops the machine triggers an alarm.

WaterJet - Air Pressure Low

This input is for future development and is currently not used.

WaterJet - Water pressure Low

This input monitors the water pressure and if the input goes High it triggers an alarm.

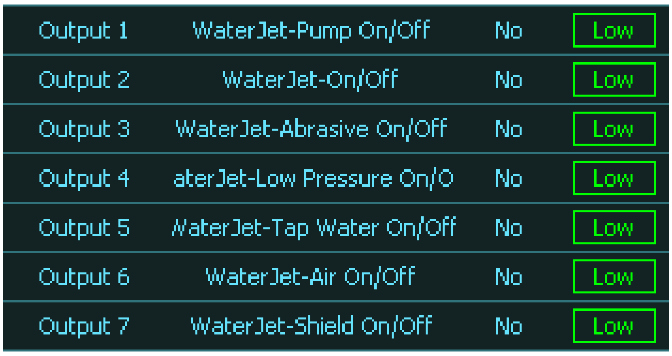
WaterJet - Abrasive Low

This input monitors abrasive levels and if the input goes High it triggers an alarm.

WaterJet - Abrasive Metering

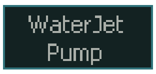
This input monitors the abrasive and if the input goes High it triggers an alarm.

Outputs



Output 1	WaterJet-Pump On/Off	No	Low
Output 2	WaterJet-On/Off	No	Low
Output 3	WaterJet-Abrasive On/Off	No	Low
Output 4	aterJet-Low Pressure On/O	No	Low
Output 5	WaterJet-Tap Water On/Off	No	Low
Output 6	WaterJet-Air On/Off	No	Low
Output 7	WaterJet-Shield On/Off	No	Low

WaterJet - Pump On/Off

This output is used to turn the Main WaterJet Pump on and off and is controlled via the 

button on the F2 screen.

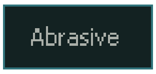
WaterJet - On/Off

v5.79 - 11 December, 2023

This output turns opens the waterjet valve for cutting. It is controlled via the M3 command or by using the button on the F2 screen.

WaterJet - Abrasive On/Off

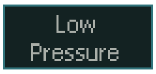
This output turns on and off the abrasive and is active when Abrasive Cutting Mode is selected. 

It can also be manually turned on and off using the 

button on the F2 Screen

WaterJet - Low Pressure On/Off

This output turns on and off the Low Pressure and is active when LP Peircing Mode is selected. 

It can also be manually turned on and off using the 

button on the F2 Screen

It is used to perform High Pressure Bleed off and Low Pressure Piercing.

WaterJet - Tap Water On/Off

This output is used to top up the water tank as needed.

It is turned on and off manually using the 

button on the MDI screen. **CTRL+M**

WaterJet - Air On/Off

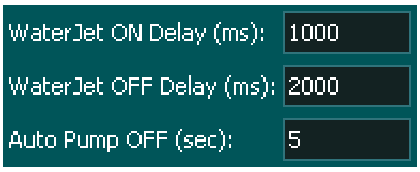
This output is used to turn on an air solenoid as required.

It is turned on and off manually using the 

button on the MDI screen. **CTRL+M**

Timers

These timers are found on the WaterJet Multi-Head Settings screen



WaterJet ON Delay (ms):

This timer defines the time delay needed to allow the machine to configure itself for Low pressure and Abrasive modes

This timer is defines in milliseconds.

WaterJet OFF Delay (ms):

This timer defines the time delay is used at the end of the cutting cycle after turning off the Low Pressure for High Pressure Bleed off before turning off the Waterjet.

This timer is defined in milliseconds.

Auto Pump OFF(sec)

This timer will automatically turn off the Pump if cutting is not started before this timer expires.

Each time cutting is started the timer resets and starts counting down again after the cutting is stopped.

If the timer is set to 0 the Pump will not automatically turn off.

Offsets

These settings are found on the WaterJet Multi-Head Settings screen

These offsets define the WaterJet heads position relative to another head you may have on your machine.

If this is the only head you have on the machine or you do not wish to use this head in combination with another head then these values can be left at 0

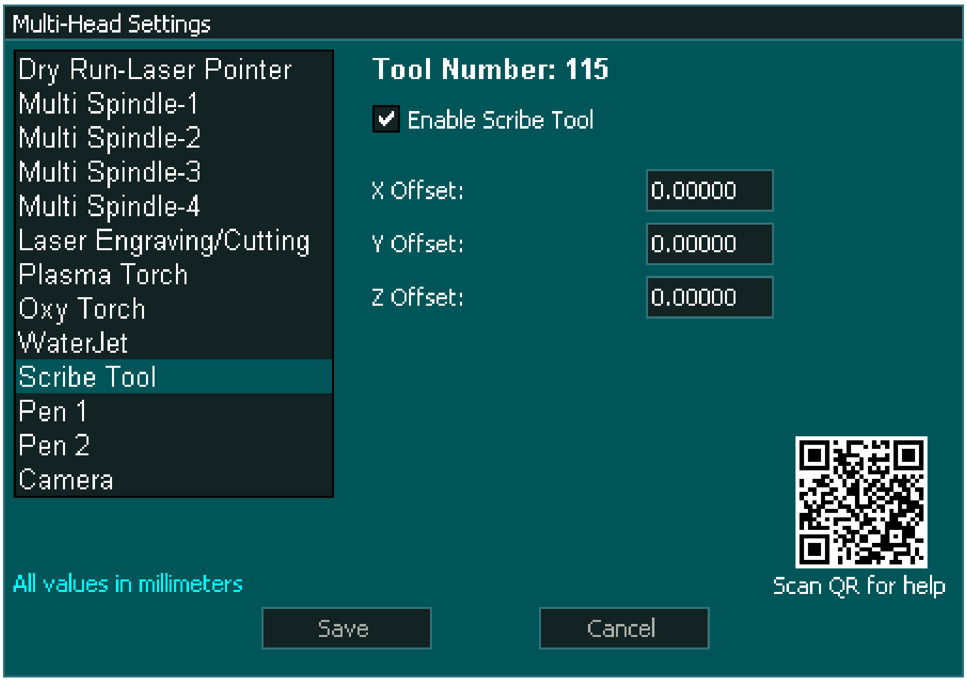
13.9. Scribe Tool

The scribe tool is generally used with Plasma but can be used for other setups as well.

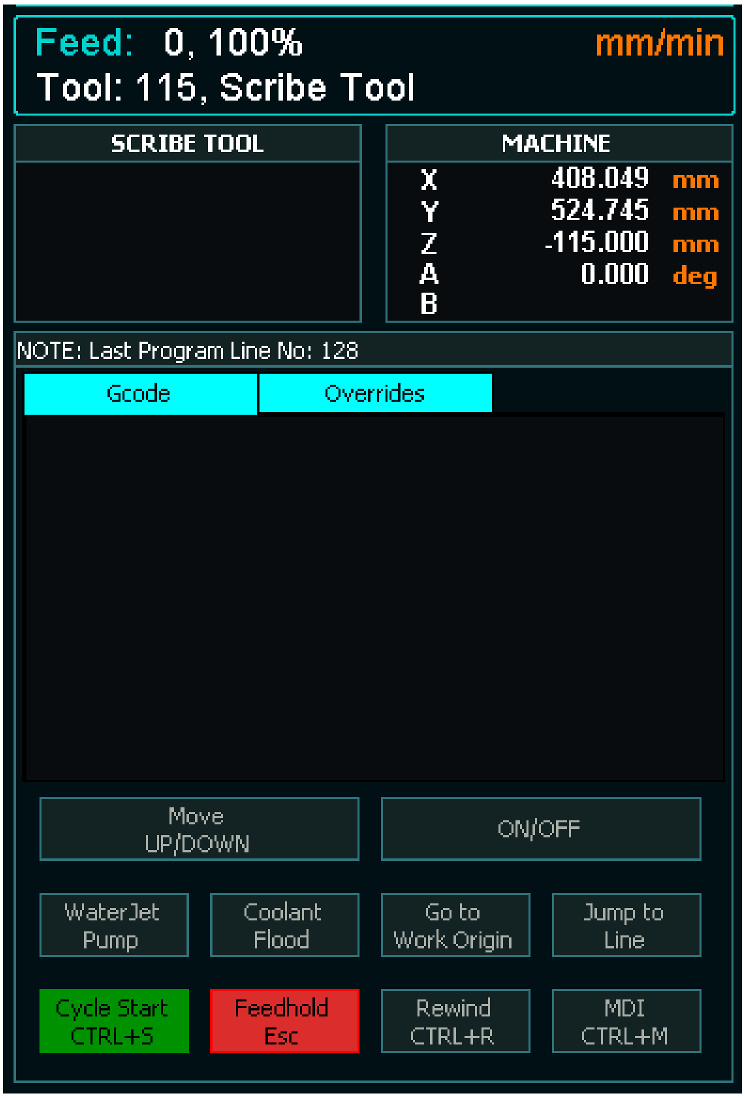
- Tool 115
- To change to Waterjet issue a **T115 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- This tool is commonly used as part of a Plasma torch setup for marking material.
- The X, Y & Z offset relative to another head can be entered in the Multi-Head Setting page
- An output is assigned to move the scribe tool up and down as needed.
- An output is provided to turn the scribe on and off.

Output 6	Scribe-Up/Down	No	Low
Output 7	Scribe-On/Off	No	Low

Assigned Scribe Outputs



Multi-Head Setting



F2 Screen

Configuration

- Enable Scribe in the Multi-head screen.
- Assign an output for Scribe up /Down. 

- Assign an output for Scribe on/Off. 

- Enter the X, Y and Z axis offset from the reference tool into the Scribe Multi-Head setting screen.

This would be the Main spindle or Plasma torch in most setups.

Scribe Logic

- Gcode command issued eg. **T115 M6**
- Scribe up/Down output will go High. This output is used to push the scribe down into position.
- M3 is used to turn on the Scribe
- M5 is used to turn off the Scribe.
- If a different tool is selected the Scribe up/Down output will go Low which will pull the scribe up into the idle position.
- There are buttons on the F2 Screen when Scribe is selected which allow the user to move the Scribe up and down as well as turn the Scribe on and off as needed.

Wiring a Pneumatic Scribe

In this example the Scribe is pushed down into position using a pneumatic cylinder controlled by an air solenoid and the scribe is air driven so a 2nd air solenoid is used to turn on the air to make the scribe vibrate. If the Scribe is electric or the Scribe is moved into position using a linear actuator the solenoids would be removed and the actuator and Scribe would be driven directly from the Relay.

Example wiring diagram

WARNING: The example below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your selected hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.

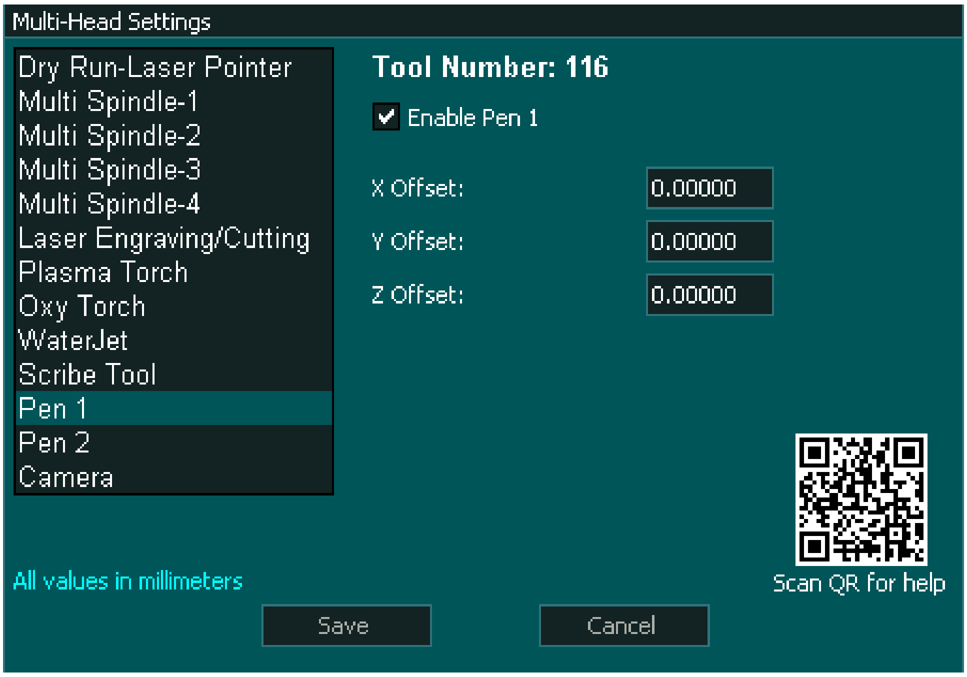

MASSO G3
WARNING
REFER TO USER MANUAL BEFORE WIRING THE UNIT
ATTENTION
OBSERVE PRECAUTIONS ELECTROSTATIC SENSITIVE DEVICE
HIND TECHNOLOGY
www.masso.com.au
Model: G3-5A1SI
DIFFERENTIAL SIGNALS
Scribe Up / Down
Scribe On / Off
RL1
RL2
RL5
RL6
NC NO C
Scribe Up / Down
Scribe On / Off

13.10. Pen 1 & 2

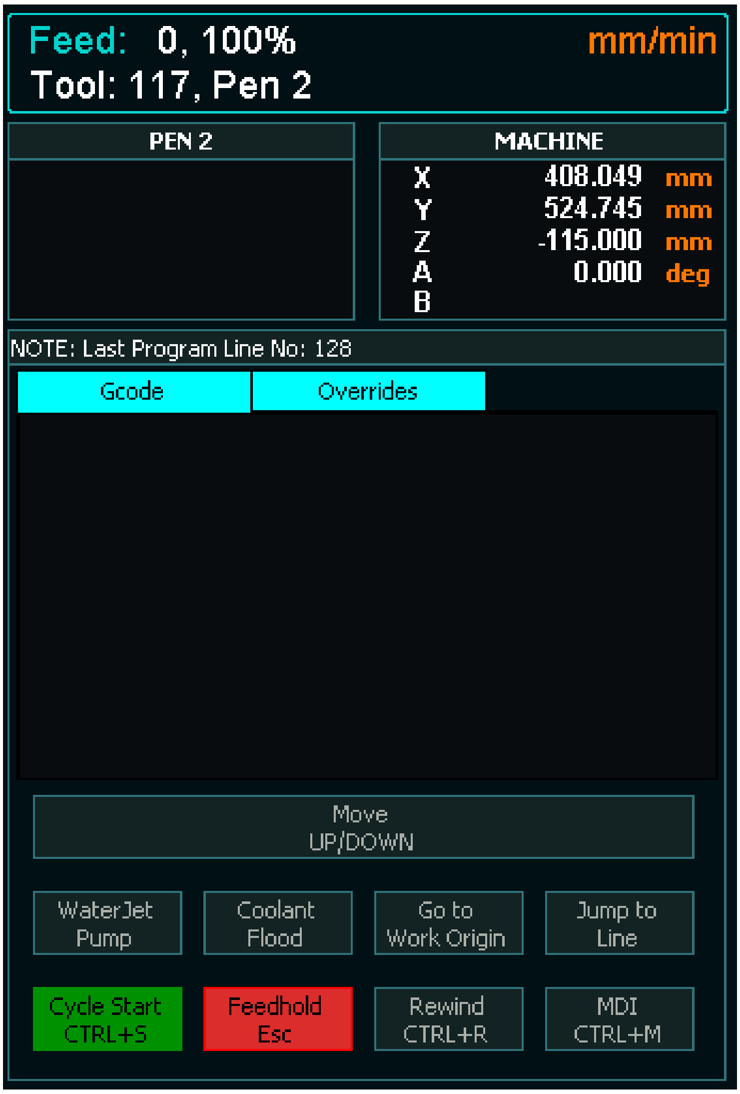
The Pen tool can be used with marker pens and other similar tools as needed

- Tools 116 & 117
- To change to Pen issue a **T116 M06** or a **T117 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen when you run your Gcode file
- The X, Y & Z offset relative to another head can be entered in the Multi-Head Setting page
- A Pen Up/Down output is provided for each pen and can be assigned to one of the TTL outputs.

Assign Pen outputs



Multi-Head Setting



F2 Screen

Configuration

- Enable Pen 1 and Pen 2 as required in the Multi-head screen.
- Assign an output for Pen up /Down.

- Enter the X, Y and Z axis offset from the reference tool into the Pen 1 & Pen 2 Multi-Head setting screens. This could be the Main spindle or a Plasma torch.

Pen Logic

- Gcode command issued eg. **T116 M6** for Pen 1
- Gcode command issued eg. **T117 M6** for Pen 1
- Only one pen can be used at a time
- The appropriate Pen up/Down output will go High. This output is used to push the Pen down into position.
- If a different tool is selected the Pen Up/Down output will go Low which will pull the Pen up into the idle position.
- There is a button on the F2 Screen when Pen 1 or 2 is selected which allow the user to move the Pen up and down as needed.

Wiring a Pen

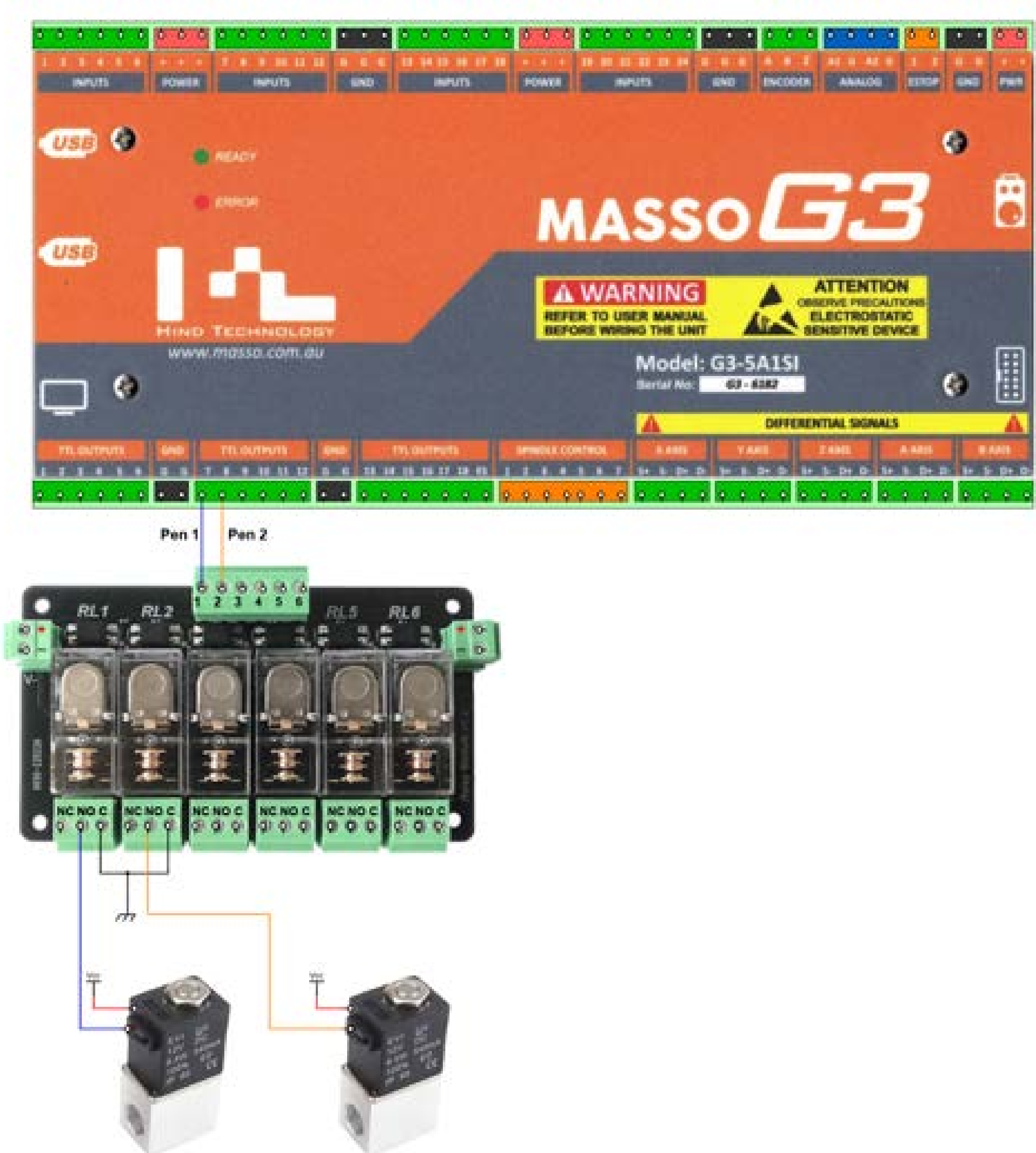
This example shows the wiring for both Pens 1 & Pen 2

The Pens are moved into position using Pneumatic cylinders with air solenoids used to supply air to the cylinders.

If a linear actuator is used instead then the relay would connect directly to the actuator and it would be wired accordingly.

Example wiring diagram

WARNING: The example below is intended to illustrate the concept of how such a system could be wired. The actual wiring of your machine will depend on the hardware used and it's requirements. Please consult your user manual for the correct way to wire your selected hardware. If unsure please consult a qualified electrical engineer to assist with wiring of your machine.

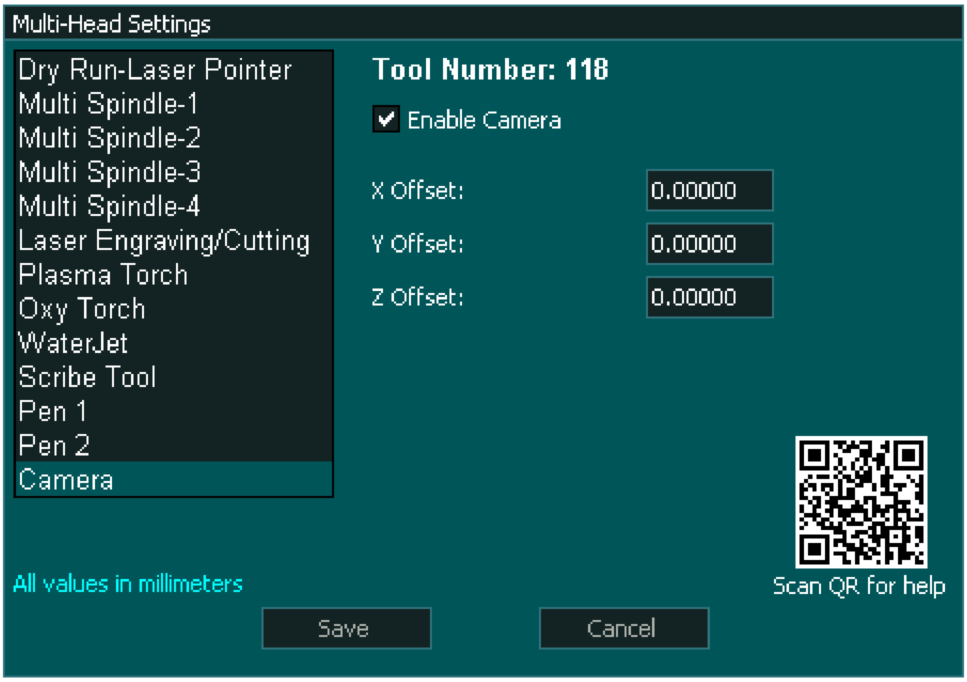

MASSO G3
WARNING
REFER TO USER MANUAL BEFORE WIRING THE UNIT
ATTENTION
OBSERVE PRECAUTIONS ELECTROSTATIC SENSITIVE DEVICE
Model: G3-5A1SI
www.masso.com.au
HIND TECHNOLOGY
DIFFERENTIAL SIGNALS
Pen 1
Pen 2
RL1
RL2
RL5
RL6
NC NO C
Pen 1 Up / Down
Pen 2 Up / Down

13.11. Camera

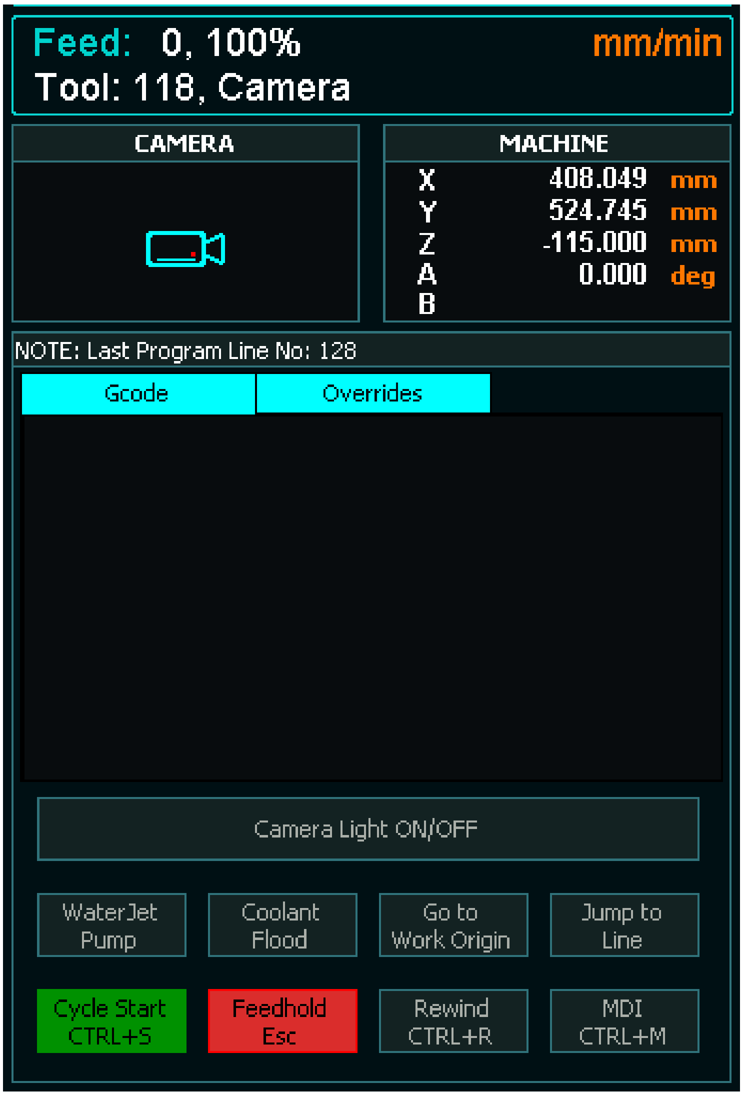
> **This tool is currently in development**

- Tool 118
- To change to Camera issue a **T118 M06** command in MDI and include this in your Gcode file to ensure that it changes to the correct screen if you run a Gcode file
- A TTL output is provided to turn on the Camera light and can also be used to turn on the camera if it has the capability.
- MASSO does not support external USB cameras at this time and will not display an image on screen but can be used with a camera and external screen.
- This tool allows you to align the X & Y axis using a camera mounted the the Z axis which can be used for focusing the camera.
- Once in your chosen location you can view your target, read or Zero the axis coordinates as needed.
- Enter the X & Y Offset value from your main tool that you will be using as a reference for the machine. This is usually the Main Spindle, Plasma head or WaterJet head.
- All Multi-head offsets must reference from the same tool for their offsets.

Assign Camera Light output



Multi-Head Setting


Feed: 0, 100%
mm/min
Tool: 118, Camera
CAMERA
MACHINE
X 408.049 mm
Y 524.745 mm
Z -115.000 mm
A 0.000 deg
B
NOTE: Last Program Line No: 128
Gcode
Overrides
Camera Light ON/OFF
WaterJet Pump
Coolant Flood
Go to Work Origin
Jump to Line
Cycle Start CTRL+S
Feedhold Esc
Rewind CTRL+R
MDI CTRL+M

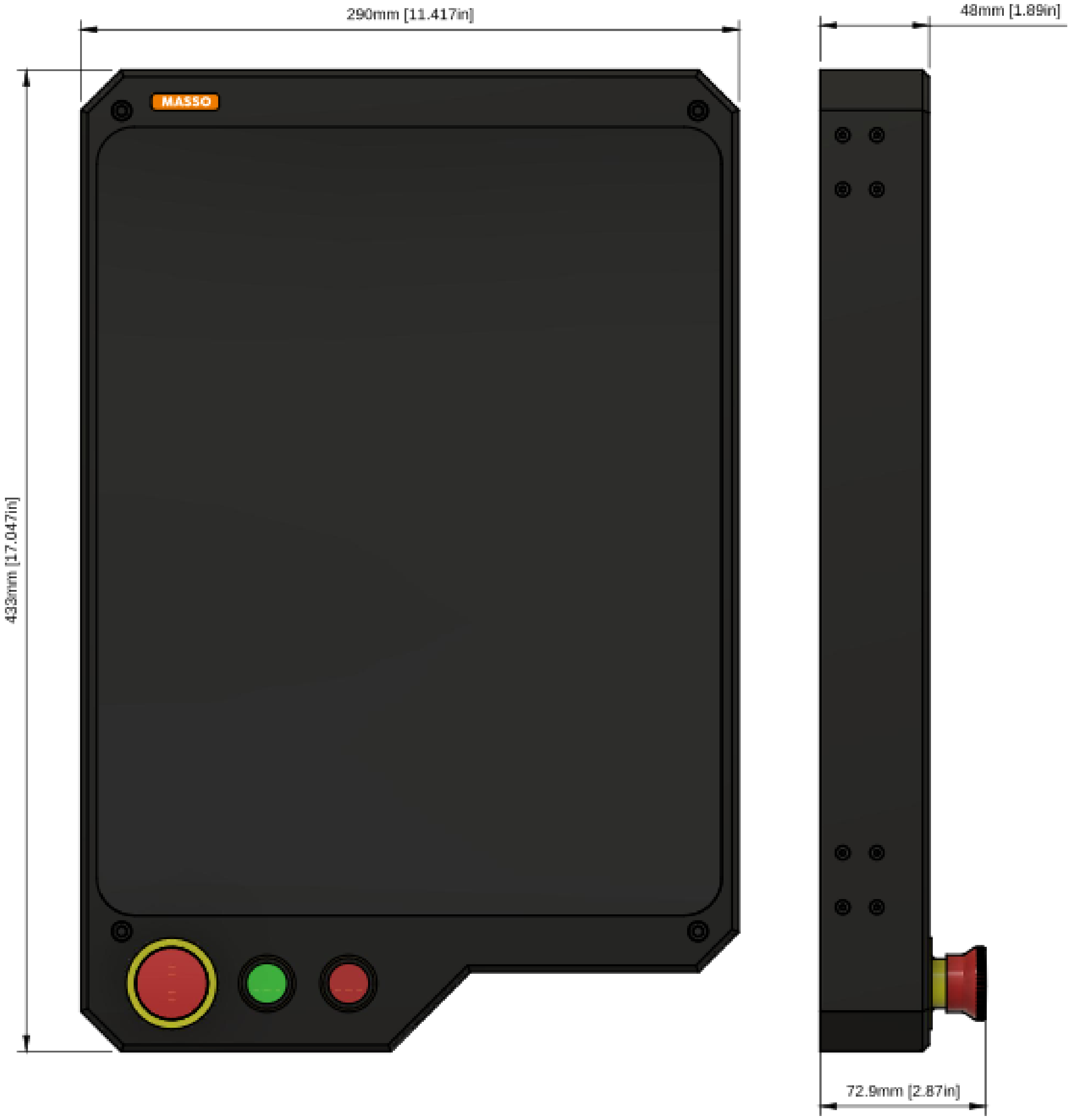
F2 Screen

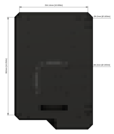
14. Setup and Calibration

Read other subtopics below:

14.1. Mounting and Mechanical Data

MASSO G3 Touch





MASSO G3

ENVIRONMENT ratings

Operating Ambient Temperature 0 to +70°C.

14.2. MASSO G3 Touch Wiring Module

IMPORTANT: The **MASSO G3 Touch wiring module** does not provide extension for the two ananlog inputs on the MASSO G3 Touch.

Description

The **MASSO G3 Touch wiring module** is an extension module used to extend the inputs and outputs from inside the MASSO G3 Touch cabinet to a machine location (This would normally be on the machine itself).

By using this module, the cable management between the MASSO G3 Touch and the machine becomes very simple and if the cables are damaged then they can be replaced quickly.

The extension kit comes with the following items:

- Local extension module board that plugs into MASSO Touch.
- D cables to connect the two boards.
- Machine side extension Module used to wire your machine inputs and outputs.

Features of the MASSO G3 Touch Wiring module include

- A fuse holder for the 1 amp fuse to power your MASSO G3 Touch.
- Power is provided at the Machine side extension board and is sent to the MASSO G3 Touch through the extension cables.
- 24 Dip switches which can be used to switch enable pull-up resistors for inputs if needed.
- Optical isolation for the Spindle CW and CCW outputs on the Machine side.
- A DIN rail mount for the Machine side module of the Wiring module.
- The Local extension board has connectors for inputs 1, 2, and Estop. This will allow the existing buttons and the Estop button on the front of the MASSO Touch to be reconnected.
- The Local extension board has an access port for the onboard battery.

Installing your MASSO G3 Touch Wiring Module

Step 1

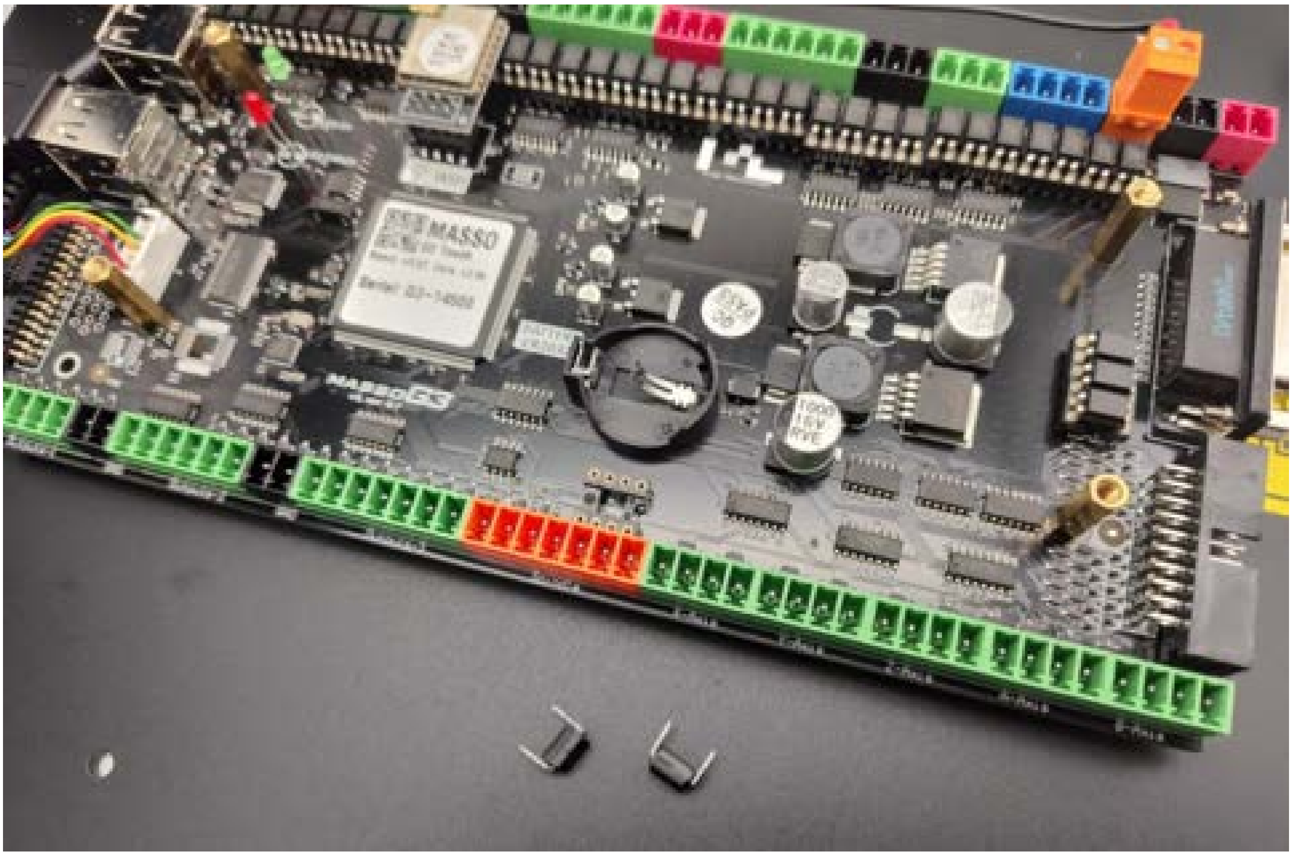
Open your MASSO G3 Touch cabinet

Step 2

- Remove the top label from your MASSO and set it aside along with the 4 screws that secure it in place.
- Remove the wires from inputs 1, 2, POWER and Estop 2 as these will need to be connected to the Local module.
- Remove all connectors from your MASSO G3 Touch and set them aside as you will require these later.

Carefully remove the 2 spindle optocouple IC's from the MASSO board.

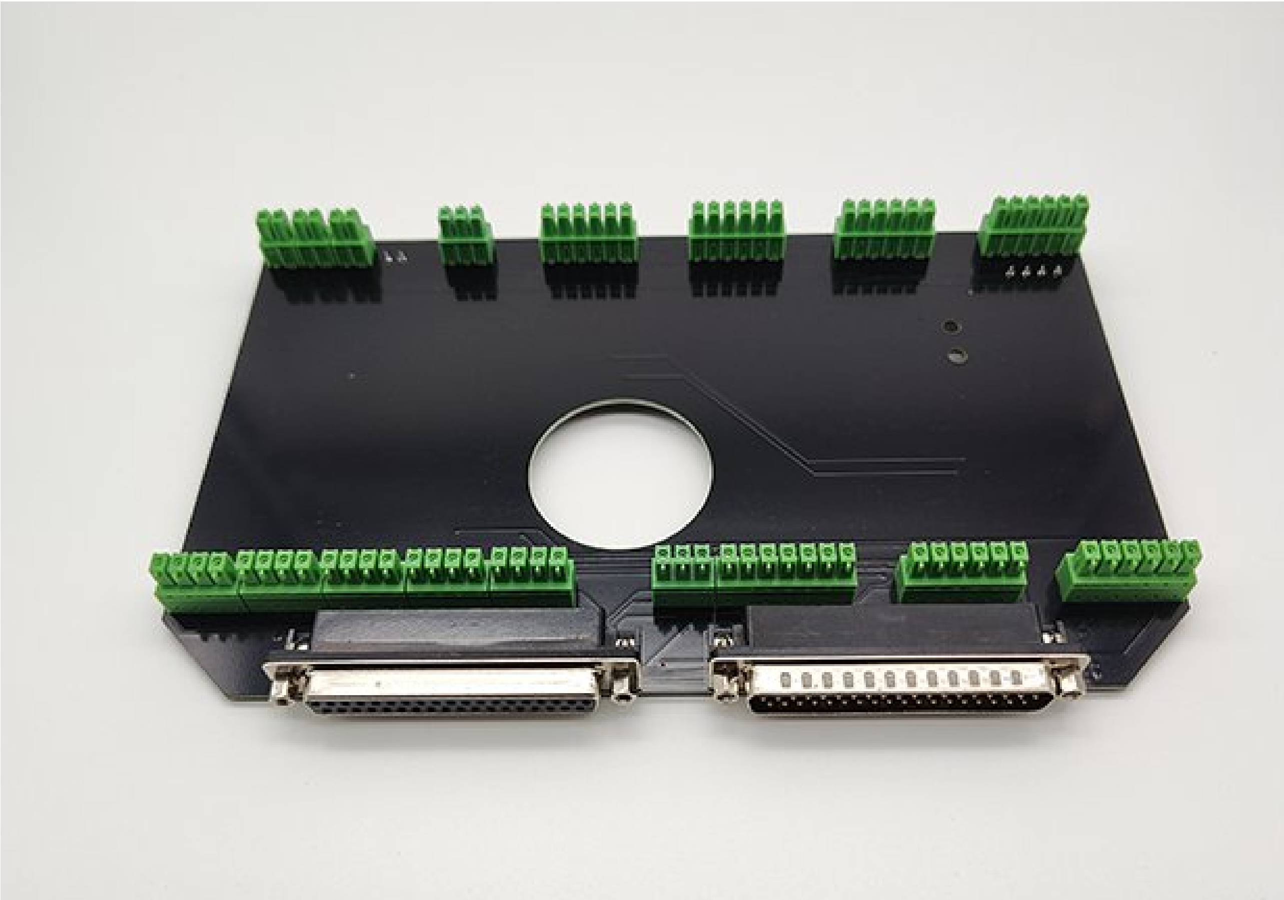
INFORMATION: If you have not yet installed your backup battery this would be a good time to do it though you can do it later if you like.



Step 3

Install the MASSO G3 Touch local extension board onto your MASSO G3 Touch. The connectors are keyed and will only connect one way.

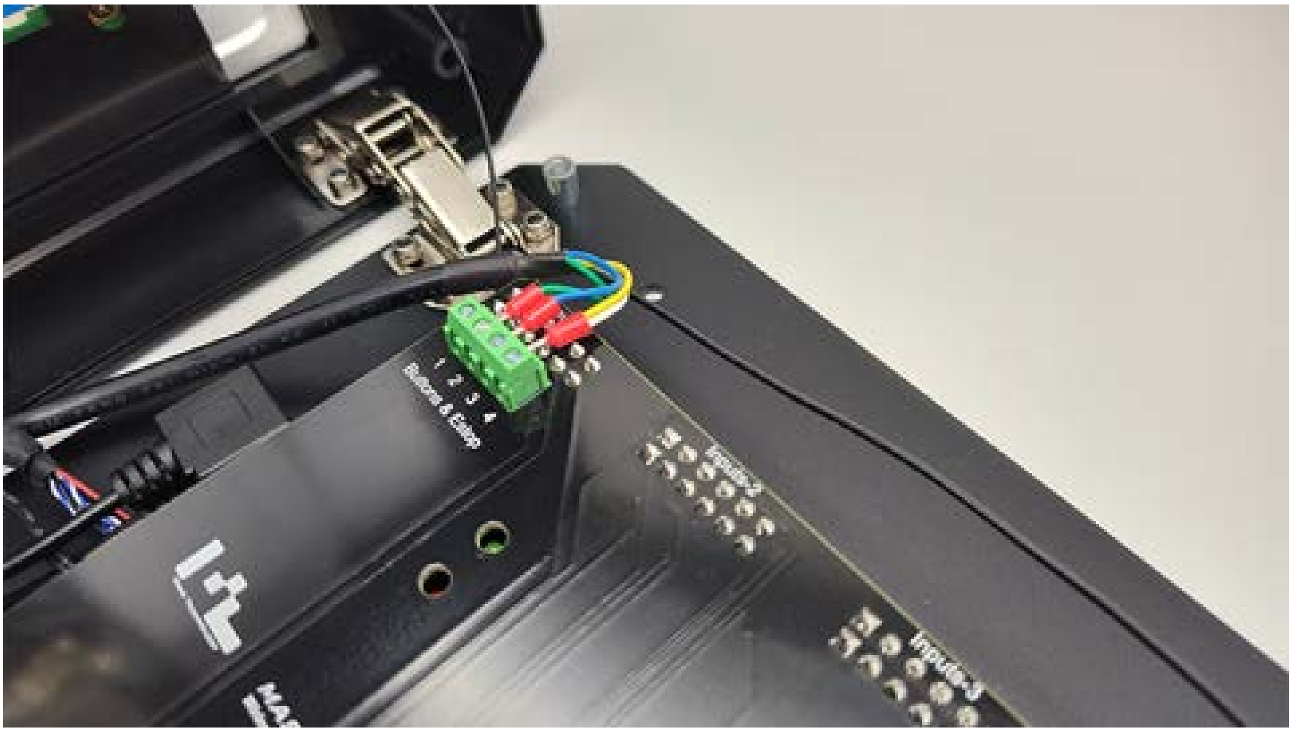
A bottom view of the board can be seen below.



- Ensure that all connector pins are correctly aligned with the connector side shown below facing MASSO and the 38-pin connectors orientated towards the bottom of the MASSO touch as shown below.
- Take care that the **Red** and **Green** LEDs on the MASSO G3 board are standing straight and are not bent to the side or you may not be able to see them once the board is in place.
- There are 2 holes in the Local extension board that allow the LEDs to be seen when it is in place.

Step 4

- **Terminal 1 -** Connect the **Green** wire - This is MASSO Input 1.
- **Terminal 2 -** Connect the **Blue** wire - This is MASSO Input 2.
- **Terminal 3 -** Connect the **Yellow**/**Red**/**White** wires - This is the positive power that is applied to MASSO.
- **Terminal 4 -** is for external **E-Stop:**
- If an **external E-Stop** on the machine is to be used, connect one side of the external E-Stop button to the positive power MASSO is powered to.
- Remove the **Red** wires from **Terminal 3** and connect to **Terminal 4**.
- By doing the above, all E-Stop buttons will be in series, and pressing any E-Stop button will put the machine in E-Stop.



- Connect the Black Estop wire to Estop 1 or Estop 2 on the Local extension board.
- If you have a pendant installed on MASSO connect to Estop 1.
- If you do not have a pendant installed on MASSO connect to Estop 2.

Step 5

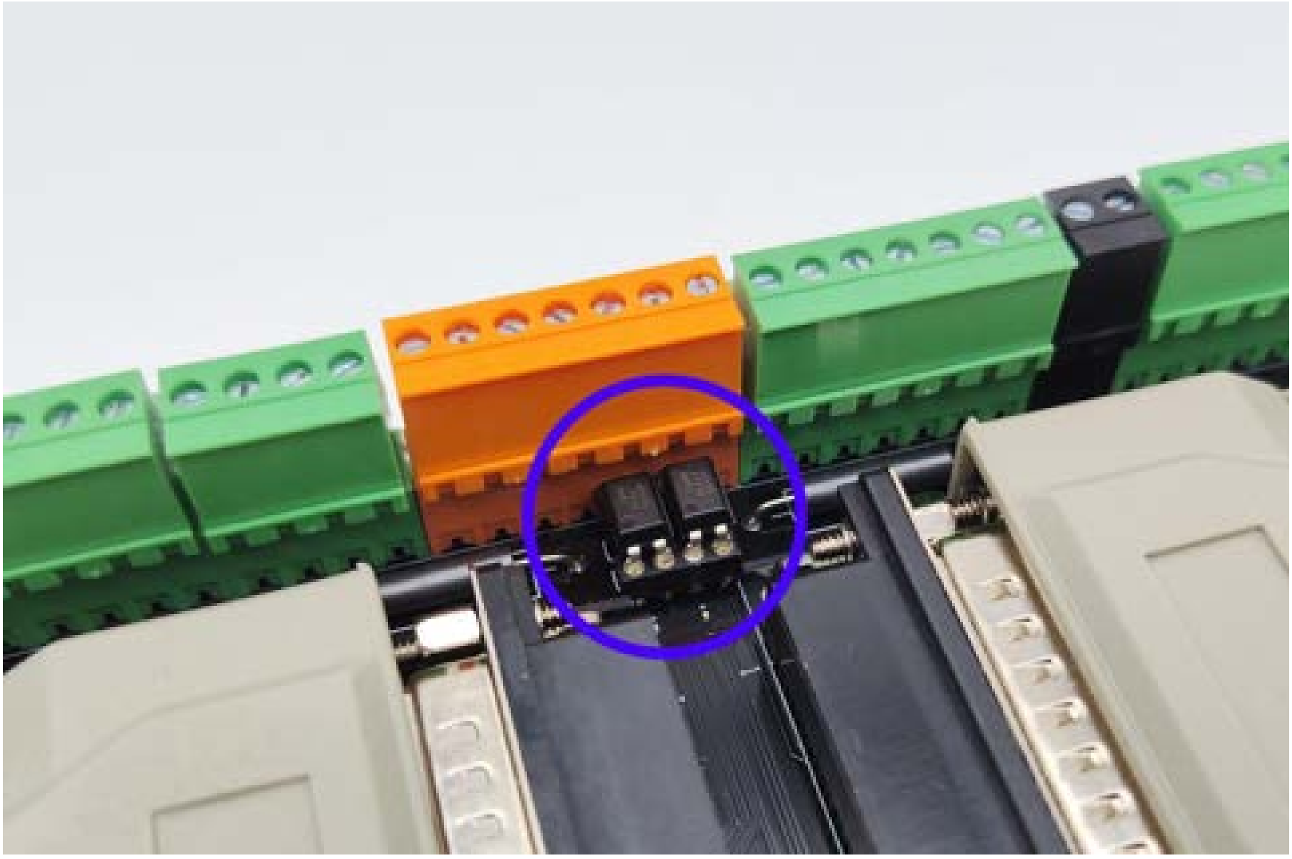
- Pass the two 37-pin connector cables through the slotted access hole in MASSO.
- Note that when you pass the cables through the rear of the MASSO cabinet you want one male and one female connector.
- Plug them into the Local extension board and secure them in place using the thumbscrews on the cable plugs.

The MASSO Touch end is now completed and the cabinet can be closed.

Machine Side

Step 1

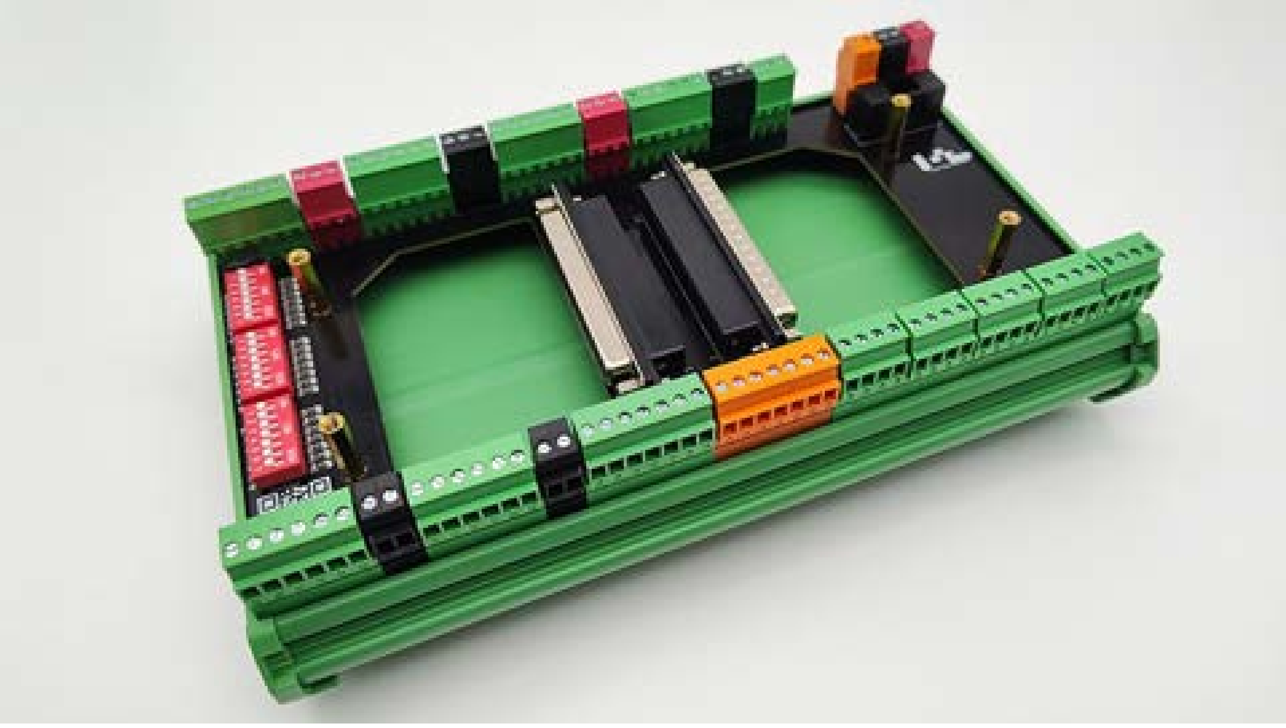
Install the two optocouplers IC's that you removed for your MASSO touch and install them into the machine side module.



WARNING: Note the little dot beside pin1 on the IC and ensure that it is orientated the same as in the photo below.

Step 2

Install the screw terminal plugs you removed from your MASSO G3 Touch into the machine side extension board as shown below.



Step 3

- Connect the two 37-pin cables to the machine side module.
- One connector is male and the other is female so the cable connections will only connect to the right connector.
- Secure them in place using the thumb screws on the cable plugs.

Step 4

Secure the MASSO G3 cover from your MASSO G3 Touch to the board using the 4 screws.

14.3. EStop Wiring

Pin No.	Description
Pin 1	E-Stop Signal - To be used when using MPG E-Stop pendant button
Pin 2	E-Stop Signal

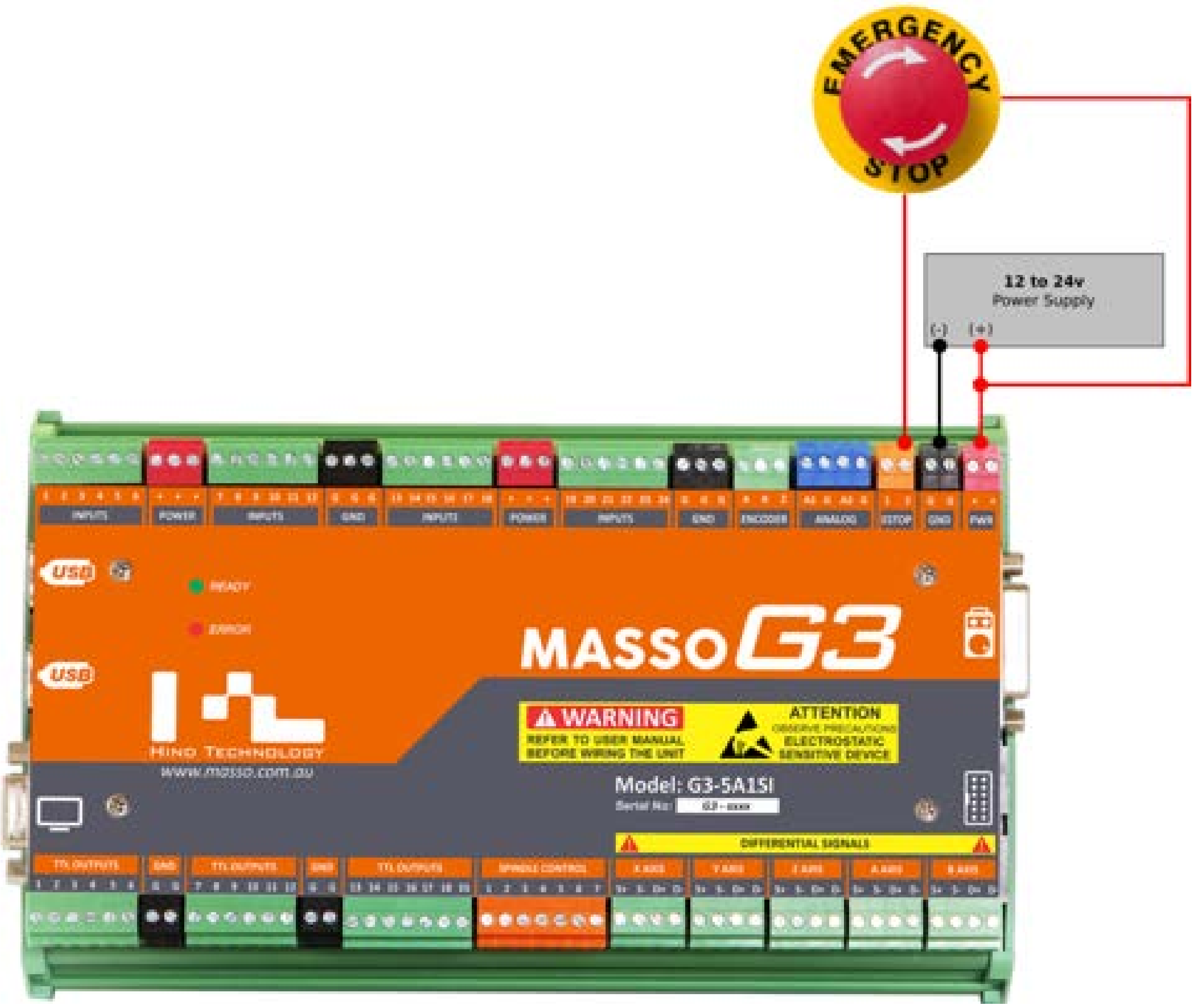
WARNING: To avoid damage to equipment or hazard to personnel, the system installer should wire the **E-Stop** button so that pressing the **E-Stop** button disables all drives and actuators on the machine. The E-Stop relay output on the MASSO should be wired to disable the axis drives and the spindle drive circuits.

Simple one E-Stop button wiring

WARNING: It is critical that inductive loads such as Motor brakes and Relays are not connected directly to the E-Stop button circuit as doing so will cause damage to the E-Stop circuit. If you need to operate a brake or similar please connected it via the ES output using the MASSO Relay Module.

The below wiring example shows how to wire and use only one E-Stop button. The **E-Stop** button is wired to **ESTOP** terminal **Pin 2**.

In the below example E-Stop button on the MPG will not work. If using a Pendant please use one of the connection methods shown below.



Wiring only one E-Stop on MPG pendant

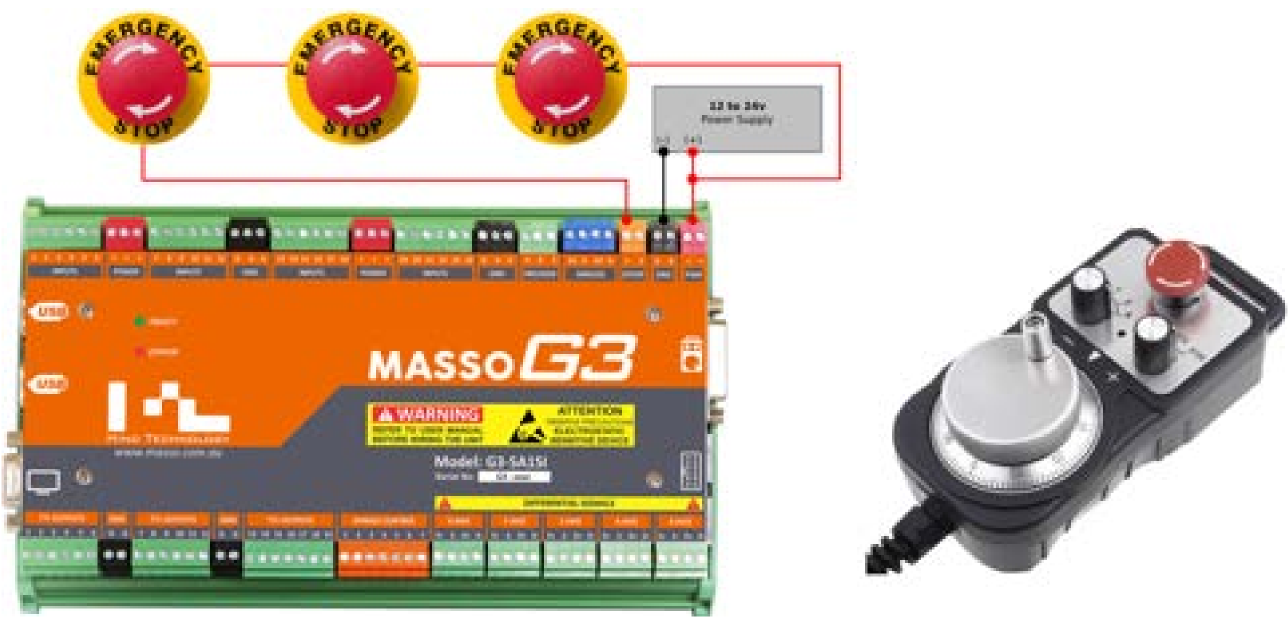
> **WARNING:** It is critical that inductive loads such as Motor brakes and Relays are not connected directly to the E-Stop circuit as doing so will cause damage to the E-Stop circuit. If you need to operate a brake or similar please connected it via the ES output using the MASSO Relay Module.

The below wiring example shows how to wire and use only the E-Stop button on the MPG pendant. **Pin 1** on the **ESTOP** terminal is wired to positive of the power supply to get the MPG E-Stop button working.

Wiring multiple E-Stop buttons and MPG pendant E-Stop button

WARNING: It is critical that inductive loads such as Motor brakes and Relays are not connected directly to the E-Stop button circuit as doing so will cause damage to the E-Stop circuit. If you need to operate a brake or similar please connected it via the ES output using the MASSO Relay Module.

The below wiring example shows how to wire and use multiple **E-Stop** buttons and MPG pendant **E-Stop** button. All **E-Stop** buttons are wired in series to **Pin 1** on the **ESTOP** terminal through the positive of the power supply. When any of the three external **E-Stop** buttons or MPG pendant **E-Stop** button is presses, MASSO will display an E-Stop alarm on the screen and the **"ES" (E-Stop output)** singnal will go LOW.



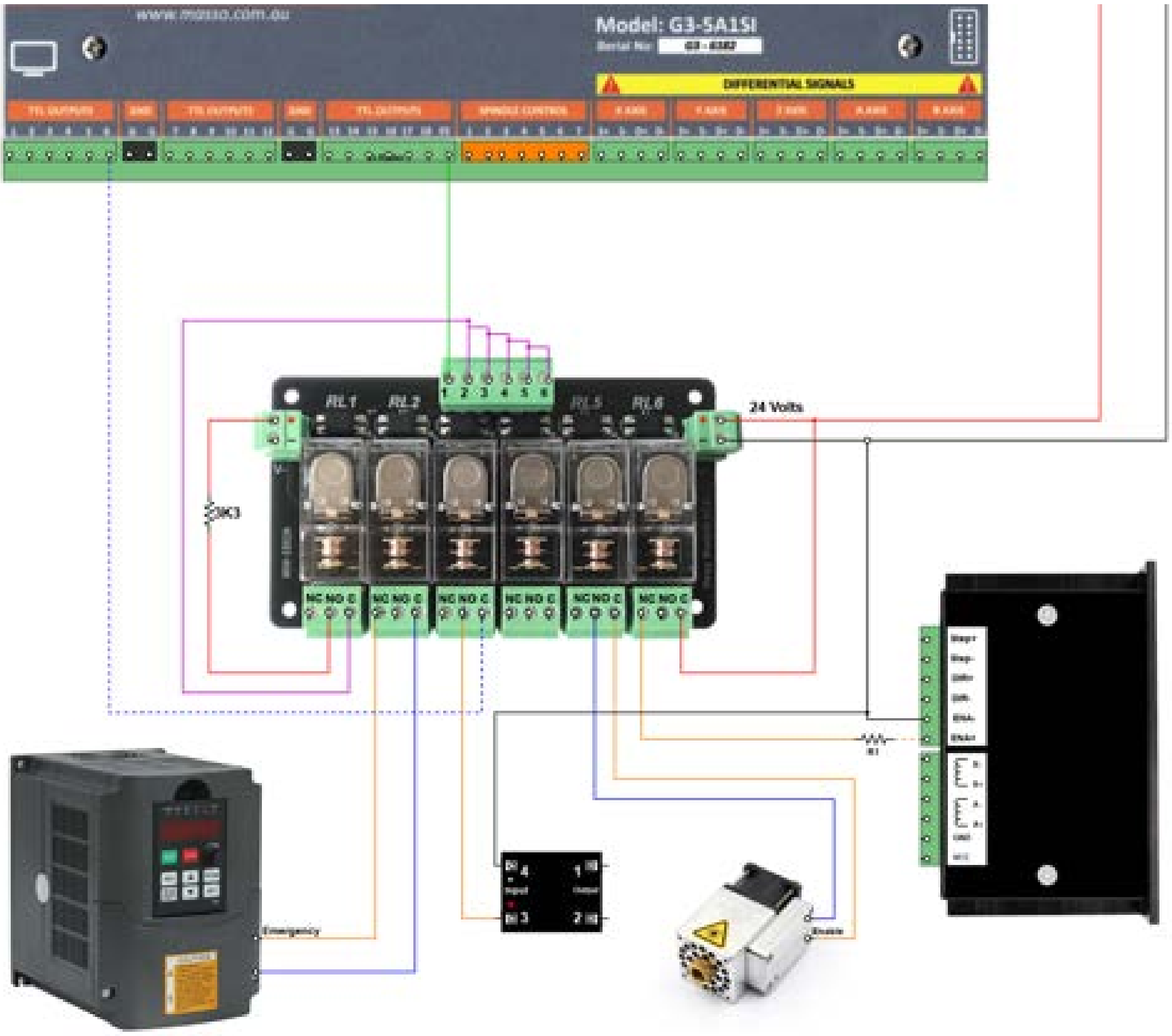
Wiring E-Stop output signal to relay

A special output signal **"ES" (E-Stop output)** is available on the outputs terminal. This output is internally hardwired to the **E-Stop** button signals and goes LOW when the **E-Stop** button is pressed.

- The output voltage of this output is 2.3 volts and drops to 0v when the Estop button is pressed. This means that the Estop relay is permanently on when the Estop is released and the relay turns off when the Estop is pressed. This provides fail safe operation.
- This output is used to control a relay and then the relay disables all drives and actuators on the machine. The user should not rely on the software to stop the axis, spindle or other actuators in case of an emergency and must disable all drives electrically.
- The normal state of the ES Relay is energized when the machine is not in an EStop condition.
- Multiple relays can be used if you need more than 1 set of relay contacts
- Up to 2 MASSO relay inputs can be connected to the ES output however if you require more than 2 relays connect them as shown below.
- You can connect multiple MASSO Relays together as shown. Use this method of wiring if you require 3 to 5 relay outputs. Relay 1 is connected to the ES output on MASSO and the Output of Relay 1 will operate all other relays.
- A single 3.3K resistor will work to operate 2 to 5 relays on the same MASSO Relay Module.

INFORMATION: MASSO Relay Module information is available here: MASSO Relay Module

Caution: The disable methods for the devices in the diagram below are for demonstration purposes only, to show various connection methods. Please consult your user manual for the correct method to disable and enable your device.



WARNING: If you are disconnecting mains power in an EStop situation it is highly recommended that you do not run the mains through the MASSO Relay. Use the relay to operate a separate relay located elsewhere in the control cabinet. This is so that you are not mixing Low voltage signal and Mains voltages on the same board as this can lead to accidents. It is best practice to keep your mains voltage circuits separate and physically protected against accidental contact by the user.

This video explains the EStop switch install process

How to install Estop on Masso - Masso Edition 012

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Troubleshooting

- Use a normally closed switch contact when wiring your Estop as this makes the Estop failsafe. If the wire to the switch breaks it will Estop the machine until it is fixed ensuring safe operation.
- The Estop show High in the F1 screen when the Estop is released and changes to Low when the Estop is operated

Inputs	Function	Invert	Status
EStop	EStop	No	High

- Ensure that the Estop input is not inverted in the F1 screen. If your Estop is inverted select the input and press the spacebar to toggle between Yes & No
- If using the MASSO Pendant use Estop 1 instead of Estop 2 or the Estop on the pendant will not work.
- If you have wired your MASSO to use the Estop on a pendant, unplugging the pendant will put the machine into Estop until the Pendant is plugged back in.
- If you have multiple Estop buttons and you cannot get your machine out of the Estop, check each button to make sure they have all been released.
- When troubleshooting the Estop with a multimeter you should measure the MASSO power supply voltage on Estop2 when the Estop button is released and 0 volts when the Estop button is operated. This is true even when you have a Pendant installed.
- When troubleshooting the Estop with a MASSO pendant installed you should measure MASSO power supply voltage on Estop1 and Estop2 when all Estop buttons are released. If an external

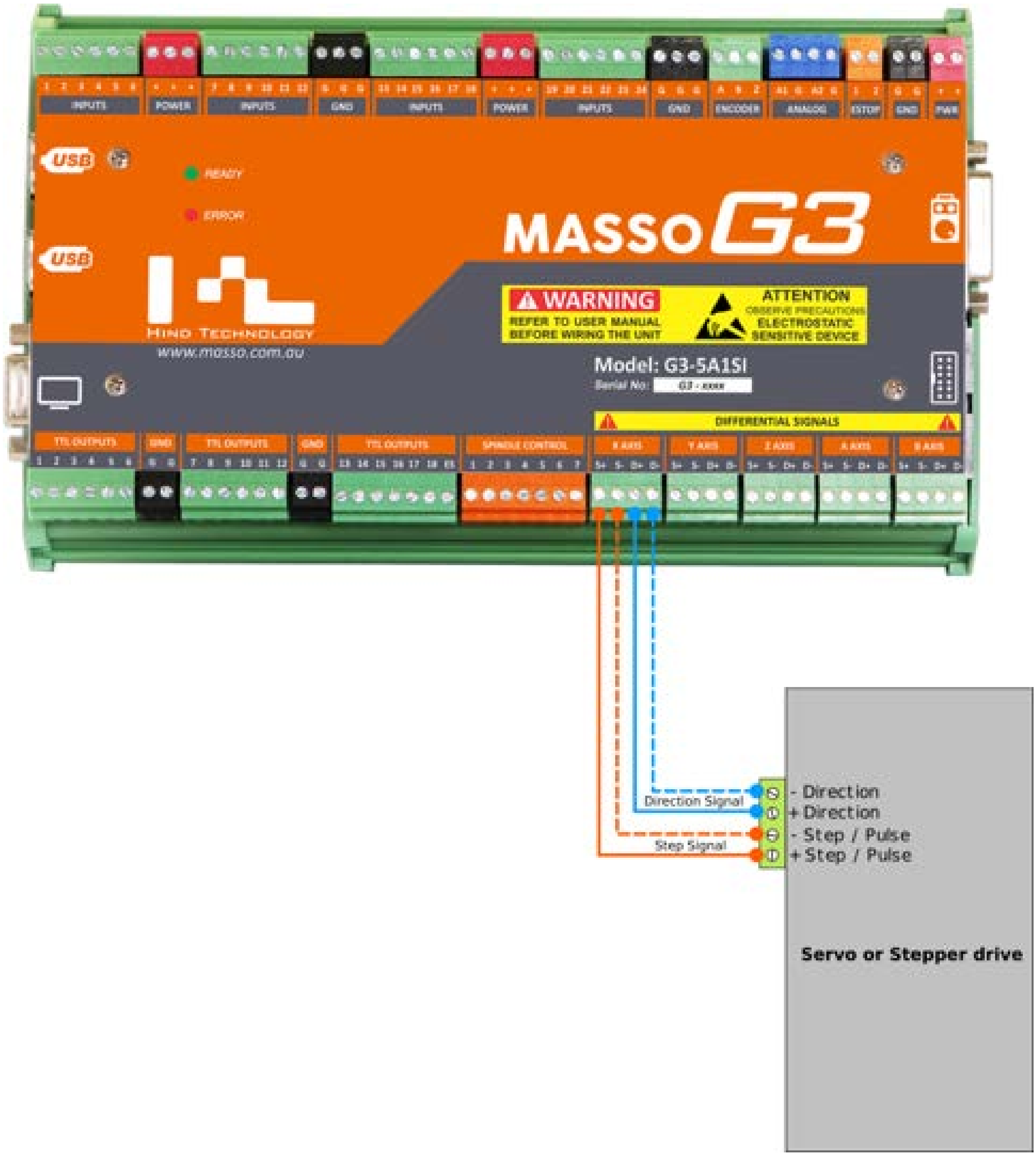
Estop button is operated you should measure 0v on Estop 1 and Estop 2. If the External Estop button is released and the Pendant Estop is pressed you should measure MASSO power supply voltage on Estop1 and 0v on Estop 2.

14.4. Axis Servo/Stepper examples

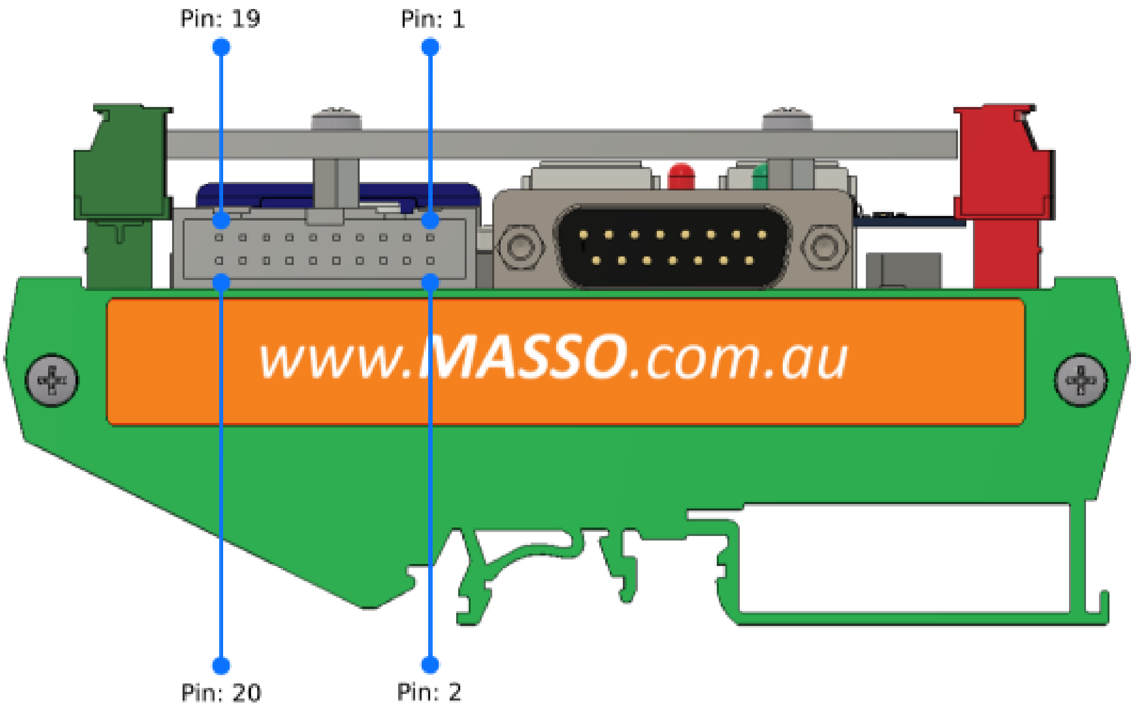
> **WARNING**: Axis Step and Direction signals are differential type signals and the following precautions must be taken to wire the controller to avoid any electrical damage to the system:

- All axis outputs are differential signals with **-4** to **+4** voltage signals.
- Never short-circuit the signals with each other, connect to GND or any voltage supply as this will damage the Axis output.
- All signals must be isolated from other signals and connected directly to the drives

Wiring example



MASSO G3 side connector information



IDC Connector with TTL 5v signals:
Pin 1: GND
Pin 2: Do Not Connect
Pin 3: B-Axis Direction
Pin 4: B-Axis Step
Pin 5: A-Axis Direction
Pin 6: A-Axis Step
Pin 7: Z-Axis Direction
Pin 8: Z-Axis Step
Pin 9: Y-Axis Direction
Pin 10: Y-Axis Step
Pin 11: X-Axis Direction
Pin 12: X-Axis Step
Pin 13: Do Not Connect
Pin 14: Do Not Connect
Pin 15: Do Not Connect
Pin 16: Do Not Connect
Pin 17: Do Not Connect
Pin 18: Do Not Connect
Pin 19: Do Not Connect
Pin 20: Do Not Connect

Read other subtopics below:

14.4.1) Differential Receiver Module

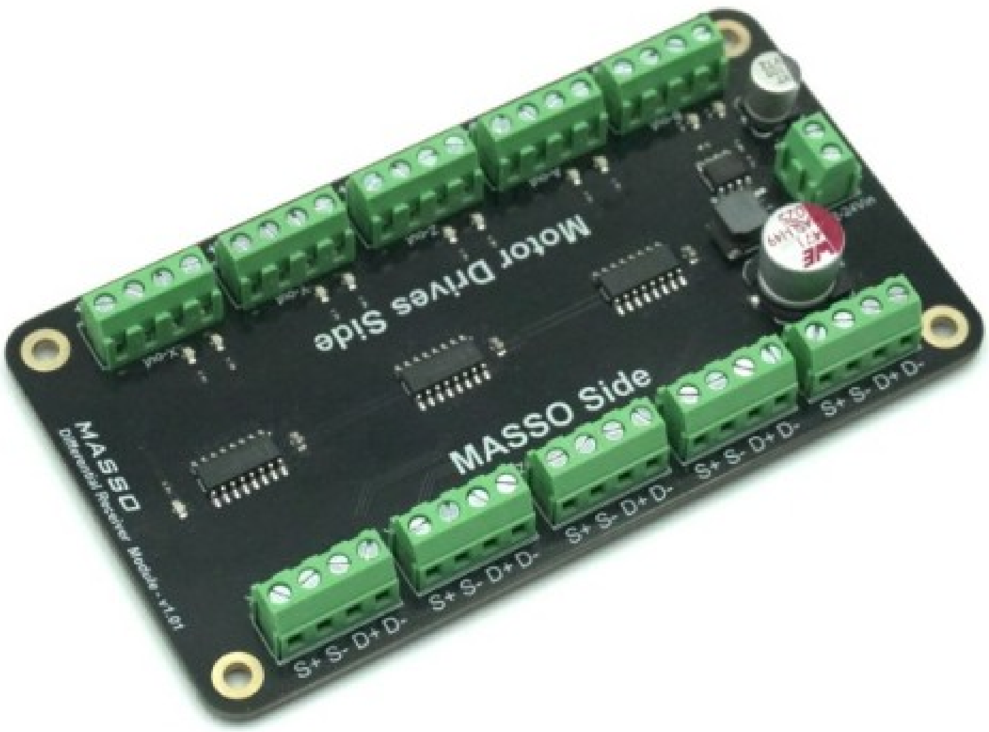
14.4.2) MASSO Closed Loop Stepper Motors

14.4.3) Gecko 203V

14.4.4) Gecko G340

14.4.5) Gecko G540

14.4.1. Differential Receiver Module



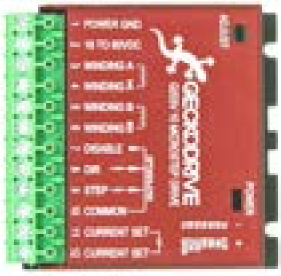
When to use the MASSO Differential Receiver Module

- The MASSO Differential Receiver Module is designed to provide support for Stepper or Servo motor drives that do not support advanced differential signals.
- Differential signals provide great immunity to electromagnetic noise that can interfere with motor control signals and cause issues with motor positioning or might cause unexpected motion on the machine axis.
- VFD drives for spindle motors and plasma cutting sources generate high electromagnetic noise and can interfere with motor position signals.
- With differential signals, long cables with STEP and DIRECTION signals from the MASSO controller can be run to the motor drives.
- Do not mount the Differential receiver next to the controller. Mount it next to the drives.

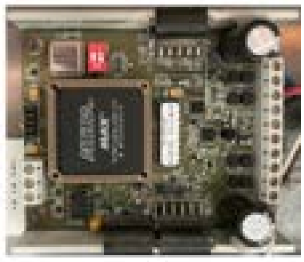
> **INFORMATION:** The MASSO Differential Receiver Module can be used to control up to 5 axis motor drives and can also provide 5 volts so that no external 5 volt power supply is required.

Some of the example drives that do not support differential signals





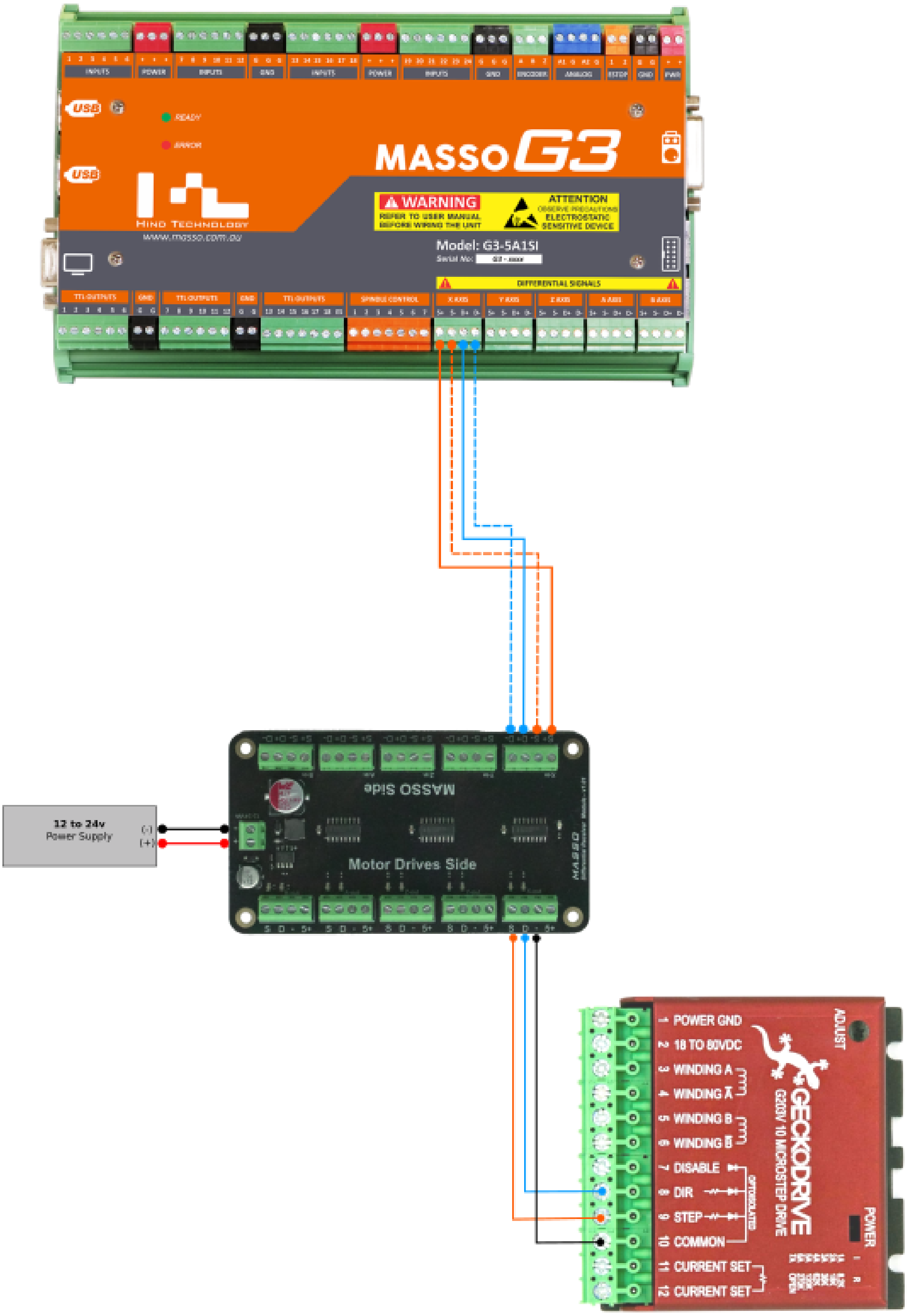




Wiring example with a common negative signal

The below diagram shows a **GECKO G203V** drive that takes TTL signals with a common negative.

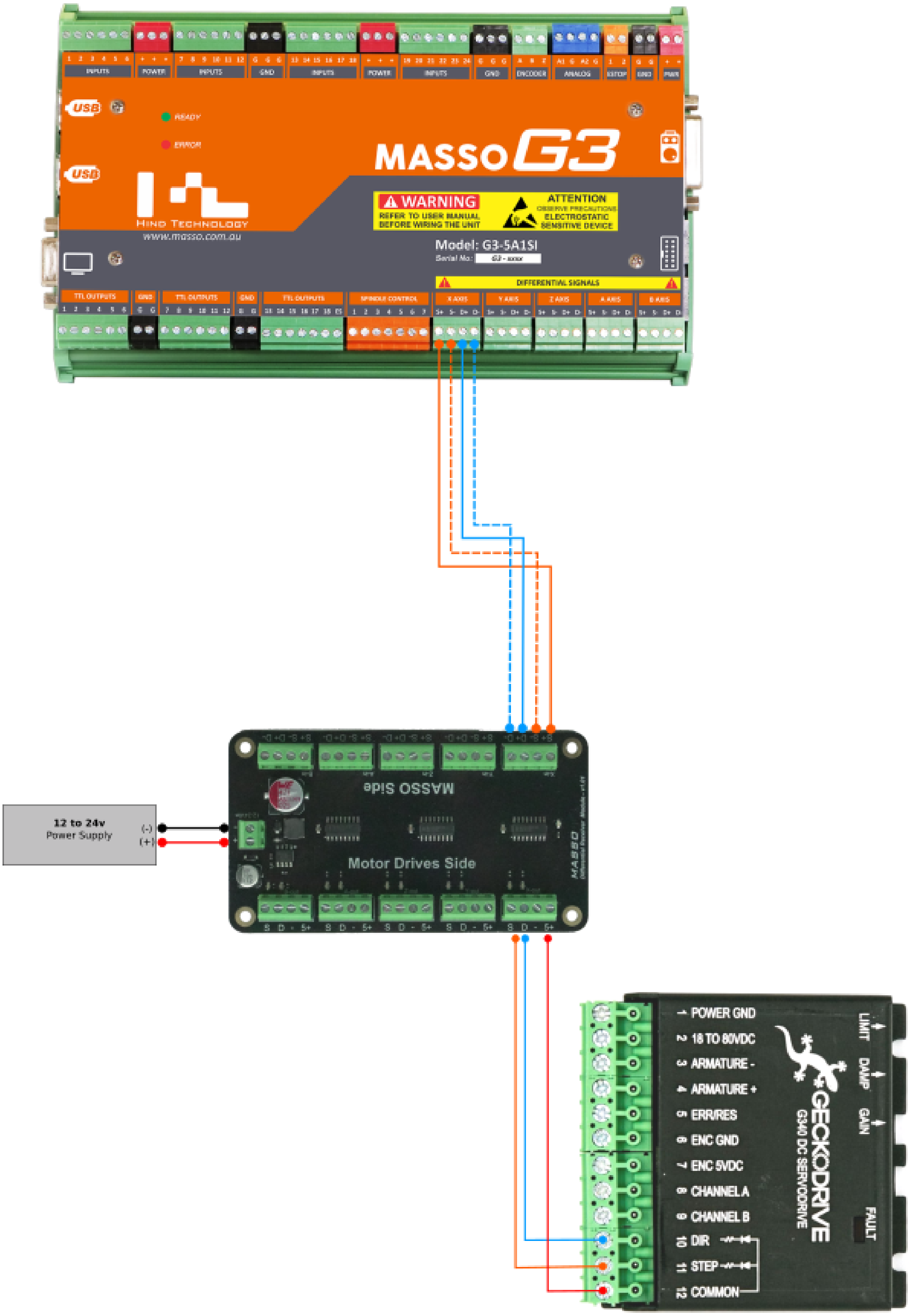
Mount the Differential receiver close to the drives.


MASSO G3
Model: G3-5A15I
12 to 24v
Power Supply
(-)
(+)
MASSO Side
Motor Drives Side
1 POWER GND
2 18 TO 80VDC
3 WINDING A
4 WINDING A
5 WINDING B
6 WINDING B
7 DISABLE
8 DIR
9 STEP
10 COMMON
11 CURRENT SET
12 CURRENT SET
GECKODRIVE
G203V 10 MICROSTEP DRIVE

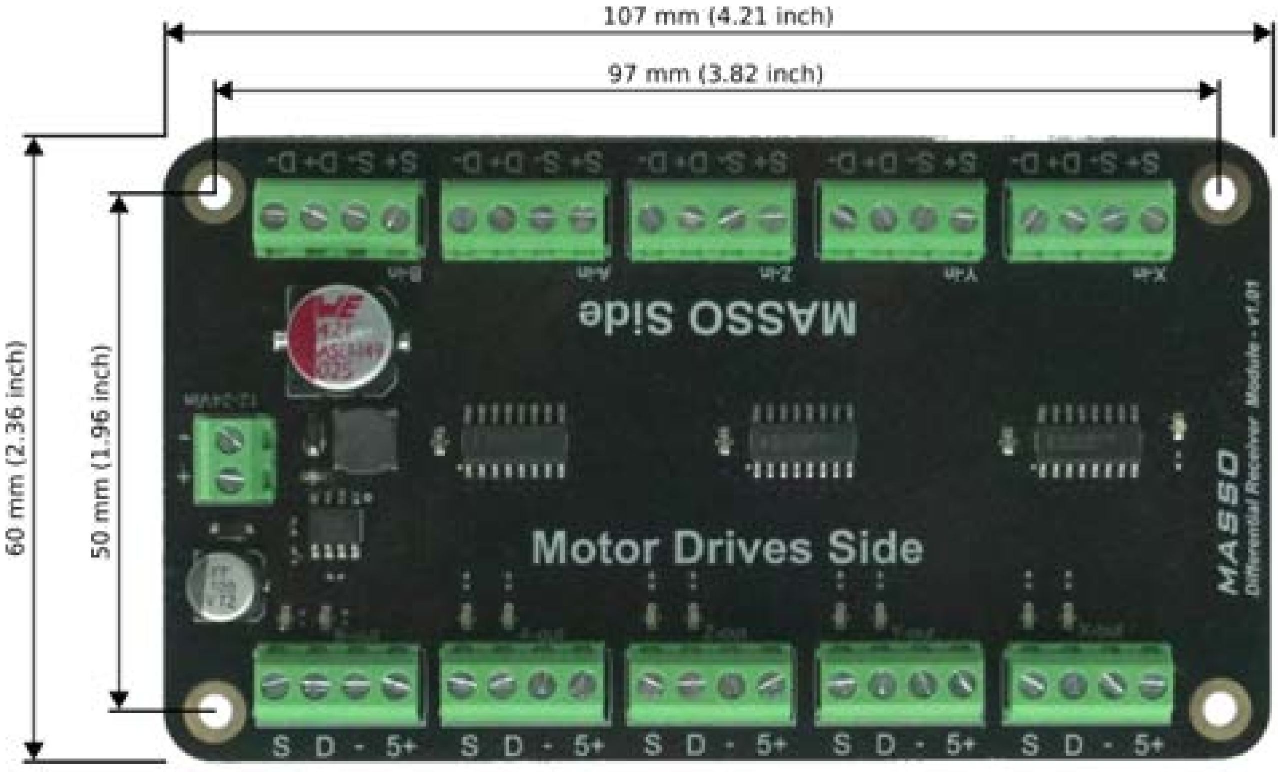
Wiring example with a common positive signal

The below diagram shows a **GECKO G340** drive that takes TTL signals with a common positive. The MASSO Differential Receiver Module provides 5 volts and no external 5 volt power supply is required.

Mount the Differential receiver close to the drives.


MASSO G3
Model: G3-5A1SI
MASSO Side
Motor Drives Side
12 to 24v
Power Supply
(-)
(+)
POWER GND
18 TO 80VDC
ARMATURE -
ARMATURE +
ERR/RES
ENC GND
ENC 5VDC
CHANNEL A
CHANNEL B
DIR
STEP
COMMON
GECKODRIVE
G340 DC SERVODRIVE

Mounting and Mechanical Data

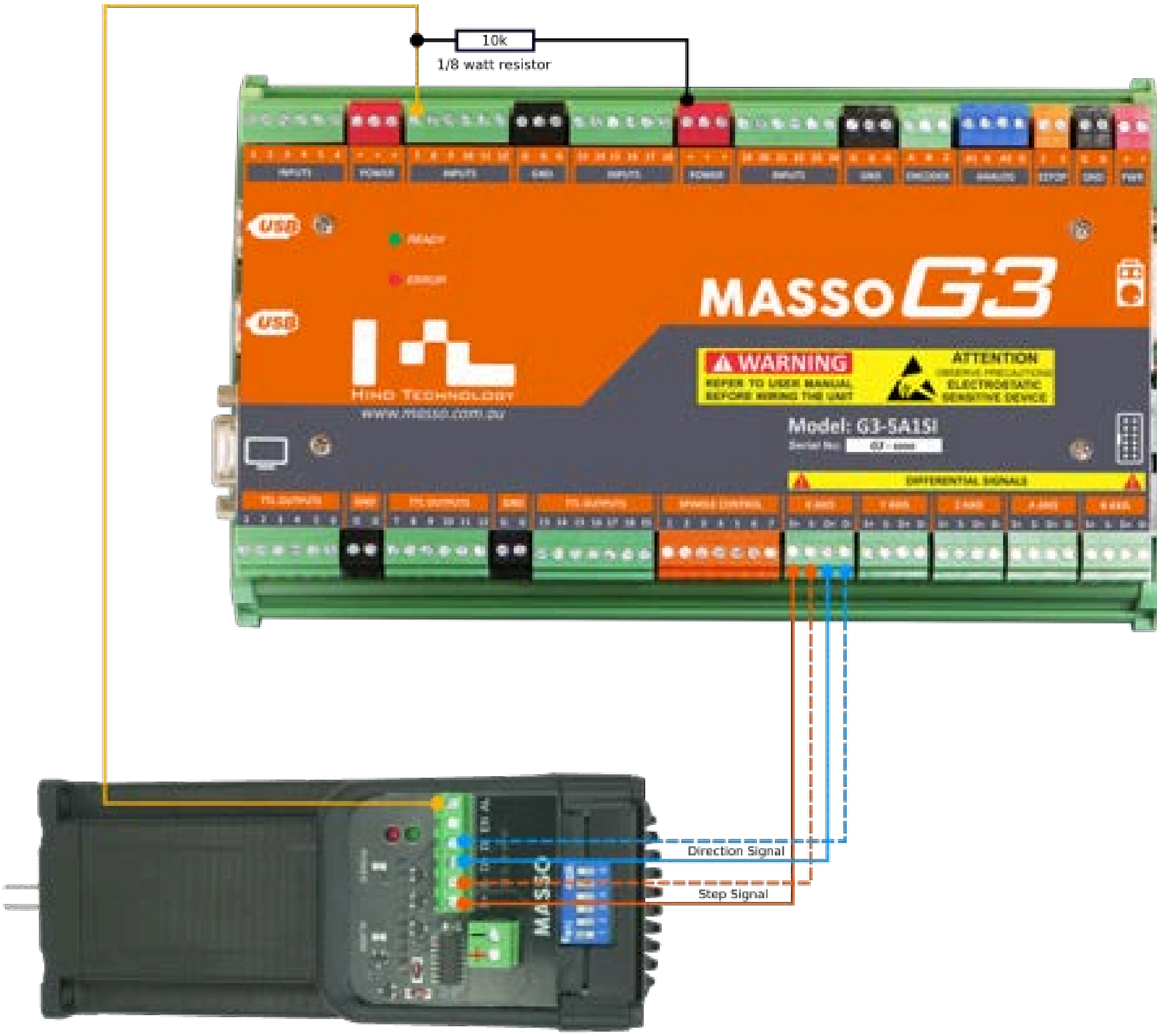


14.4.2. MASSO Closed Loop Stepper Motors

Wiring instructions

The MASSO Closed Loop Steppers require the following signals:

- **Differential output signals for STEP and DIRECTION -** These signals are directly provided by the MASSO G3 controller on all 5 axis outputs.
- **Enable signal -** A 5v to 24v signal is required to enable the motors, this signal can be provided by a relay.
- **Alarm signal -** An alarm signal output is provided by the motor to notify the controller if the motor is in an alarm state. Ensure you install the 10K pull up resistor as shown below. This input should not be inverted and should show Low when there is no alarm on MASSO. Each motor alarm input requires it's own resistor.
- **Power -** 24VDC to 36VDC.
- **Current -** 2Nm model can draw up to 3.5 Amps.
- **Current -** 3Nm model can draw up to 4 Amps.



INFORMATION: Use Shielded twisted pairs between MASSO and the Motor for the Step and direction differential signals. This will provide the greatest noise immunity. Ensure that the shield is connected to the ground at the MASSO end only. Do not ground the shield at both ends or you will create a ground loop. AWG 24 (0.2mm²) to AWG 22 (0.3mm²) is suitable for the signal wires. Ensure the wires are multi-stranded and twisted.

Power

The MASSO closed loop stepper motor drive is powered by a 24 to 36 volts DC power supply.

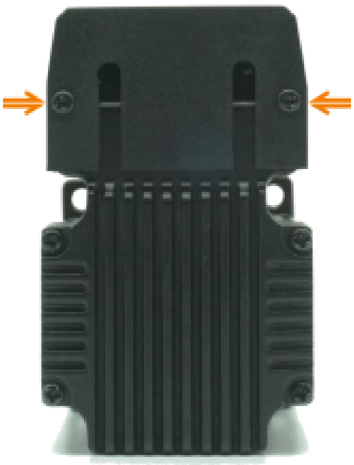
The power connector requires a minimum conductor size of 0.75mm². The power connector terminal will accept a wire up to 1.5mm².

- **2Nm** model can draw up to 3.5 Amps.

- **3Nm** model can draw up to 4 Amps.

Information: The -ve of the MASSO Power supply and the -ve of the Motor power supply must be connected together to form a common ground or the Enable and Alarm signals will not work correctly. Connect the power supply negatives at the main power distribution point. **Do not use the Black GND terminals on MASSO for this purpose.**

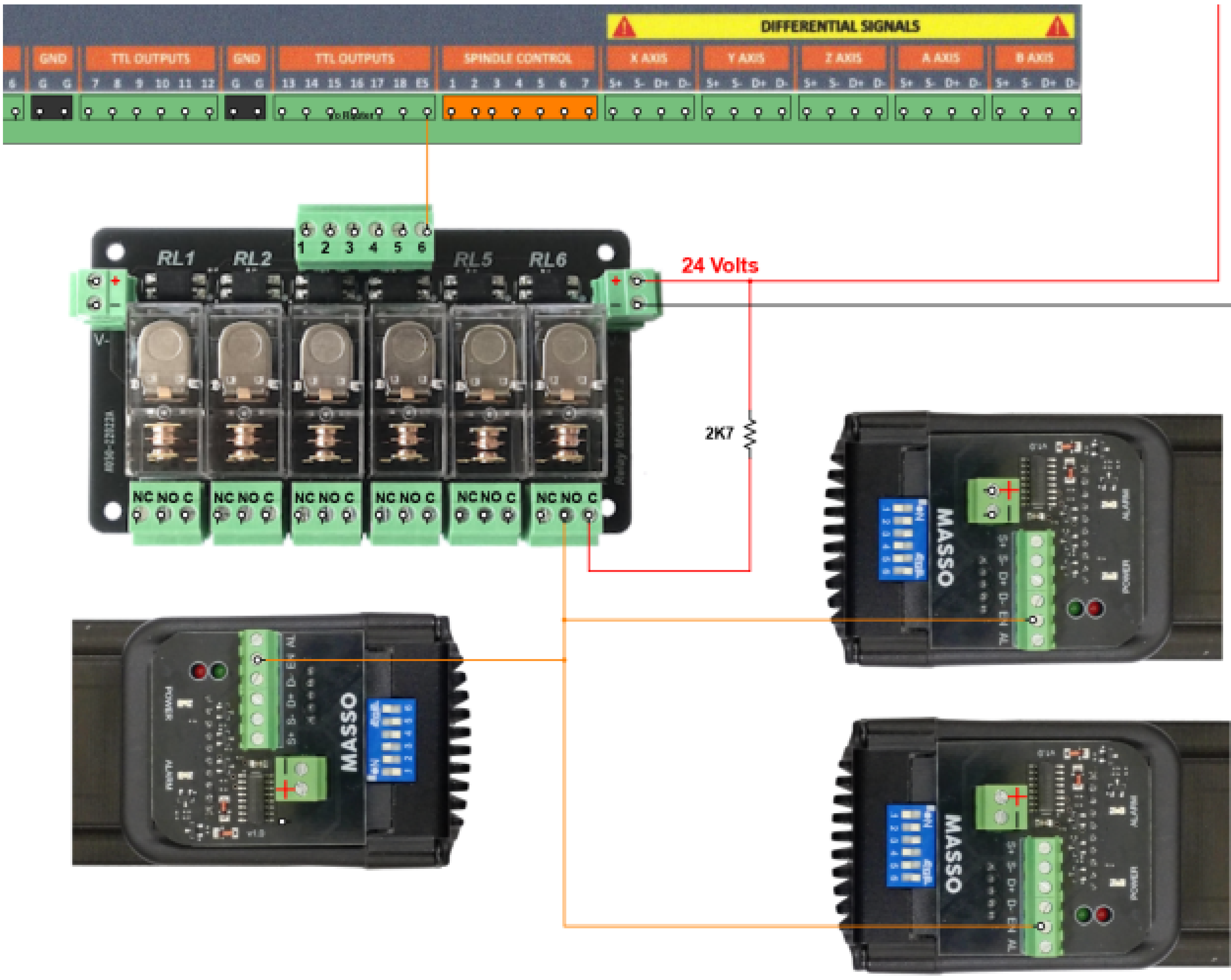
CAUTION: Observe the correct polarity when connecting the power to the MASSO closed loop stepper motor. Incorrect polarity will damage the drive.



Open the marked rear screws to open cable cover

Connecting the Motor Enable

- To enable the stepper motor a 5 to 24-volt signal is required.
- Normally this would be provided through an Estop relay which would disconnect the signal when the Estop button is pressed.
- It is suggested that this voltage be supplied via a resistor of suitable value as it is only a logic level signal and the resistor will limit fault current in case it accidentally comes into contact with the ground. A 2.7K 1/4 watt resistor is a good choice for this task.
- If the Enable signal does not work check that the Motor power supply and the MASSO power supply share a common ground.



Setting Up Motor Resolution

- The MASSO closed loop stepper motor uses a built in optical encoder to track position.
- Resolution is set using dip switches 1 to 4 on the motor.

WARNING: Only change the switch settings when the motor is powered off.

CAUTION: Switch 5 must be set to OFF position.

INFORMATION: Use switch 6 or settings in the MASSO F1 screen to invert motor rotation direction.

RESOLUTION SETTINGS

S1	S2	S3	S4	Pulses/Rev
ON	ON	ON	ON	400
OFF	ON	ON	ON	800
ON	ON	ON	OFF	1,000
ON	OFF	ON	ON	1,600
OFF	ON	ON	OFF	2,000
OFF	OFF	ON	ON	3,200
ON	OFF	ON	OFF	4,000
OFF	OFF	ON	OFF	5,000
ON	ON	OFF	ON	6,400
ON	ON	OFF	OFF	8,000
OFF	ON	OFF	OFF	10,000
OFF	ON	OFF	ON	12,800
ON	OFF	OFF	OFF	20,000
ON	OFF	OFF	ON	25,600
OFF	OFF	OFF	OFF	40,000
OFF	OFF	OFF	ON	51,200

Status LED & Alarms

The motors provide two visual indications of motor status.

- A **Green LED** indicates that the motor is powered.
- A **Red LED** indicates that the motor is in an alarm state.

Alarms can be caused by any of the below reasons:

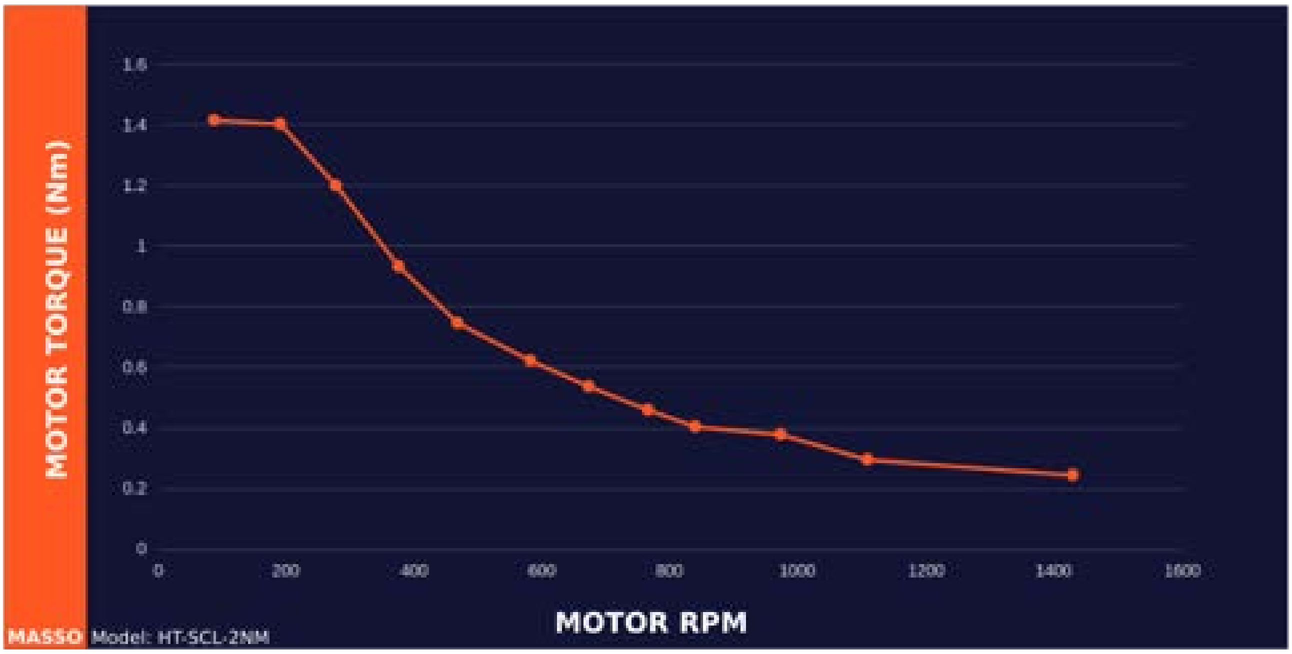
- The enable signal of 5v to 24v is not received by the motor.
- The motor received STEP signals that have acceleration or top RPM higher than the motor can support. This will also be affected by how much load is on the motor.
- The power applied to the motor is less or more than the motor's specifications.
- The current required to work under load is not enough.
- The motor is not able to complete the requested rotation due to external mechanical issues such as the machine axis hitting something or getting stuck.

For additional trouble shooting of the MASSO Closed loop stepper motor please see >>>HERE<<<

Torque Information

Stepper motors provide high torque at low RPMs but as the RPM increases the available torque reduces. The below graphs can be used for machine feed rate and torque calculations.

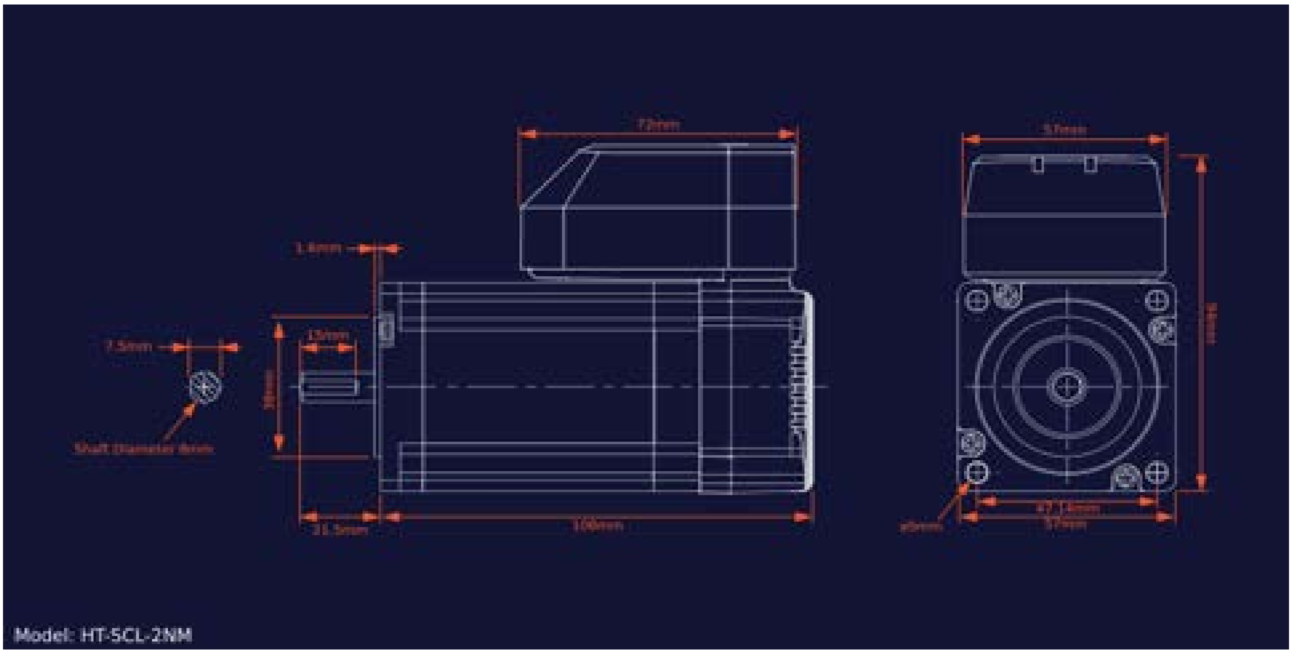
Model: HT-SCL-2NM with 2N·m maximum torque



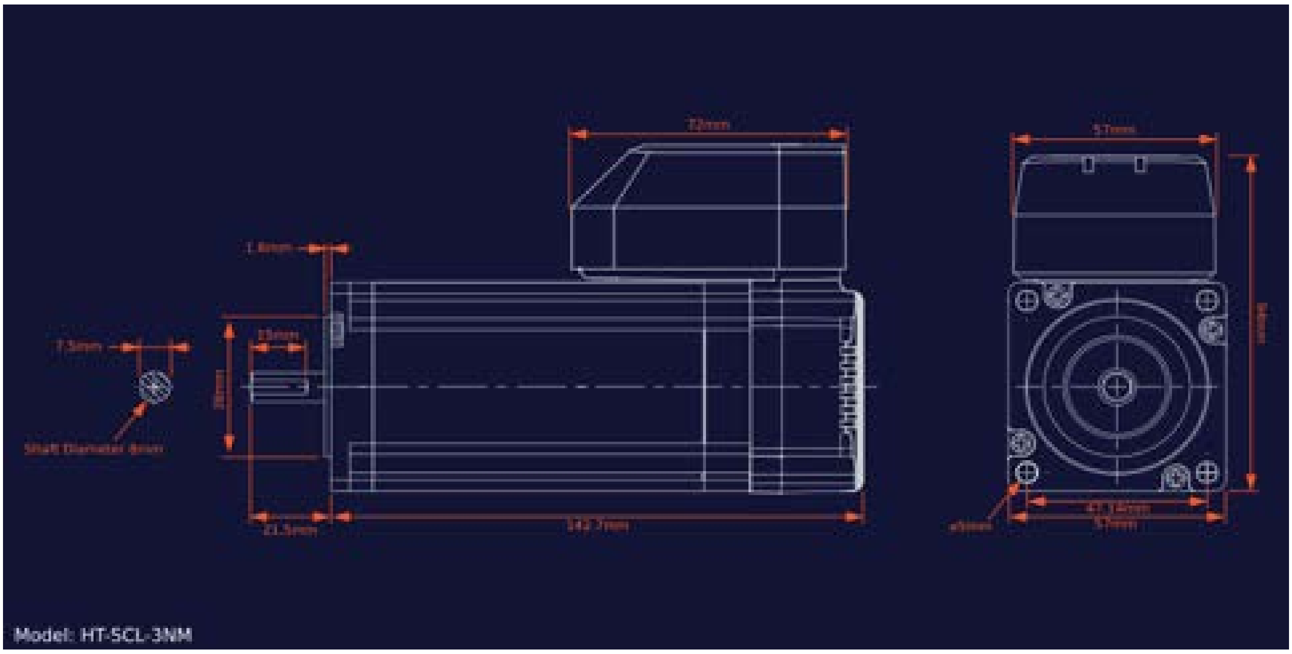
Model: HT-SCL-3NM with 3N·m maximum torque

Mechanical Data

Model: HT-SCL-2NM



Model: HT-SCL-3NM



Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

MASSO Closed Loop Stepper Motor - Episode 30

Read other subtopics below:

14.4.2.1) MASSO Closed Loop stepper Troubleshooting

14.4.2.1. MASSO Closed Loop stepper Troubleshooting

Permanent Alarm indication

If the Red LED is permanently lit on your motor

- The Red LED lights permanently when it looses steps and ca no longer recover.
- If an error occurs because of insufficient power available to drive the motor
- If the pulse rate exceeds the maximum that the motor can process.

In these cases repowering the motor will clear the alarm

If the Red LED is on permanently and repowering the motor does not clear the alarm LED

- Check the motor enable is receiving the enable signal from MASSO.
- With a meter check the voltage between the -ve of the motor and the EN input of the motor. You should see a voltage of 5 to 24 volts and if you do not see this voltage you may have a broken wire.

The only thing needed to clear the Alarm LED on power up is the enable signal.

If you get a motor alarm but the motor does not show an alarm indication

- Check the motor alarm input on the MASSO F1 settings screen.
- The Motor alarm input should show Low when there is no alarm indication on the motor.
- The motor alarm input must not be inverted.
- If there is no alarm LED on the motor but the Alarm input is showing High, check the AL wire between the motor a the MASSO input as it is fail safe and it there is a break in the wire the alarm input ill go high.
- If this is a new installation ensure that the 10K resistor is installed and the motor power supply negative rail ic connected to the negative of the MASSO Power supply.

Flashing LED Indications

Closed-loop stepper motor, position out of tolerance fault analysis and treatment

Phenomenon: The red light flashes five times at 08 second intervals and then repeats after 2 seconds

Reason 1: Check the wiring, the machine line and the encoder line, whether there is a wrong connection or poor contact.

Solution: Make sure that the wiring is in good contact and defined correctly.

Reason 2: Check the speed and acceleration time, if the speed is too fast and the acceleration time is too short, it may cause an alarm.

Solution: Appropriately reduce the speed and reduce the acceleration speed.

Reason 3: Check the structure and load, whether the structure is stuck, whether the load is too heavy, which may cause an alarm.

Solution: Adjust the structure to ensure smooth travel, and reduce the drive load test. Check the machine for binding on the faulty axis.

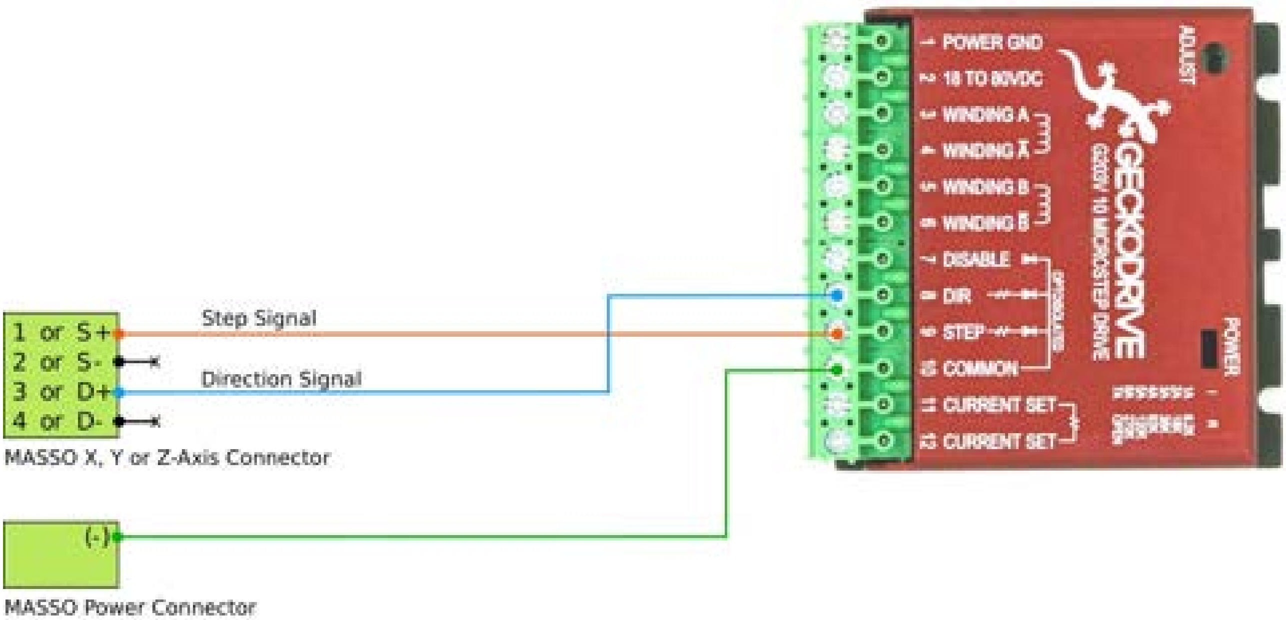
Reason 4: The above is no problem, replace the motor or driver.

Solution: Replace the product of the same model and do the exclusion test. This is best done by swapping the motor with another of the same type on the machine and see if the fault moves axis or stays on the same axis. If the fault stays on the same axis there is a mechanical problem and if the fault moves to the new axis then the motor is at fault.

14.4.3. Gecko 203V

Gecko Drive 203V wiring example

CAUTION: The **“x”** sign means do not connect.

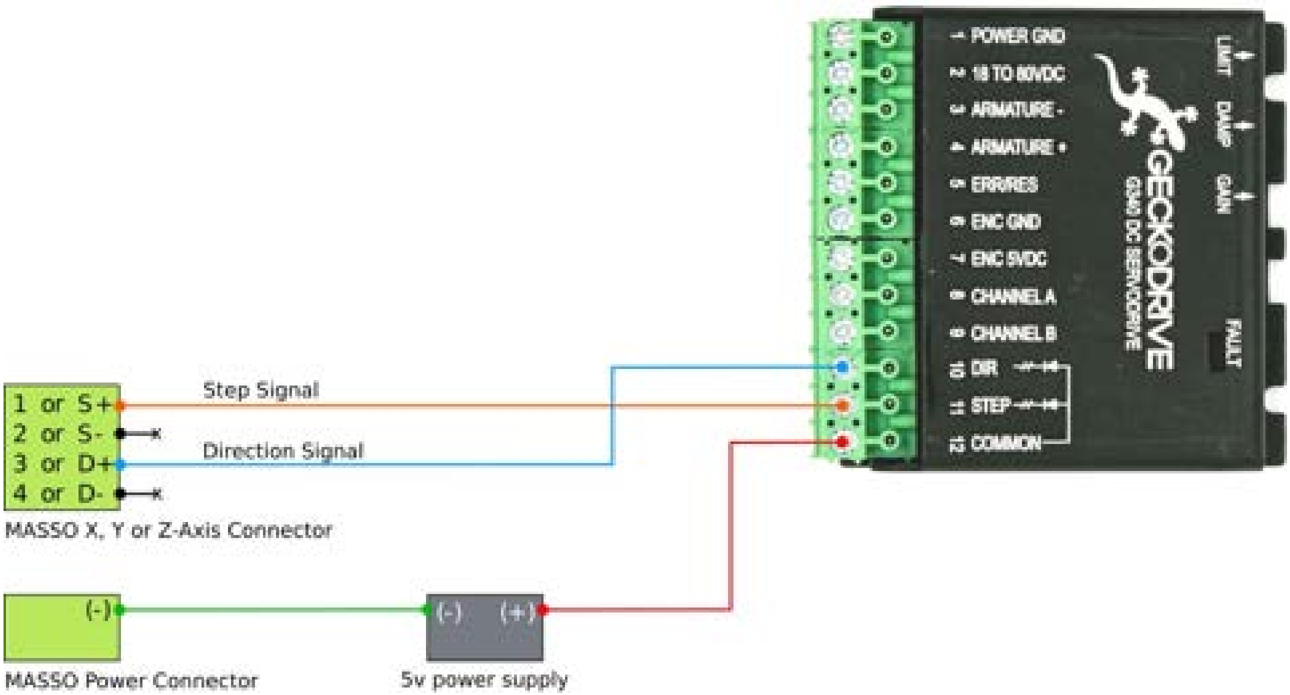


14.4.4. Gecko G340

Gecko Drive G340 wiring example

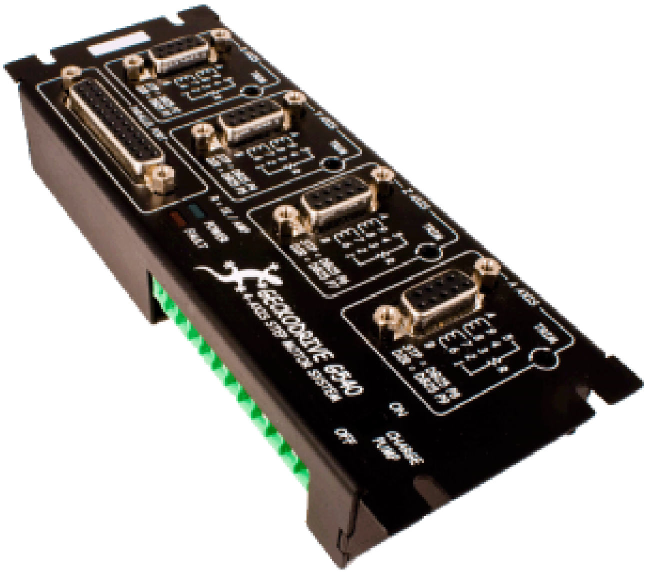
INFORMATION: As the Gecko G340 uses a common positive signal, the COMMON pin must be connected to a positive power supply and the negative of both power supplies must be connected togteher to complet the ciruit.

CAUTION: The **"x"** sign means do not connect.

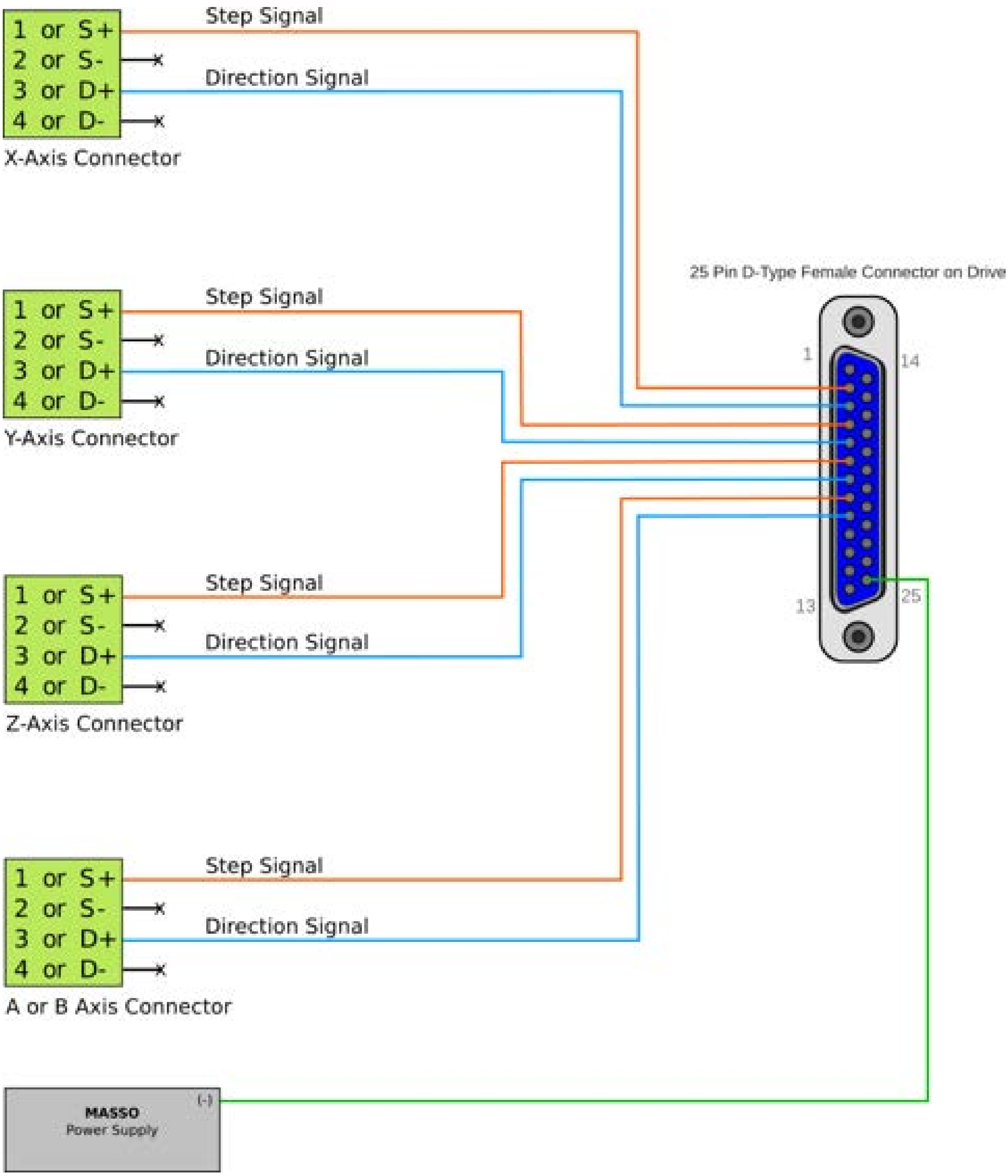


14.4.5. Gecko G540

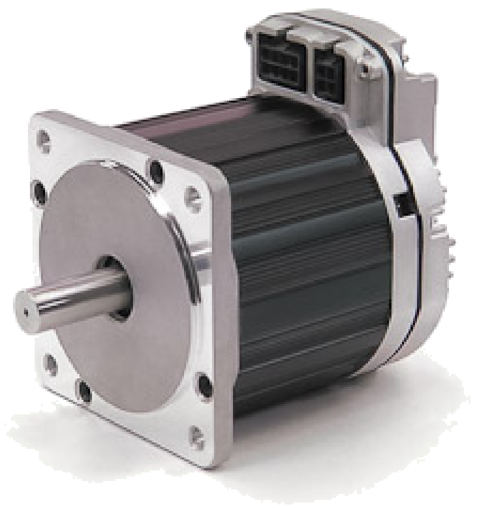
Gecko Drive G540 (4-AXIS) wiring example



CAUTION: The **"x"** sign means do not connect.

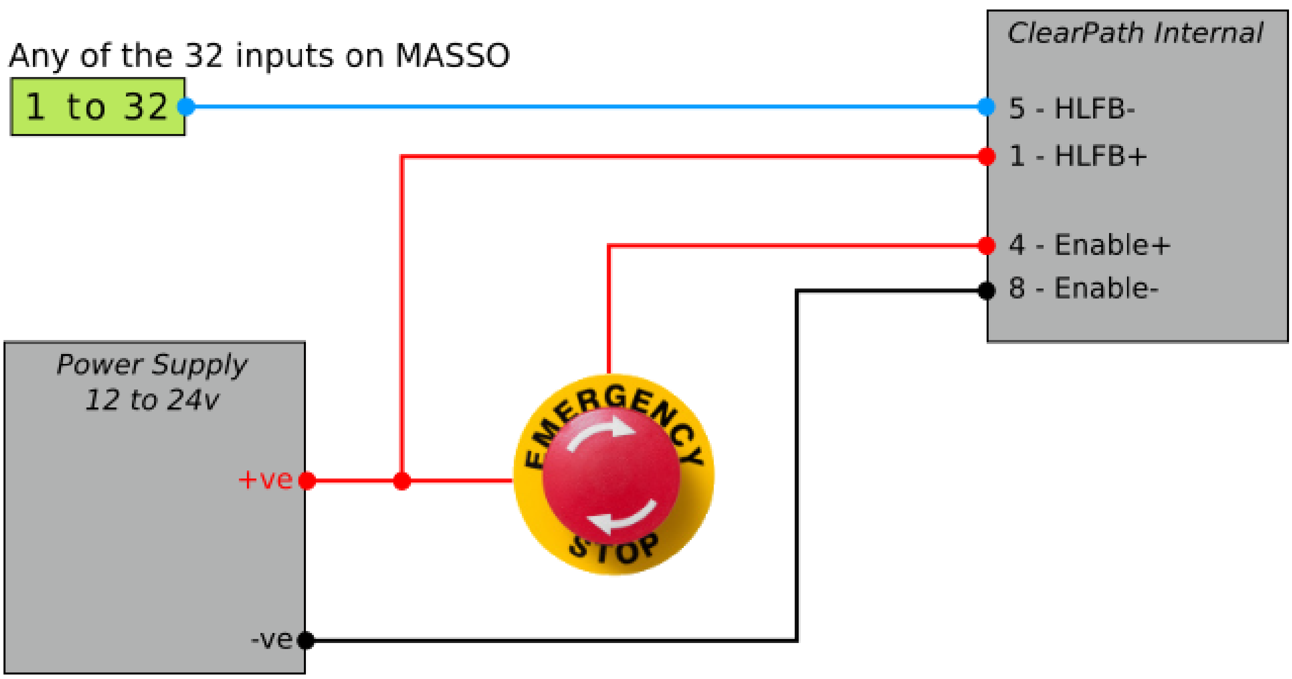

Step Signal
Direction Signal
1 or S+
2 or S-
3 or D+
4 or D-
X-Axis Connector
Step Signal
Direction Signal
1 or S+
2 or S-
3 or D+
4 or D-
Y-Axis Connector
Step Signal
Direction Signal
1 or S+
2 or S-
3 or D+
4 or D-
Z-Axis Connector
Step Signal
Direction Signal
1 or S+
2 or S-
3 or D+
4 or D-
A or B Axis Connector
25 Pin D-Type Female Connector on Drive
1
14
13
25
MASSO
Power Supply
(-)

14.4.6. Teknic - ClearPath

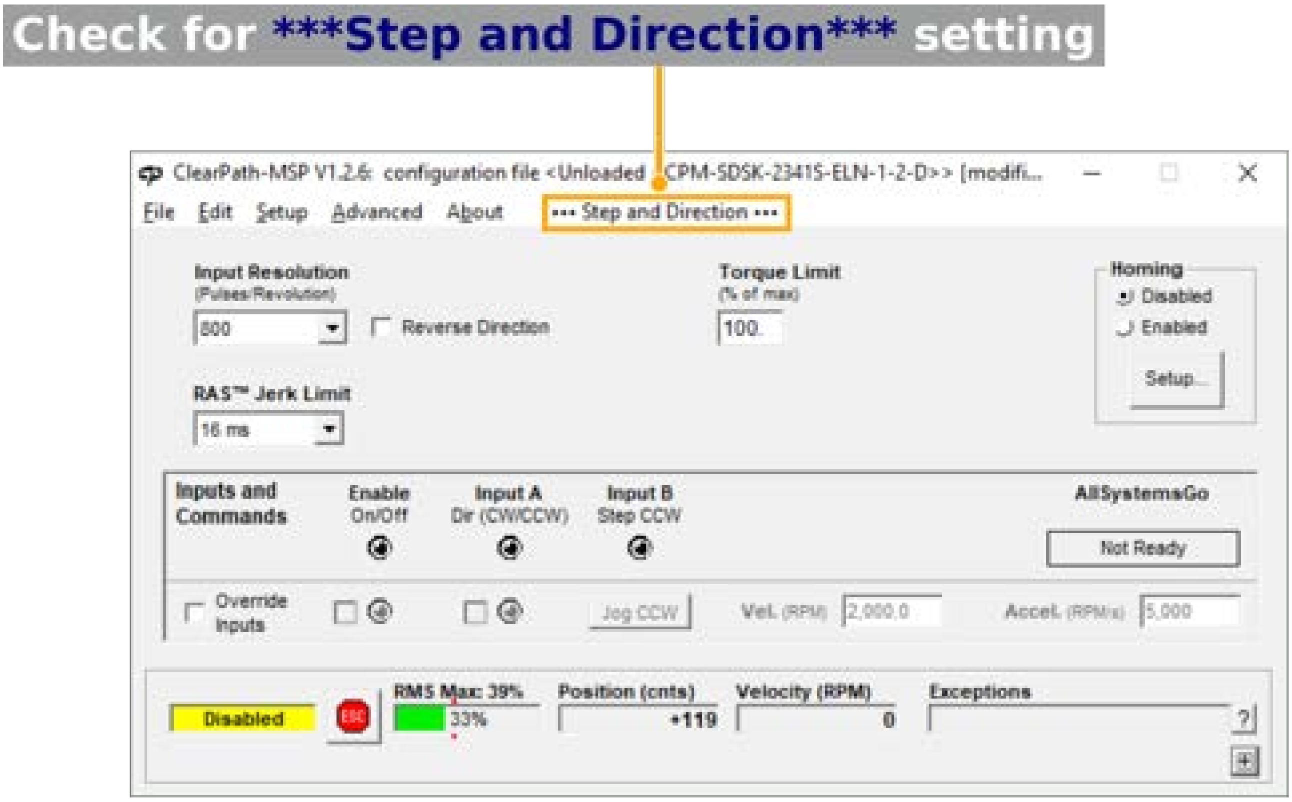


[Please refer to Teknic's ClearPath User Manual for details]

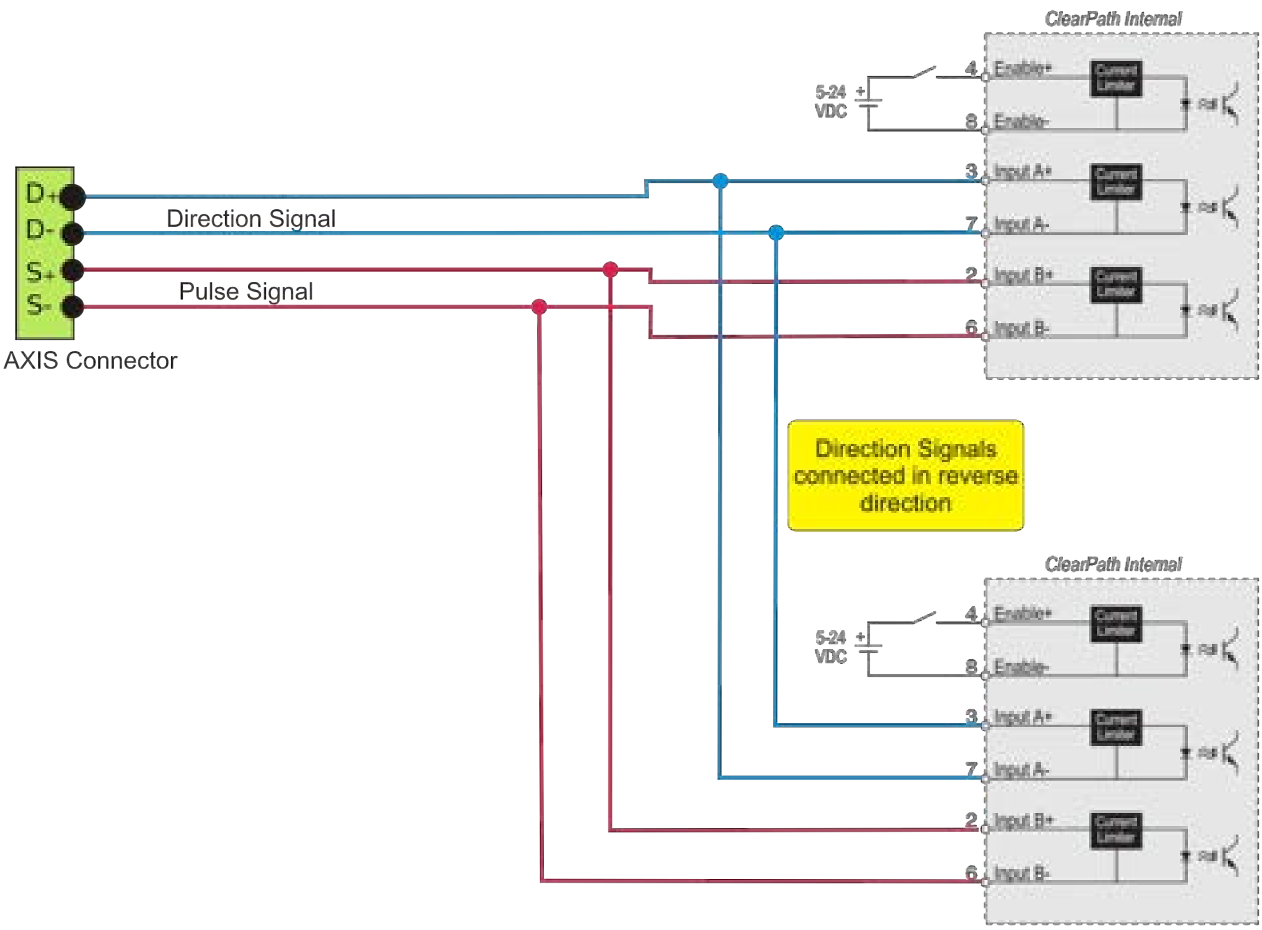
Teknic ClearPath wiring example



INFORMATION: Using the ClearPath software please check that the motor is configured to Step and Direction mode as shown below.



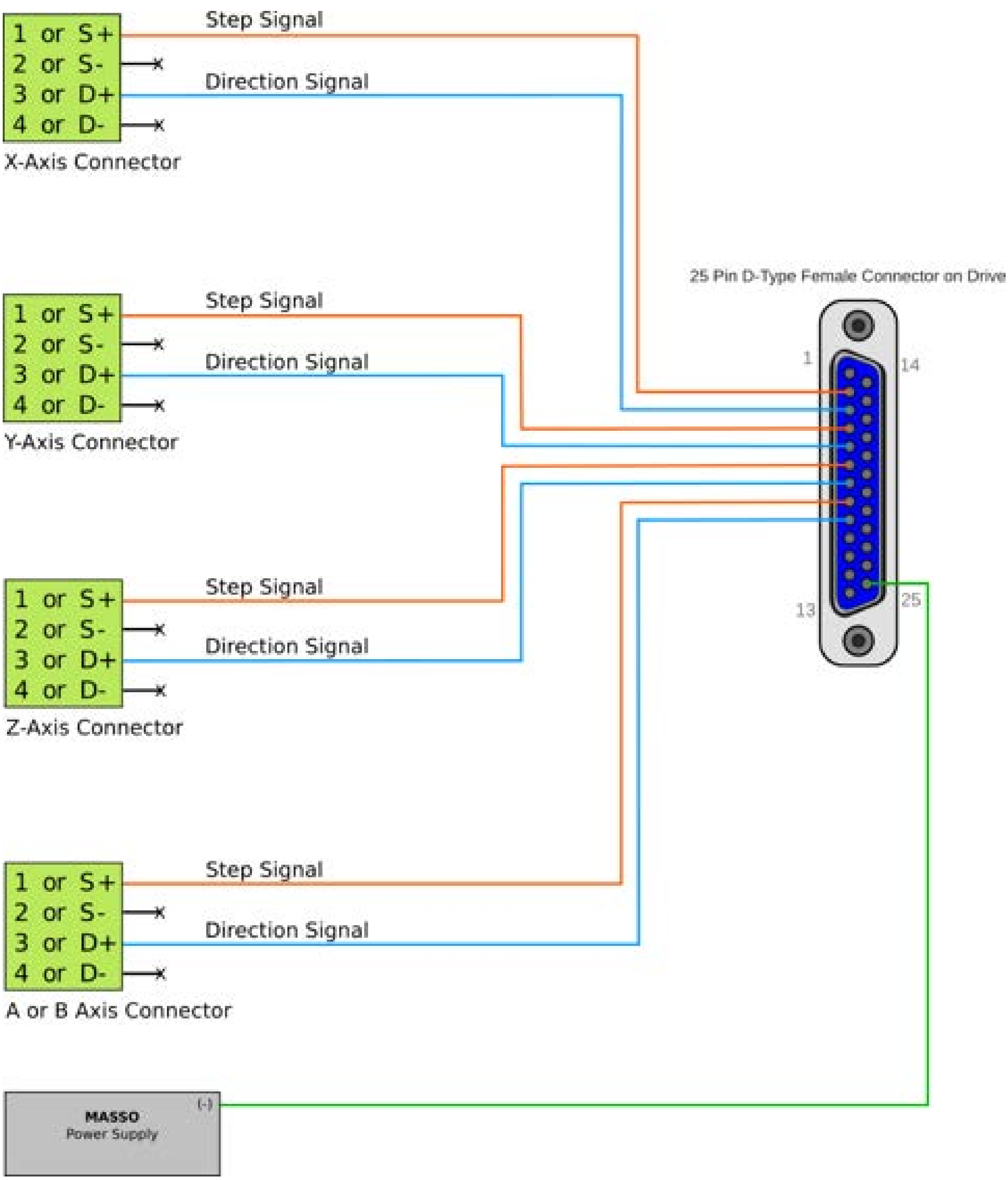
INFORMATION: Two motors on the same axis can be slaved in parallel by wiring the STEP and DIRECTION signals in parallel as shown below. As in most cases to run one of the motors in the opposite direction the DIRECTION +ve & -ve signal wires can be swapped on one of the motors.


ClearPath Internal
5-24 VDC
4 Enable+
8 Enable-
3 Input A+
7 Input A-
2 Input B+
6 Input B-
D+
D-
S+
S-
Direction Signal
Pulse Signal
AXIS Connector
Direction Signals connected in reverse direction
ClearPath Internal
5-24 VDC
4 Enable+
8 Enable-
3 Input A+
7 Input A-
2 Input B+
6 Input B-

14.4.7. Leadshine MX4660

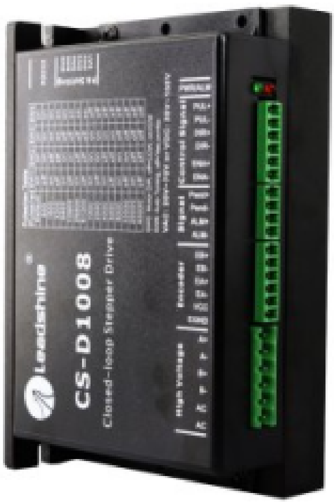
Leadshine Drive MX4660 wiring example

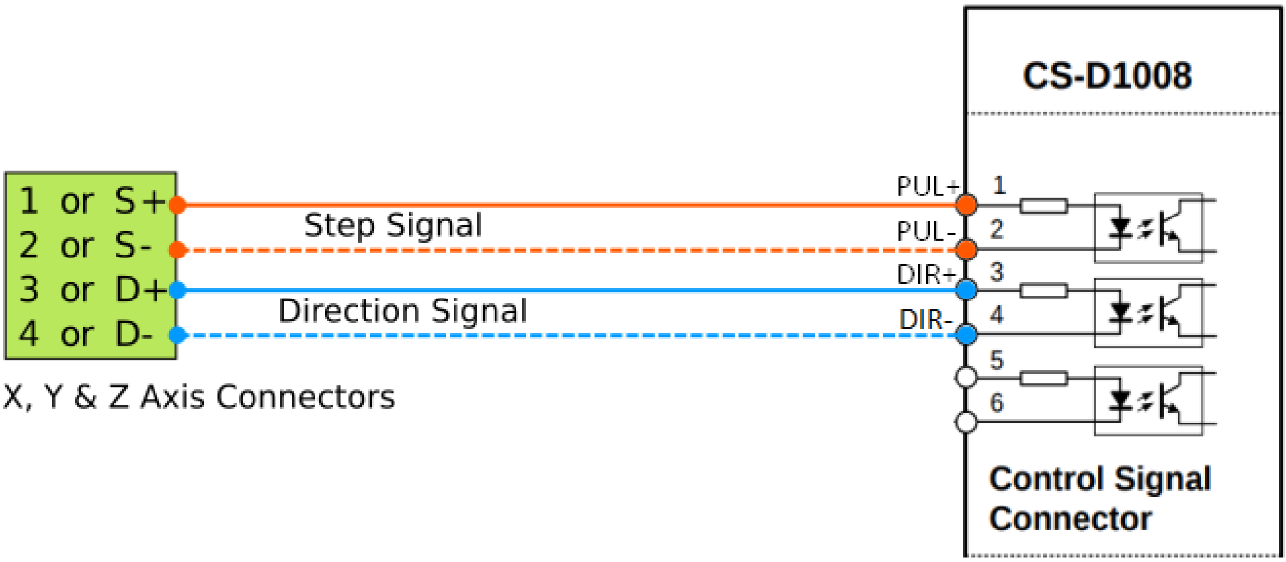
CAUTION: The **“x”** sign means do not connect.


1 or S+
2 or S-
3 or D+
4 or D-
Step Signal
Direction Signal
X-Axis Connector
1 or S+
2 or S-
3 or D+
4 or D-
Step Signal
Direction Signal
Y-Axis Connector
1 or S+
2 or S-
3 or D+
4 or D-
Step Signal
Direction Signal
Z-Axis Connector
1 or S+
2 or S-
3 or D+
4 or D-
Step Signal
Direction Signal
A or B Axis Connector
25 Pin D-Type Female Connector on Drive
1
14
13
25
MASSO
Power Supply
(-)

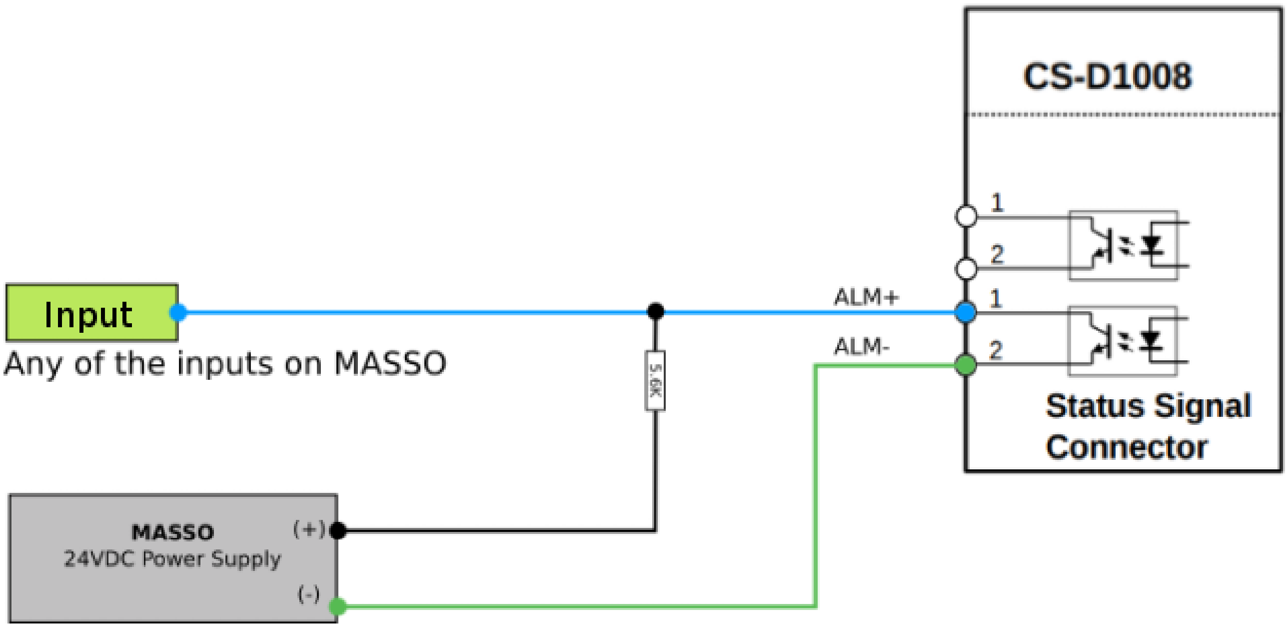
14.4.8. Leadshine CS-D1008

Leadshine Drive CS-D1008 wiring example



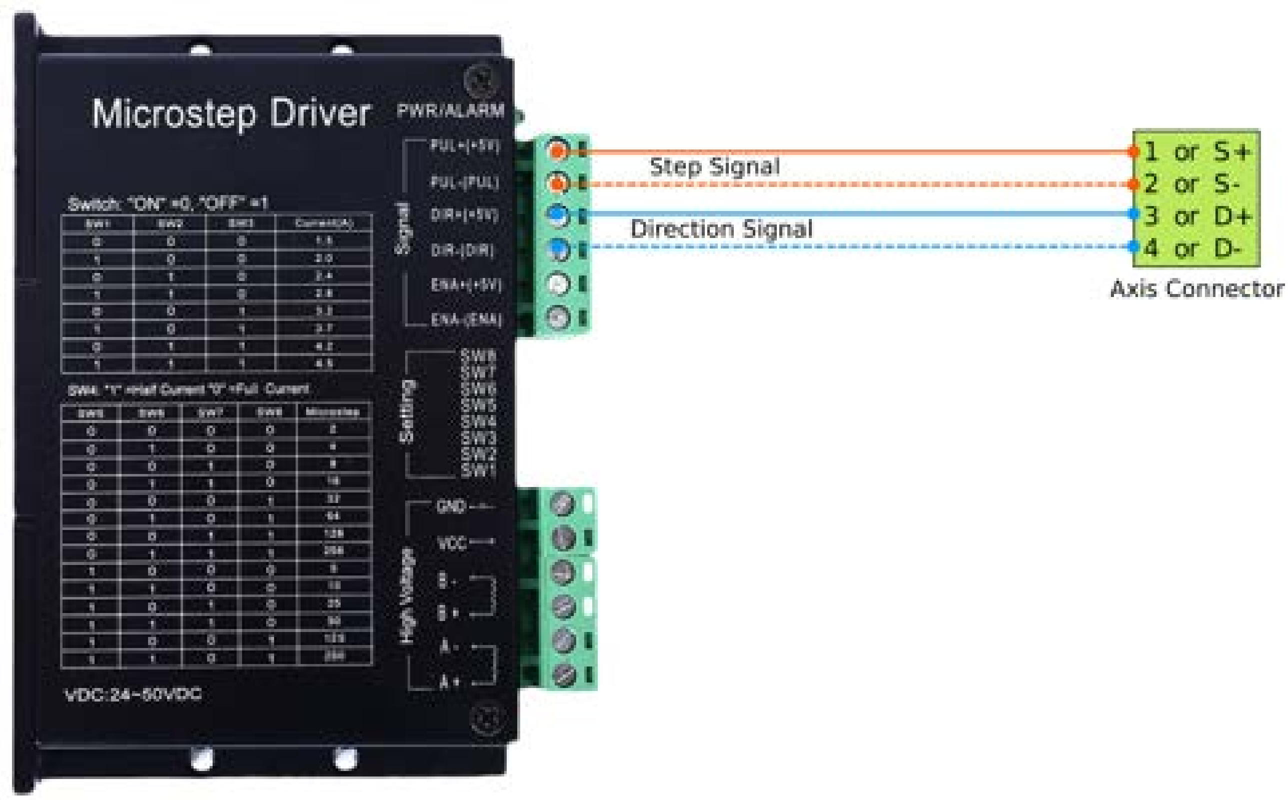


Drive alarm signal wiring


CS-D1008
1
2
1
2
ALM+
ALM-
Input
Any of the inputs on MASSO
5.6K
Status Signal
Connector
MASSO
24VDC Power Supply
(+)
(-)

14.4.9. Longs Motors

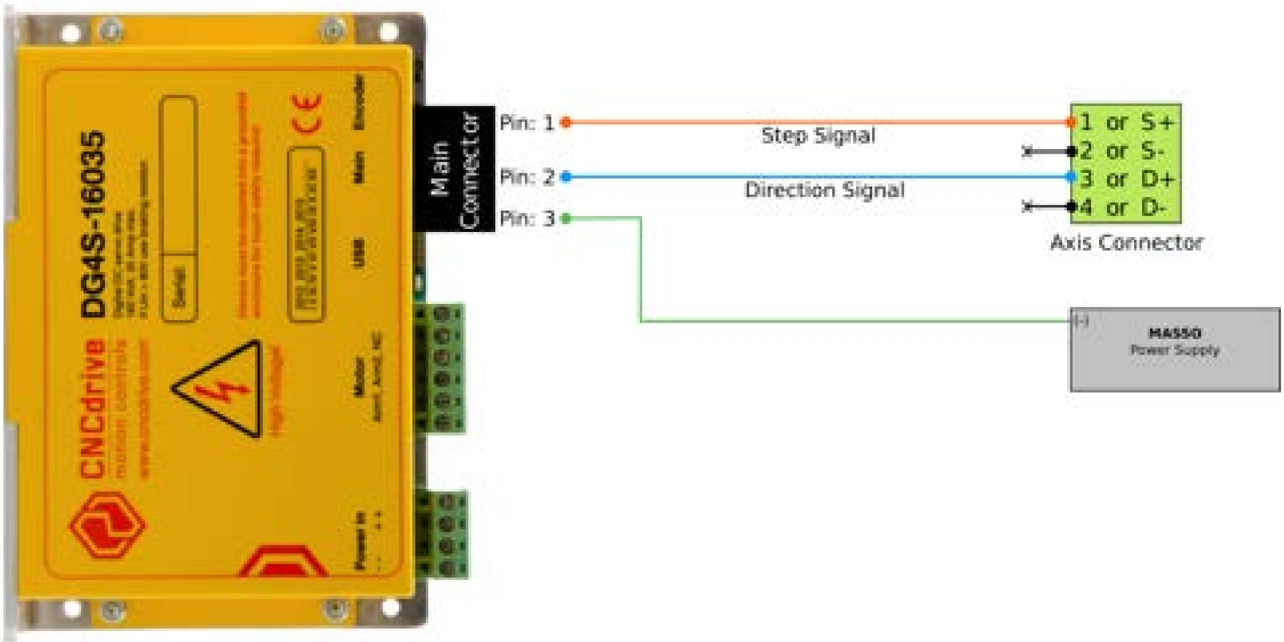
DM542A, DQ860MA wiring example



14.4.10. CNCdrive - DG4S-16035

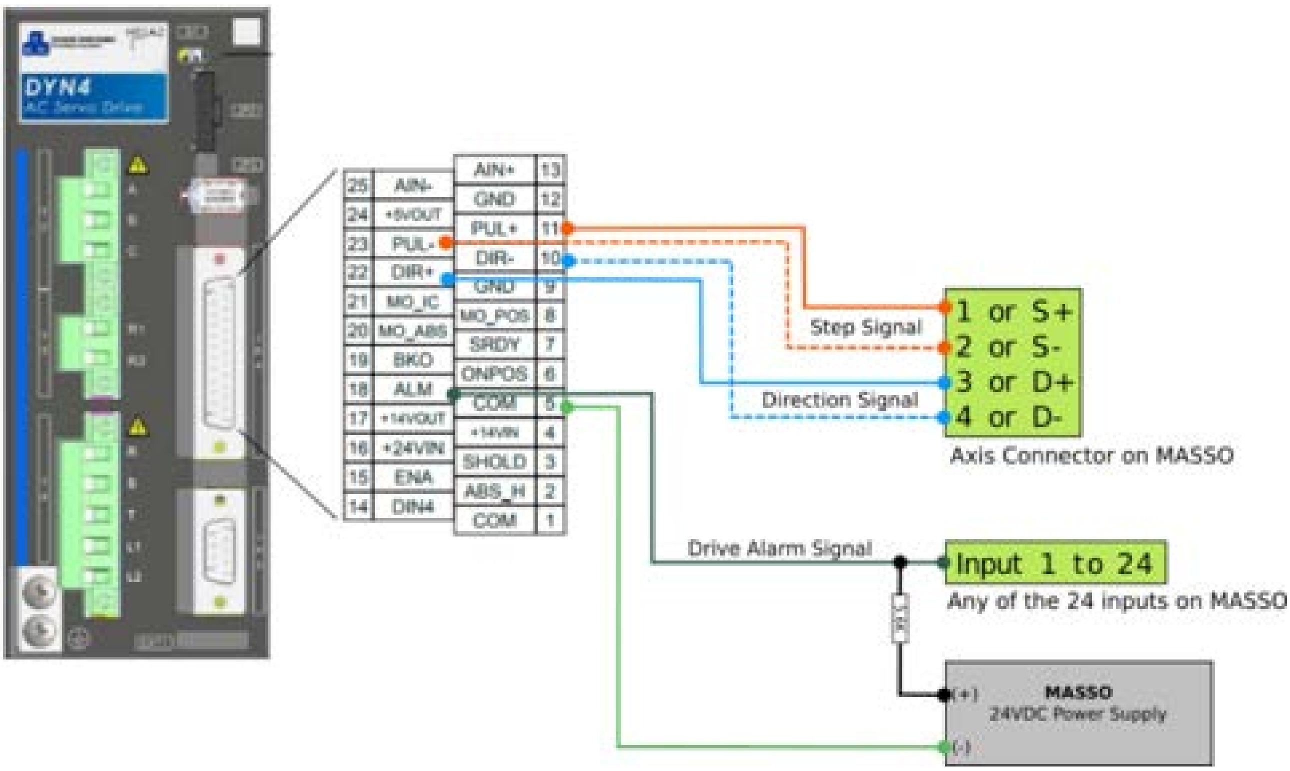
DG4S-16035 wiring example

> **CAUTION:** The “**x**” sign means do not connect.



14.4.11. DMM - Dynamic Motor Motion

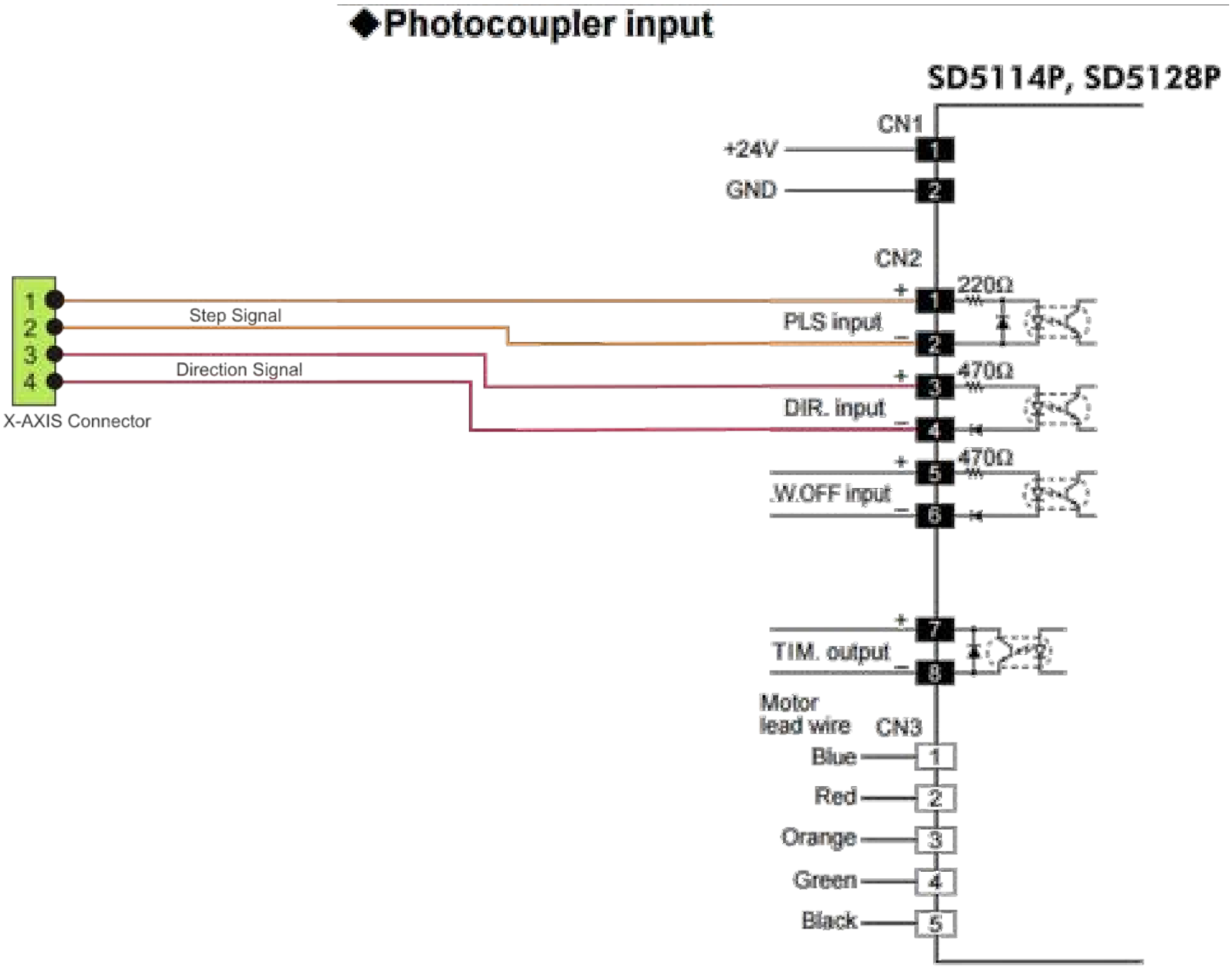
DMM DYN4 wiring example



> **Information:** The resistor value is for a 24vDC power supply. Resistor value should be changed if using a different power supply voltage.

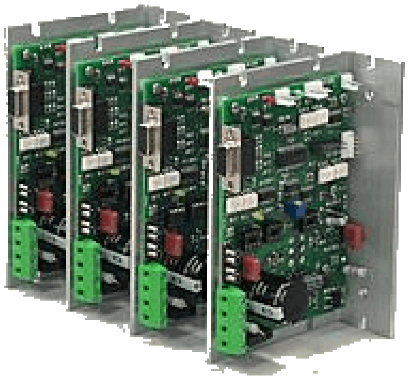
14.4.12. VEXTA

VEXTA SD51xx wiring example

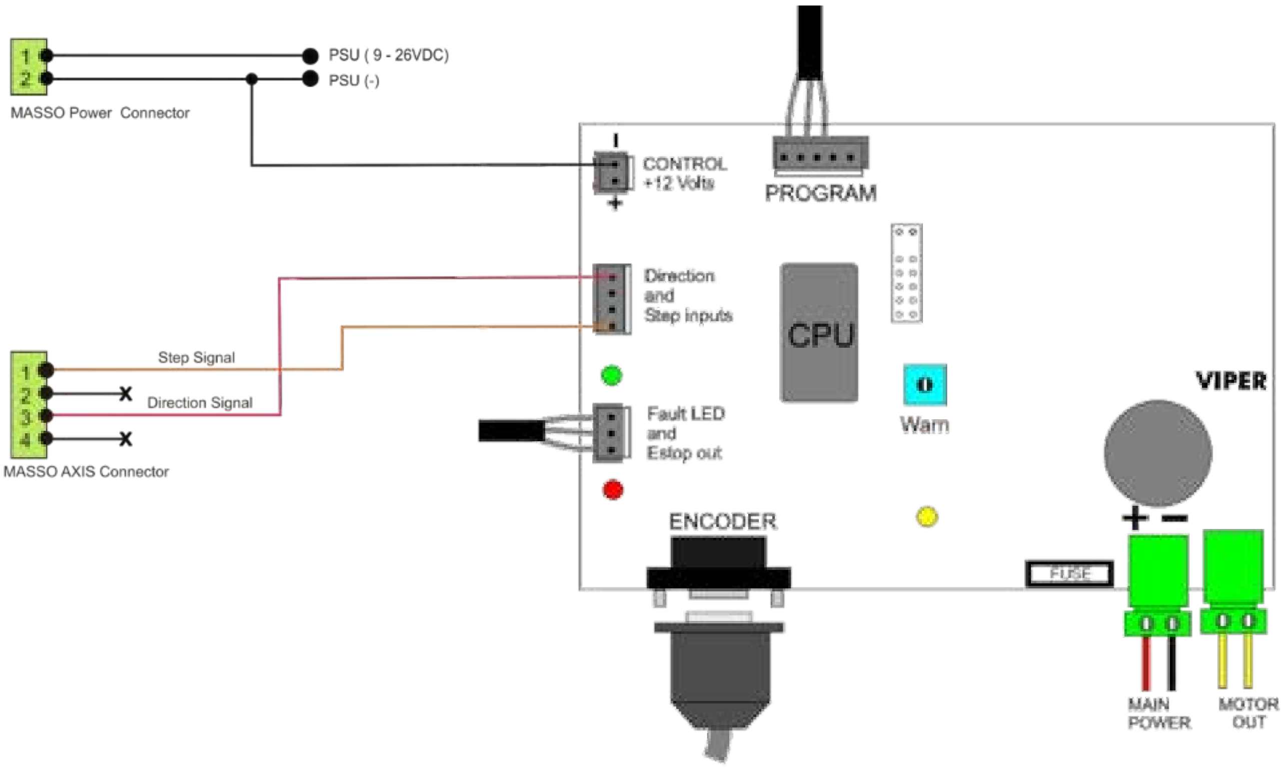


14.4.13. Viper

Viper 100F/200F wiring example

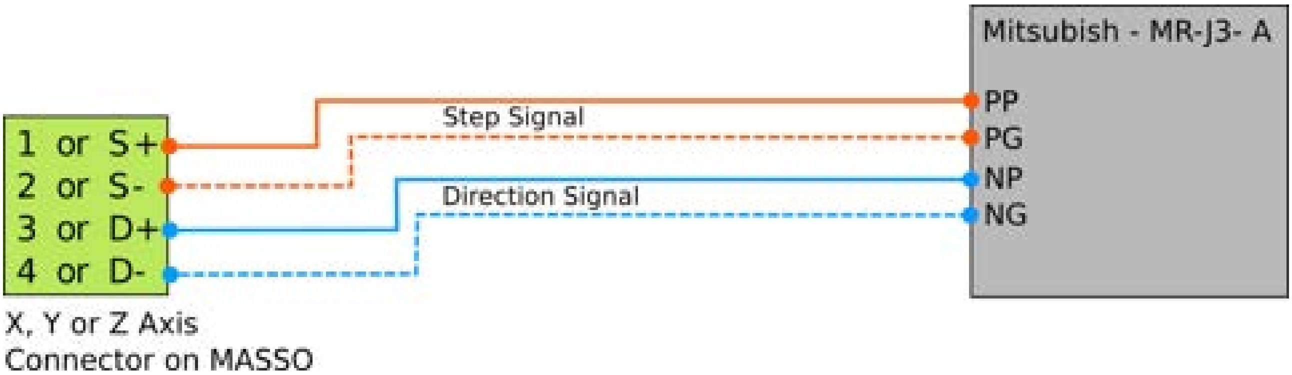


> **CAUTION:** The **“x”** sign means do not connect.

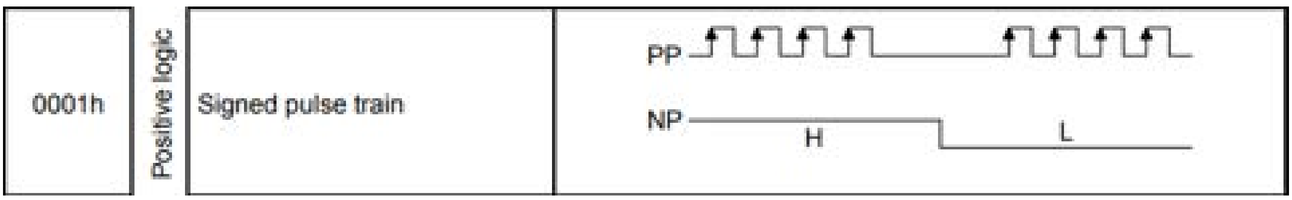


14.4.14. Mitsubishi - MR-J3

Mitsubishi - MR-J3 wiring example



INFORMATION: As per drive user manual set the PA13 parameter to 0001h to take Step(Pulse) and Direction signals.

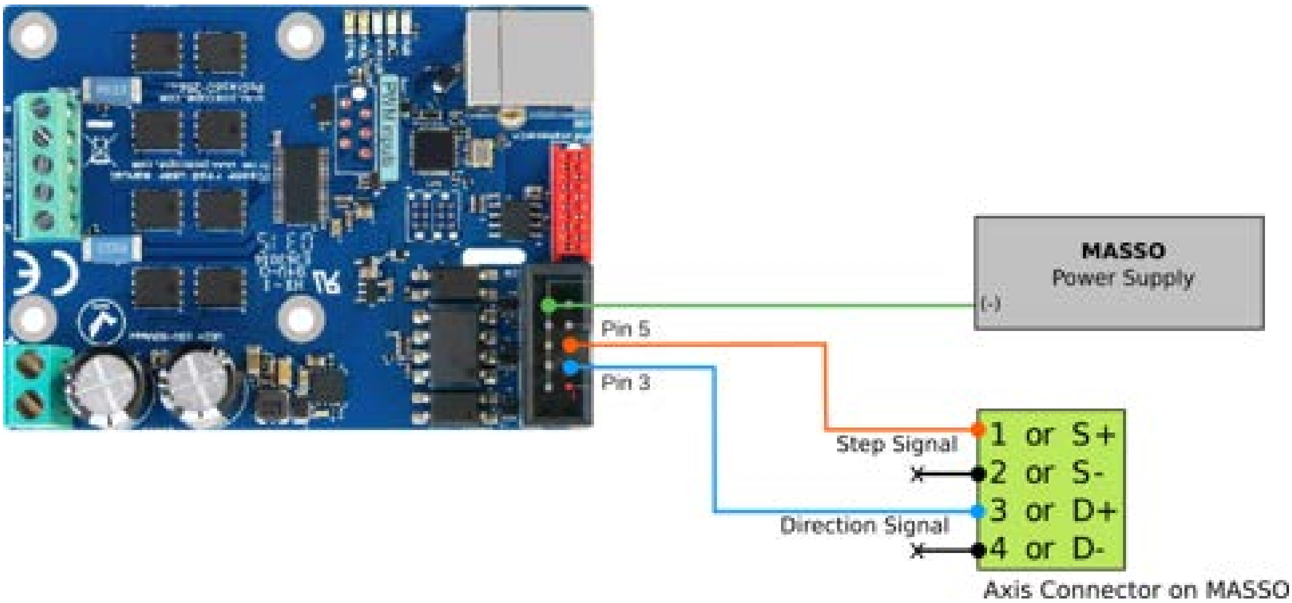


0001h	Positive logic	Signed pulse train	PP / NP (H, L)

14.4.15. PoStep60

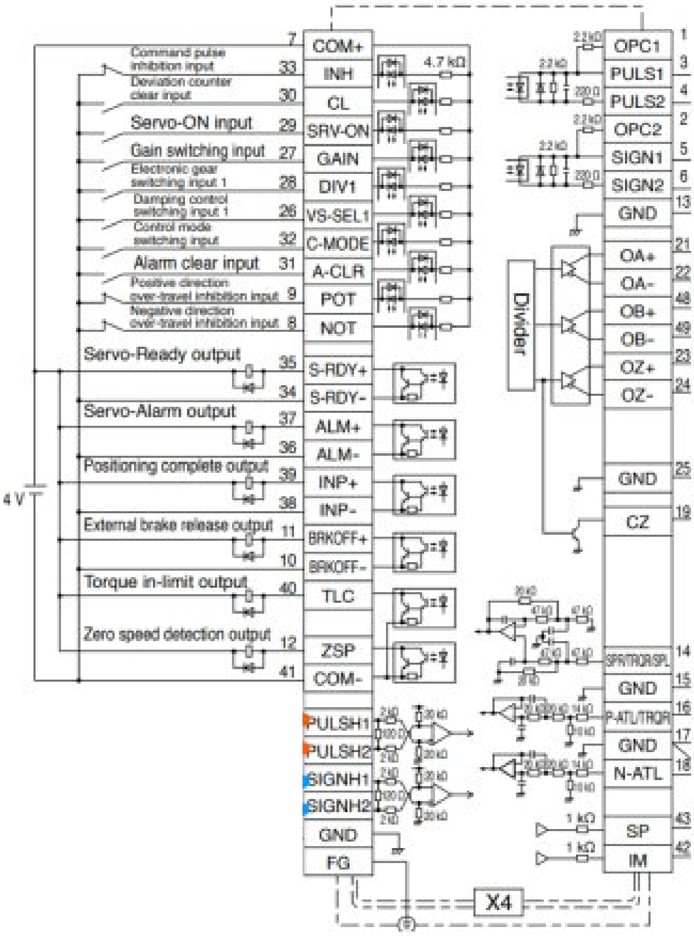
PoStep60 wiring example

> **CAUTION:** The “**x**” sign means do not connect.



14.4.16. Panasonic

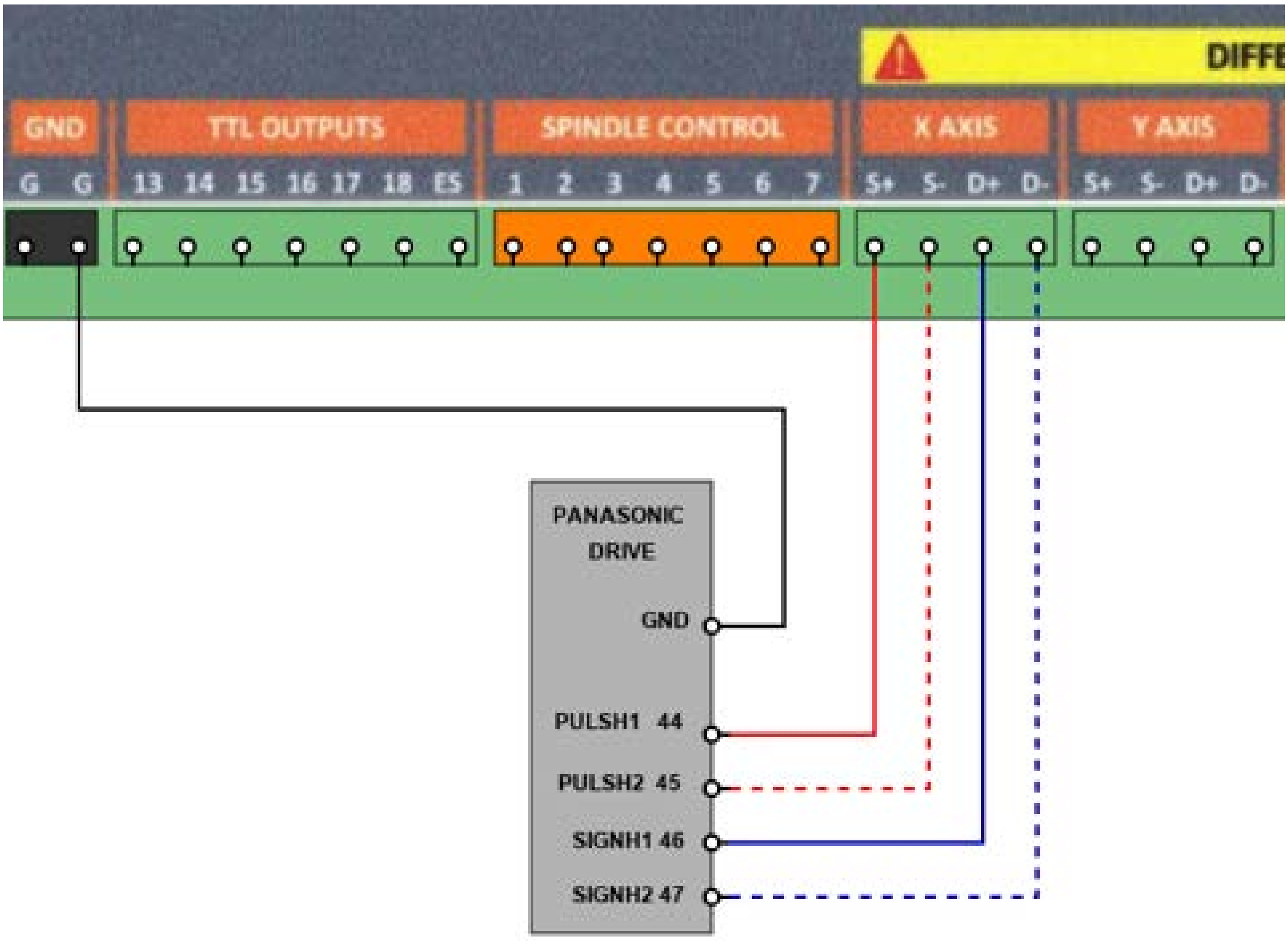
Panasonic - MCDHT3520 wiring example



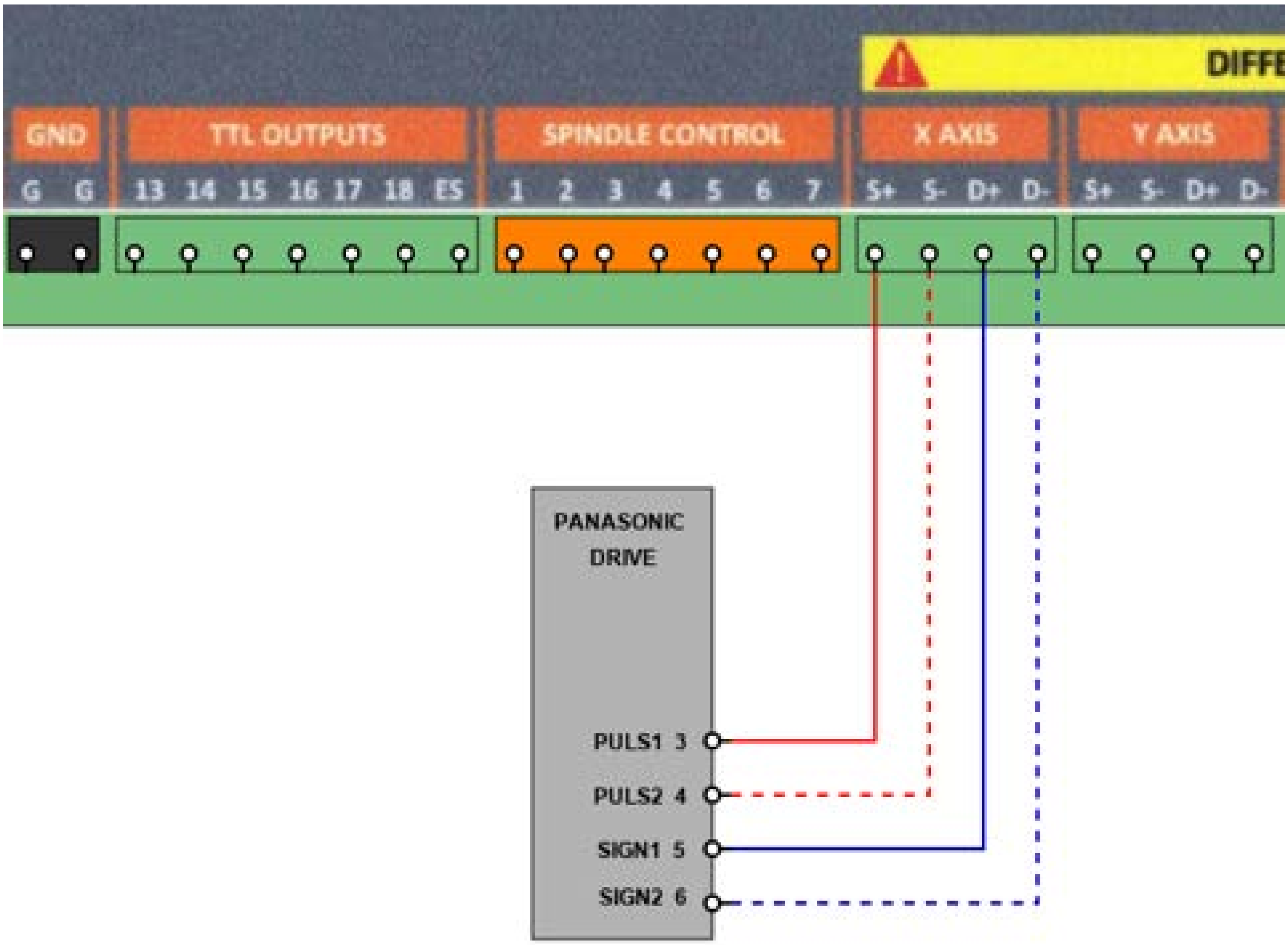
This Panasonic drive has 2 sets of PULS & SIGN inputs

- If using the Line receiver inputs you need to connect GND on the X4 connector of the drive to MASSO GND or you will get noise issues.
- This will most likely manifest as the drive randomly turning by itself.

- If using the optically isolated inputs no GND connection between MASSO and the drive is required.



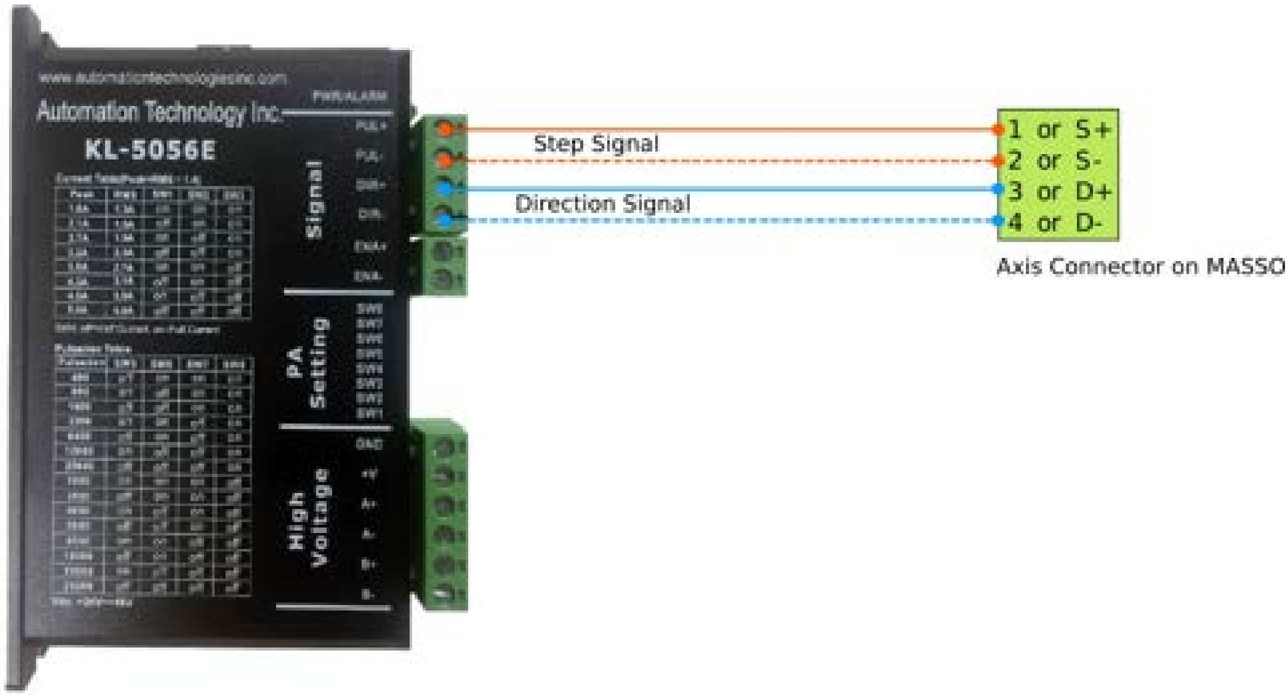
Connection using Line receiver inputs



Connection using Optical inputs

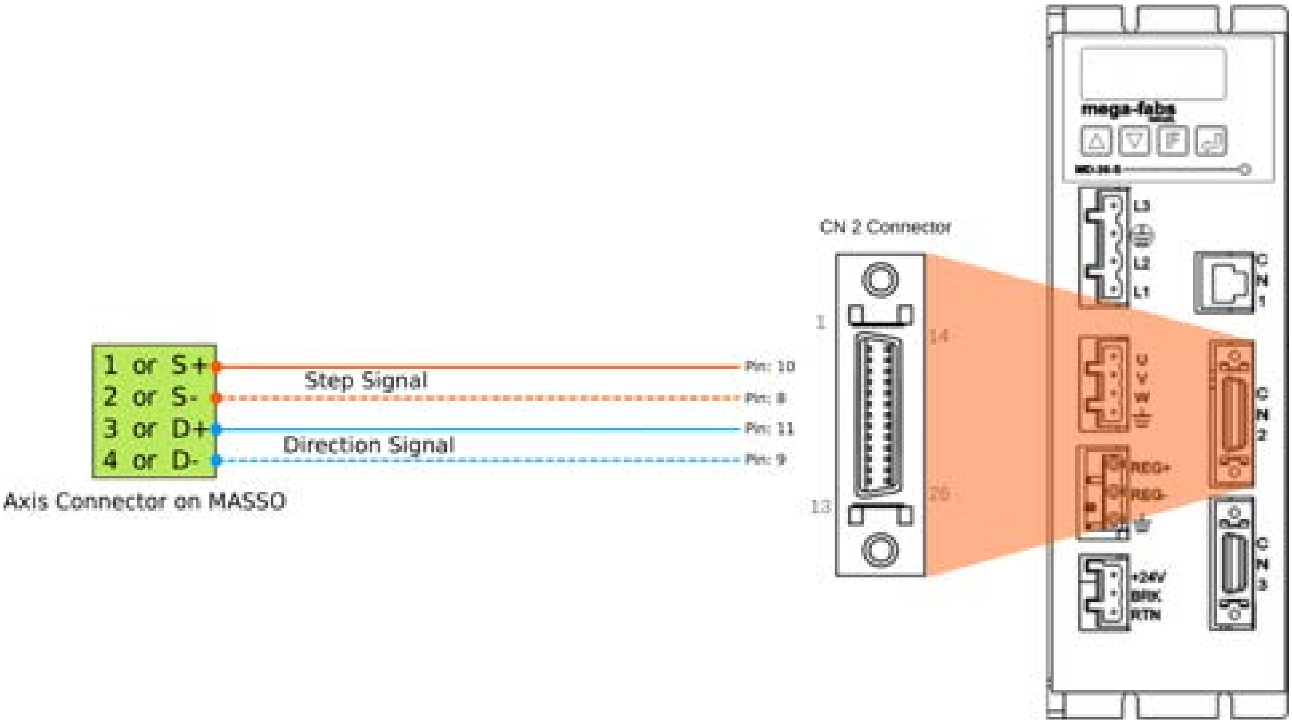
14.4.17. Automation Technology Inc.

Automation Technology Inc. - KL5056E wiring example



14.4.18. Hiwin

Hiwin mega-fabs D1 wiring example

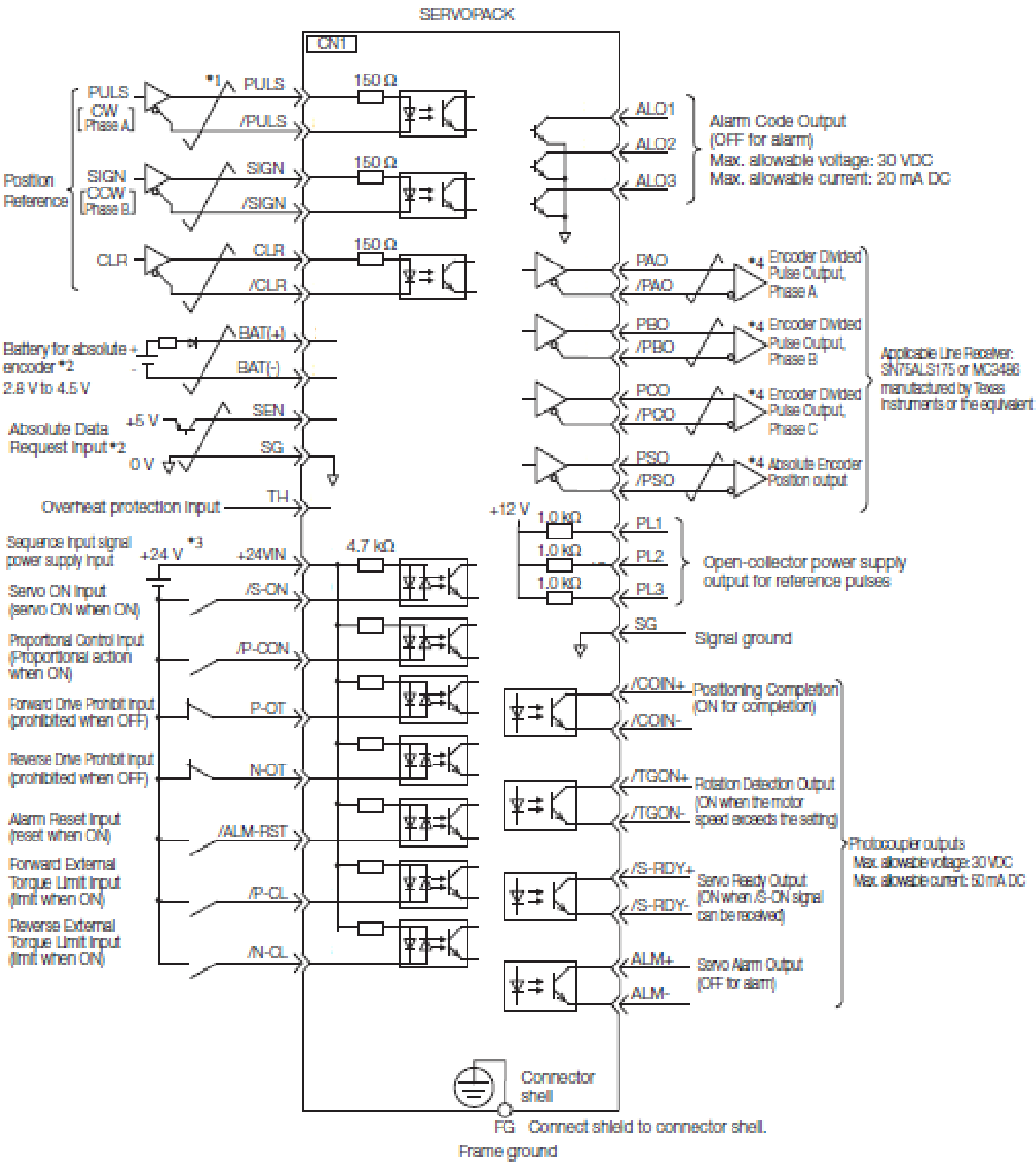

1 or S+
2 or S-
3 or D+
4 or D-
Axis Connector on MASSO
Step Signal
Direction Signal
Pin: 10
Pin: 8
Pin: 11
Pin: 9
CN 2 Connector
1
13
14
26
mega-fabs
L3
L2
L1
U
V
W
REG+
REG-
+24V
BRK
RTN
C N 1
C N 2
C N 3

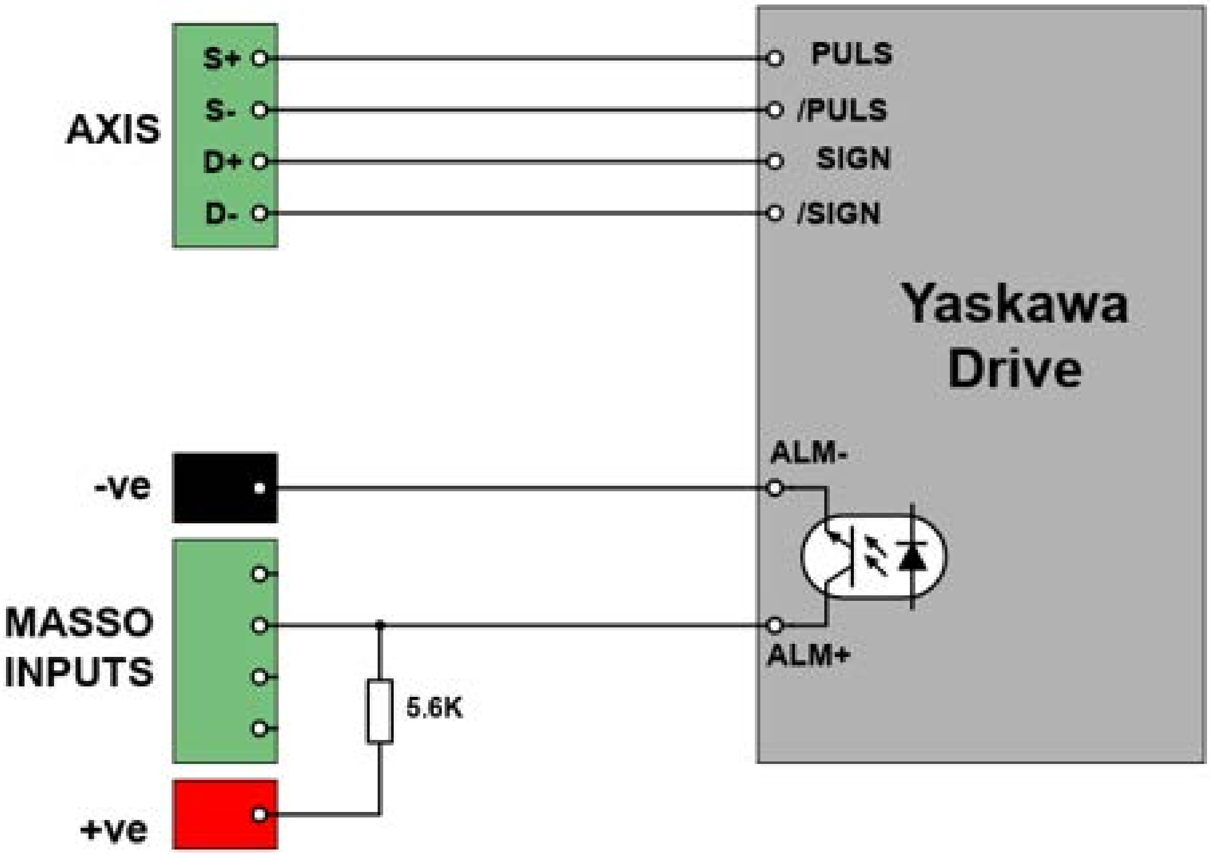
14.4.19. Yaskawa

Yaskawa Servo Drive

This covers the following Yasakawa drive models and possibly others. Please refer to your owners manual

- Sigma SGDH series
- Sigma SGM series
- Sigma SGDB Series
- SGD7S Series AC Servo Drive
- Sigma -II - Series servodrive
- Sigma -7- Series servodrive

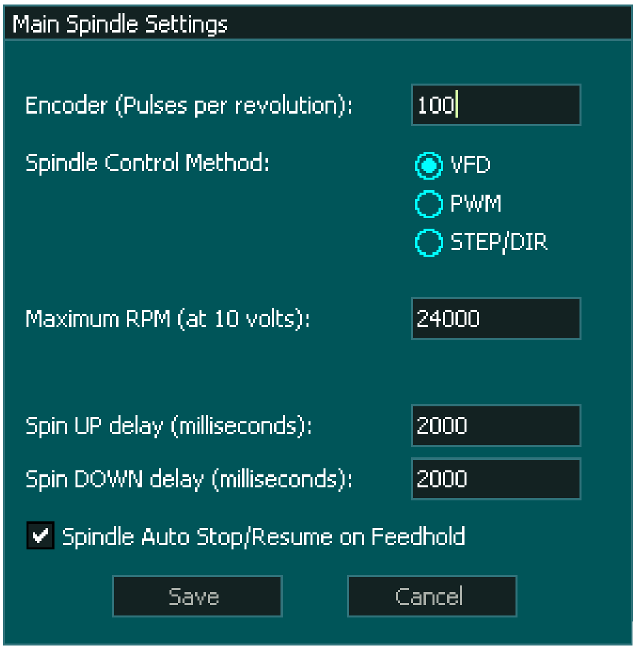


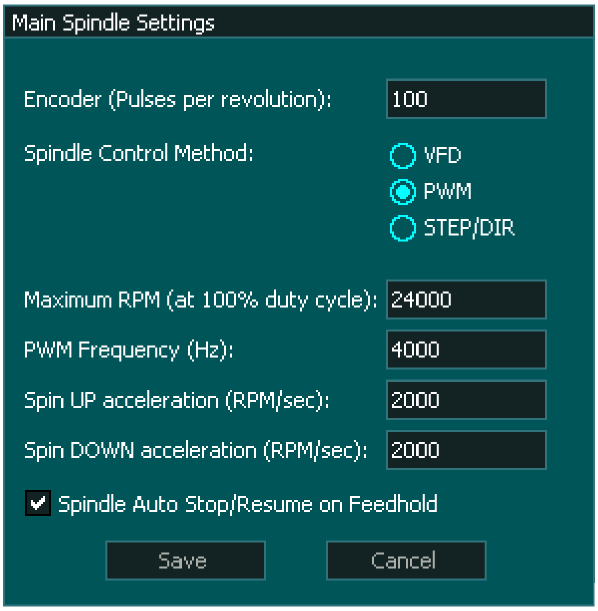

AXIS
S+
S-
D+
D-
PULS
/PULS
SIGN
/SIGN
Yaskawa Drive
-ve
ALM-
MASSO INPUTS
5.6K
ALM+
+ve

14.5. Spindle Control

MASSO provides **0~10v**, **PWM** and **STEP/DIR** control signals to control a variety of VFD and DC spindle and Servo or stepper drives

In the Spindle Settings window the mode of spindle control can be selected. Further, **Spin UP** and **Spin DOWN** delay values can be added. The spindle delay values pauses the machine on spindle ON and OFF commands for the spindle to get to the required RPM.




Main Spindle Settings
Encoder (Pulses per revolution):
100
Spindle Control Method:
VFD
PWM
STEP/DIR
Maximum RPM (at 100% duty cycle):
24000
PWM Frequency (Hz):
4000
Spin UP acceleration (RPM/sec):
2000
Spin DOWN acceleration (RPM/sec):
2000
Spindle Auto Stop/Resume on Feedhold
Save
Cancel

> **INFORMATION:** PWM frequency on the MASSO can be set between **4 kHz** to **65 kHz.**

> **INFORMATION:** When running in PWM mode MASSO outputs **Uni-polar PWM** signals.

VFD Control

- Spindle control pin1 outputs a 0 to 10 volt analogue voltage proportional to the the required speed

- Spindle Control Pin 2: Is normally LOW and changes to HIGH when the spindle is set to forward
- Spindle control Pins 4 & 5 are normally open circuit and conduct when the spindle is set to forward

- Spindle Control Pin 3: Is normally LOW and changes to HIGH when the spindle is set to reverse
- Spindle control Pins 6 & 7 are normally open circuit and conduct when the spindle is set to reverse

PWM Control

- PWM control is designed to be used with, but not limited to H-Bridge driver.
- These types of drives are used to control DC motors providing FWD, REV and speed control.

- Spindle Control Pin 2: Outputs a PWM signal when the spindle is set to forward

- Spindle control Pins 4 & 5 Turns on and off with the PWM signal when the spindle is set to forward

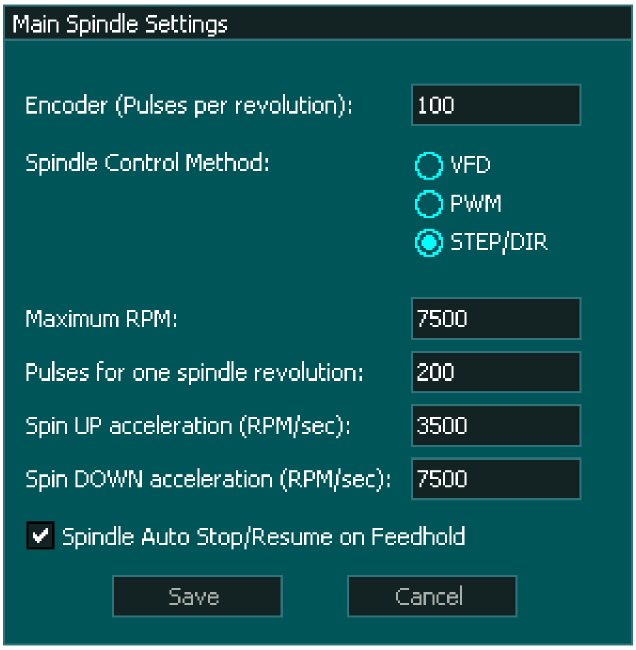
- Spindle Control Pin 3: Outputs a PWM signal when the spindle is set to reverse
- Spindle control Pins 6 & 7 Turns on and off with the PWM signal when the spindle is set to reverse

- PWM frequency on the MASSO can be set between **4 kHz** to **65 kHz.**

STEP/DIR control

Using a Stepper motor or Servo as a spindle

- The Step and direction mode outputs are **Common GND** signals.
- Spindle Control Pin 2: Step
- Spindle Control Pin 3: Direction
- **Minimum Step rate** 500 pulses per second or 150rpm if using a 200 step per revolution motor with micro step rate of 1.
- **Maximum pulse rate:** 25000 pulses per second or 7500rpm if using a 200 step per revolution motor with micro step rate of 1.
- Increasing the micro step on your motor drive will reduce both the minimum and maximum spindle speed.
- If the requested speed is below the minimum speed, the spindle will run at the minimum speed of 500 pulses per second.
- If the requested speed is above the maximum speed, the spindle will run at the maximum speed of 25000 pulses per second.



Spindle Auto Stop / Resume on Feedhold

- When this option is ticked the spindle will stop on Feed hold and and when Cycle start is pressed to resume machining the spindle will automatically restart before machining connences.
- If this option is not ticked a feed hold will not stop the spindle and the user will need to manually stop it if required. Before resuming machining the user will need to restart the spindle before pressing Cycle Start.

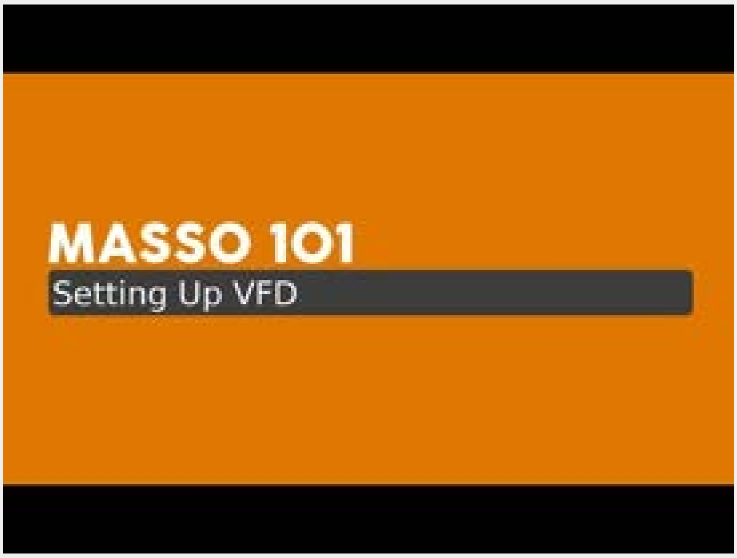
For information on wiring of the spindle control to your VFD please see our Spindle VFD examples page.

For troubleshooting a VFD / Spindle problem please see this Troubleshooting guide

14.6. Spindle VFD examples

MASSO supports 0~10v signal, clockwise and counter-clockwise signals to directly control VFD's.

> **INFORMATION:** As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, the below video provides detailed steps on how to setup and configure a VFD drive.



Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

MASSO 101 - Setting up VFD (Variable Frequency Drive) with MASSO (Spindle Drive)

For troubleshooting a VFD / Spindle problem please see this [Troubleshooting guide]

For additional VFD wiring diagrams please have a look at the MASSO Forum [VFD wiring] section

Read other subtopics below:

14.6.1) Bosch Rexroth VFD

14.6.2) Delta C200 VFD

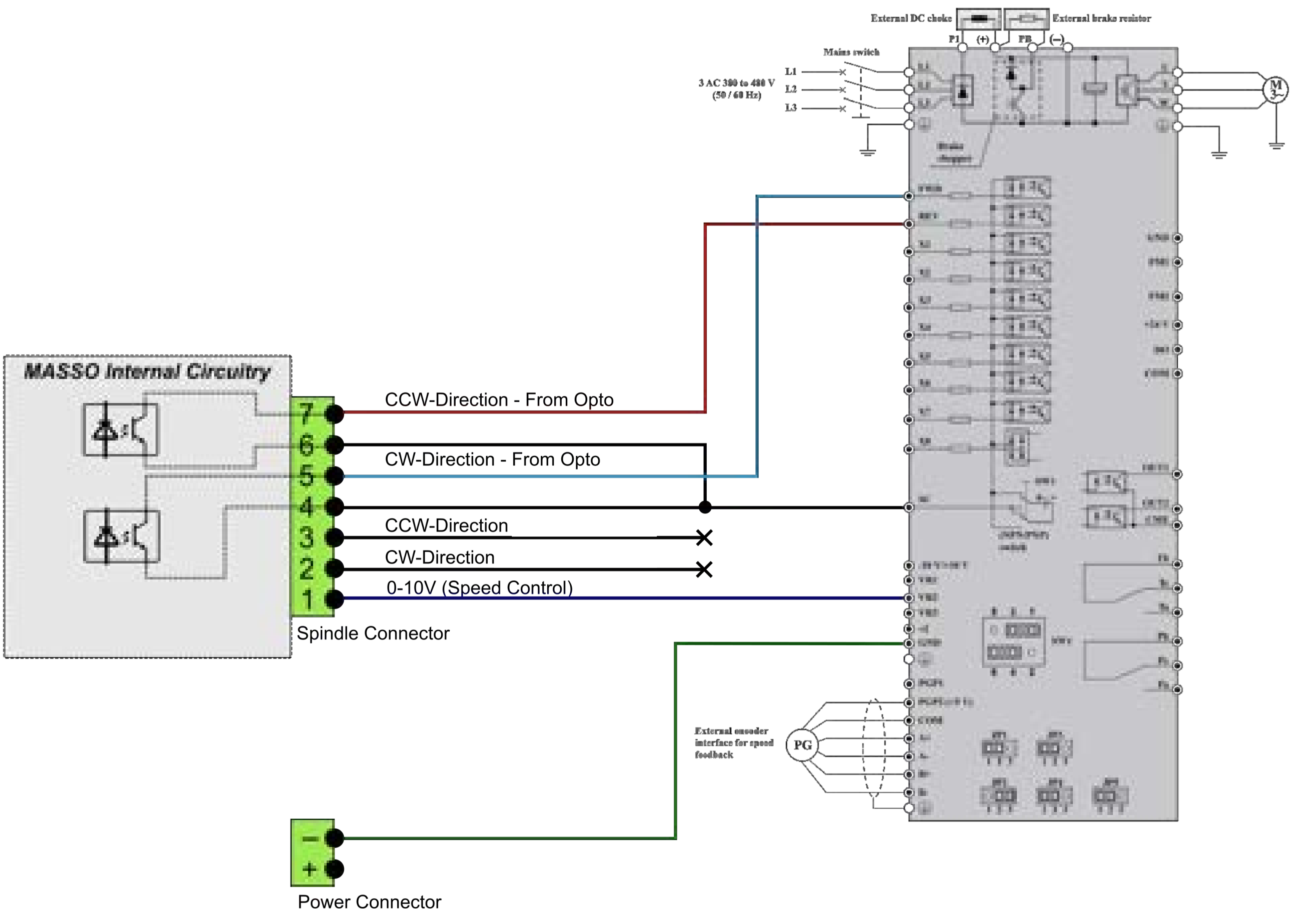
14.6.3) Delta MS300 VFD

14.6.4) Delta VFD-M

14.6.1. Bosch Rexroth VFD

Bosch Rexroth VFD wiring example

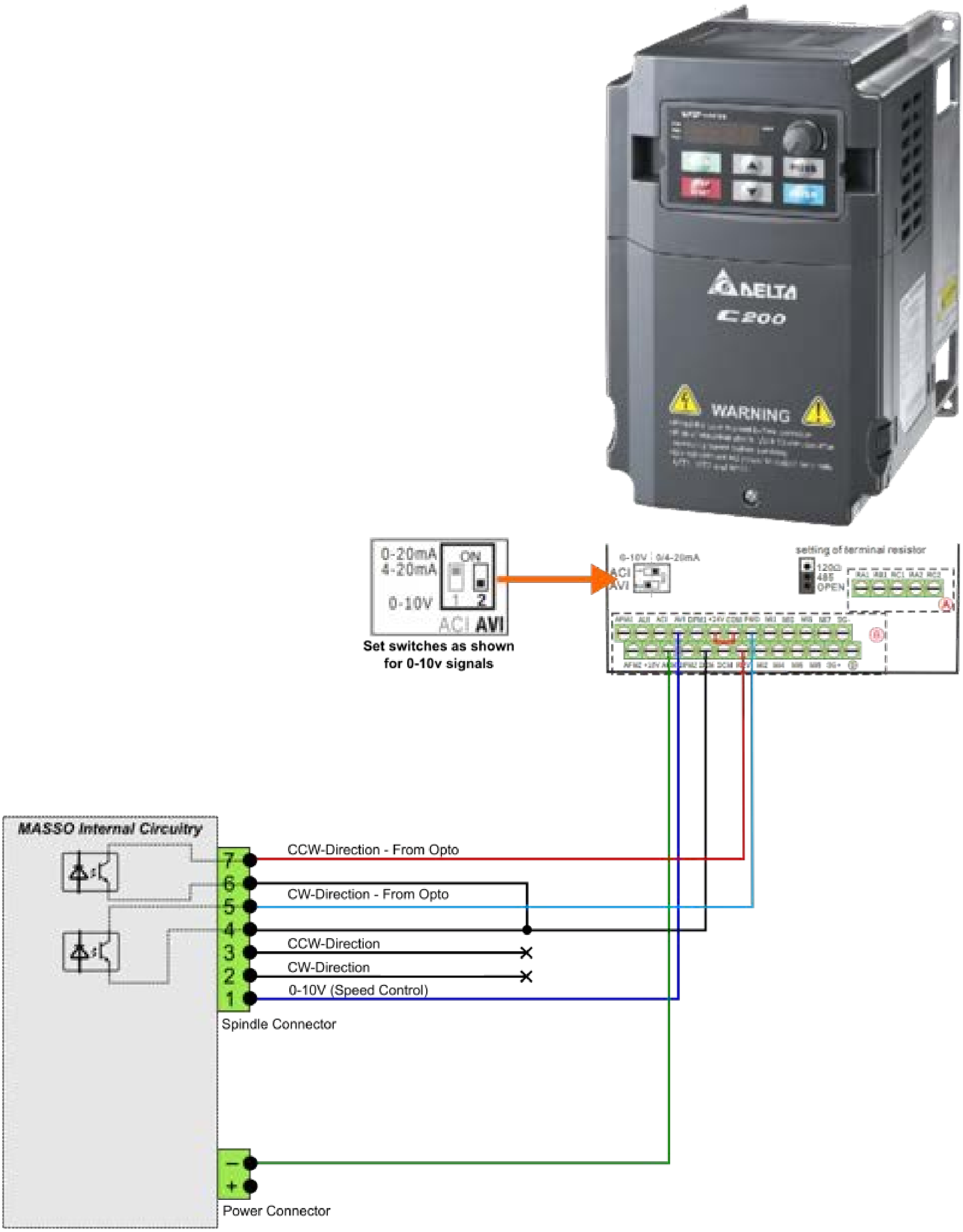
INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.



14.6.2. Delta C200 VFD

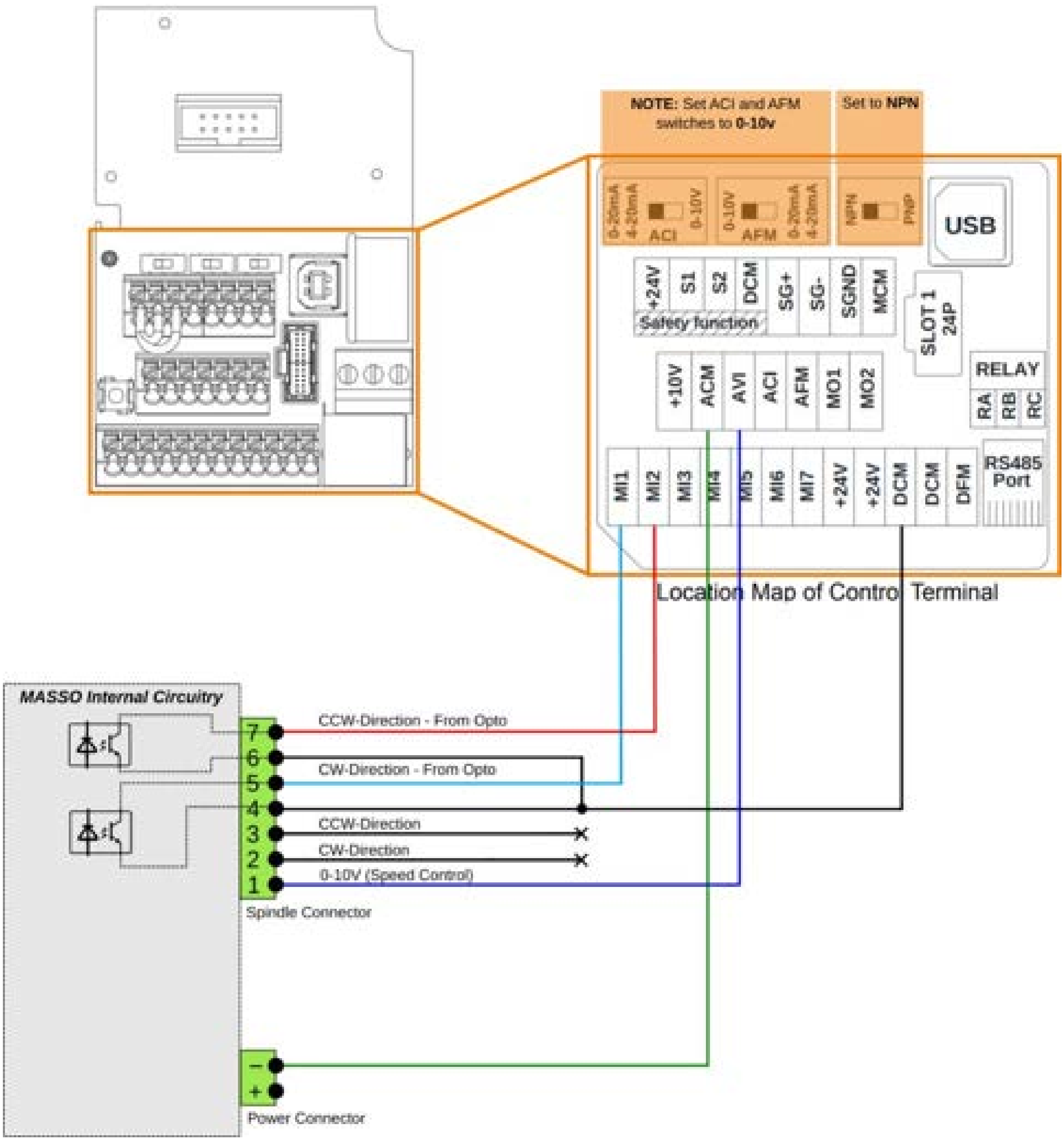
Delta - C200 series wiring example

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


0-20mA
4-20mA
0-10V
ON
ACI AVI
Set switches as shown
for 0-10v signals
ACI
AVI
setting of terminal resistor
WARNING
MASSO Internal Circuitry
CCW-Direction - From Opto
CW-Direction - From Opto
CCW-Direction
CW-Direction
0-10V (Speed Control)
Spindle Connector
Power Connector

14.6.3. Delta MS300 VFD

Delta - MS300 series wiring example

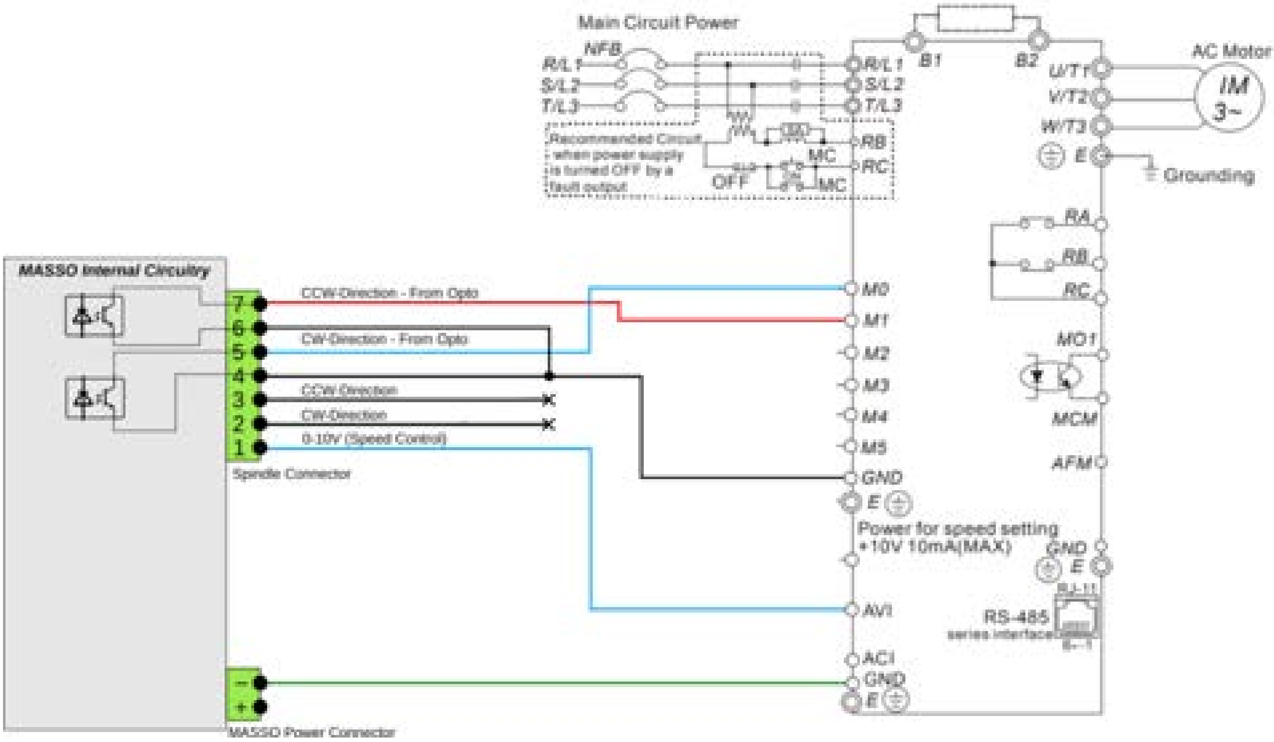


INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.

14.6.4. Delta VFD-M

Delta - VFD-M series wiring example

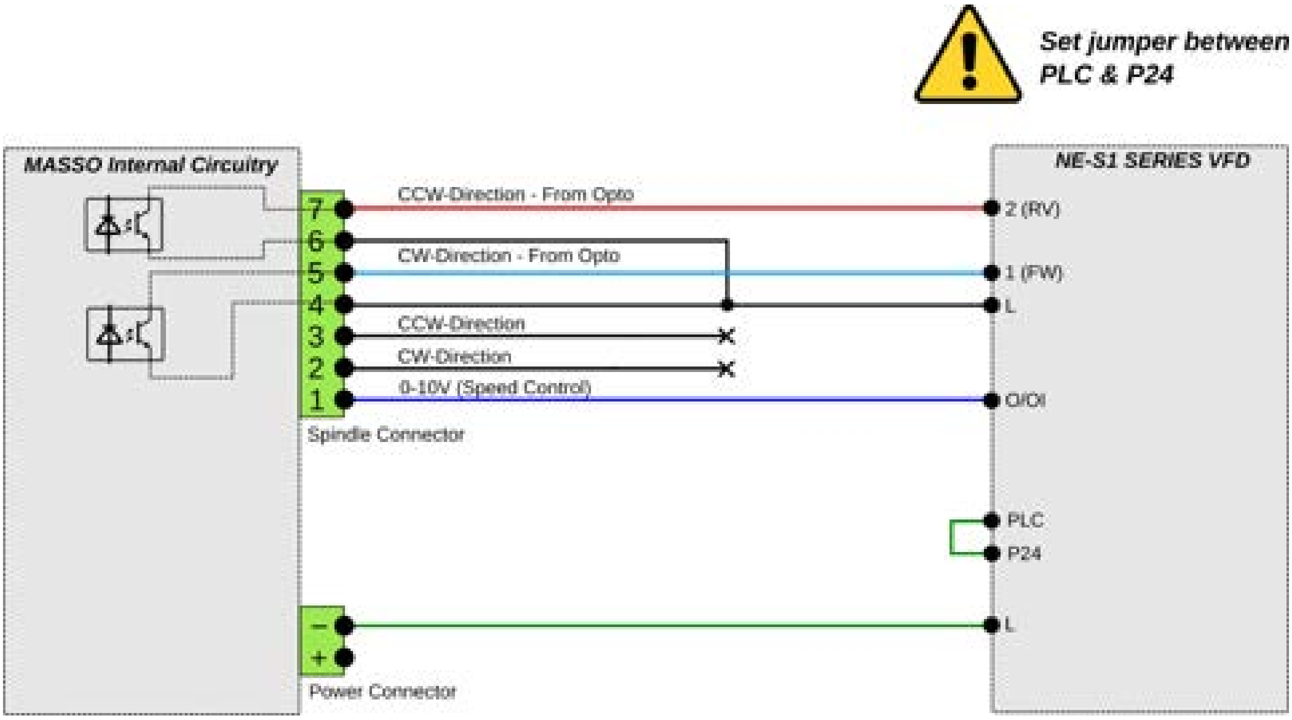
INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


Main Circuit Power
NFB
R/L1
S/L2
T/L3
Recommended Circuit when power supply is turned OFF by a fault output
OFF
MC
RB
RC
B1
B2
U/T1
V/T2
W/T3
E
AC Motor
IM
3~
Grounding
RA
RB
RC
MO1
MCM
AFM
MASSO Internal Circuitry
7
6
5
4
3
2
1
CCW-Direction - From Opto
CW-Direction - From Opto
CCW Direction
CW-Direction
0-10V (Speed Control)
Spindle Connector
M0
M1
M2
M3
M4
M5
GND
E
Power for speed setting
+10V 10mA(MAX)
GND
E
RS-485
series interface
AVI
ACI
GND
E
MASSO Power Connector

14.6.5. Hitachi VFD

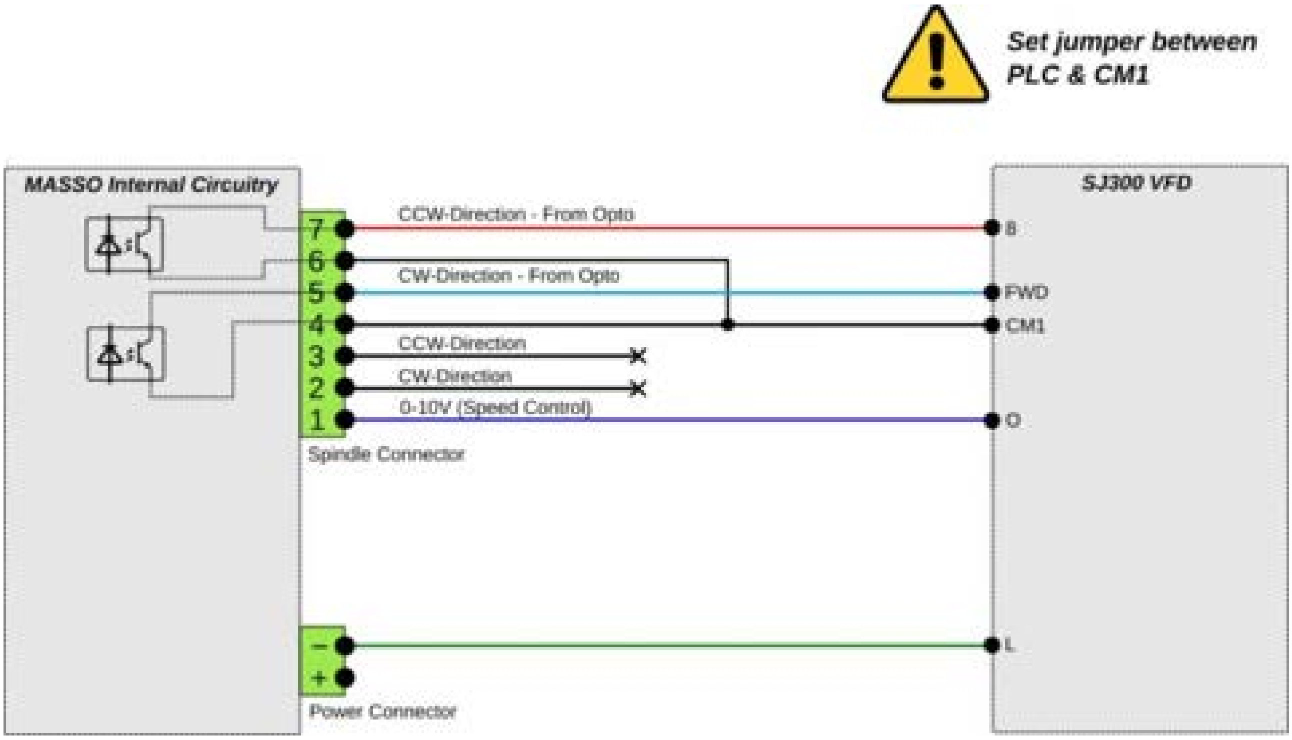
NE-S1 SERIES wiring example

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.



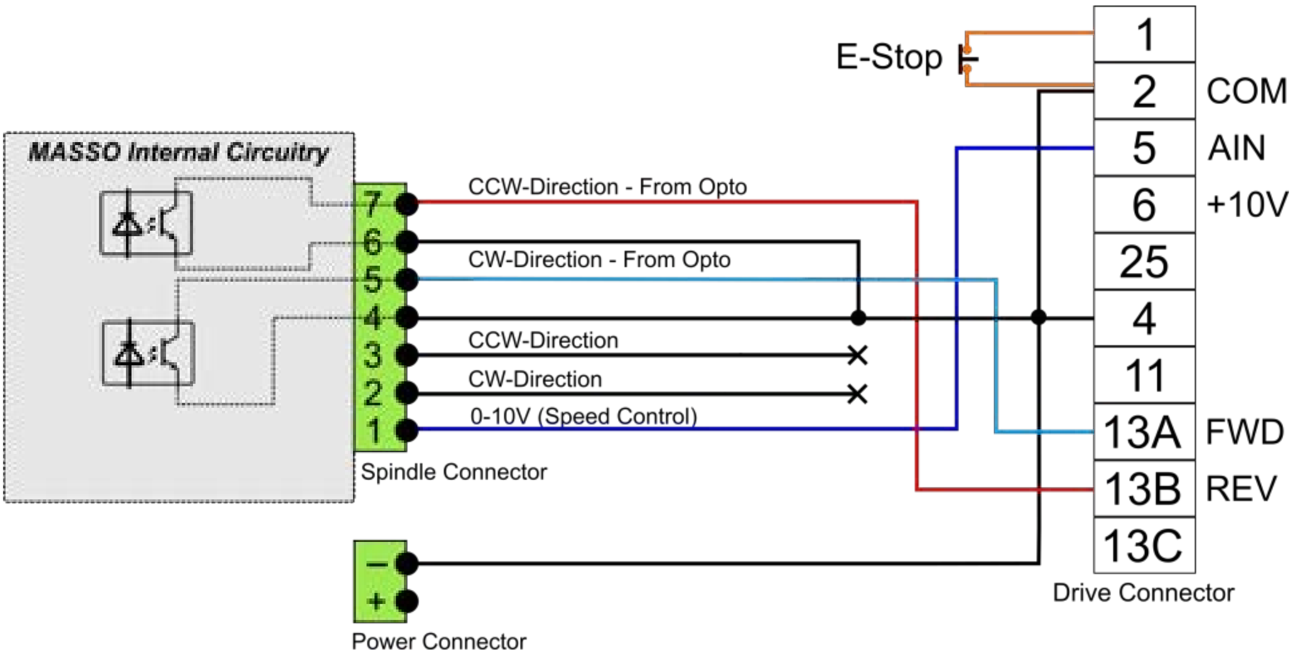
SJ300 SERIES wiring example

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


Set jumper between PLC & CM1
MASSO Internal Circuitry
SJ300 VFD
CCW-Direction - From Opto
CW-Direction - From Opto
CCW-Direction
CW-Direction
0-10V (Speed Control)
7
6
5
4
3
2
1
8
FWD
CM1
O
L
Spindle Connector
Power Connector

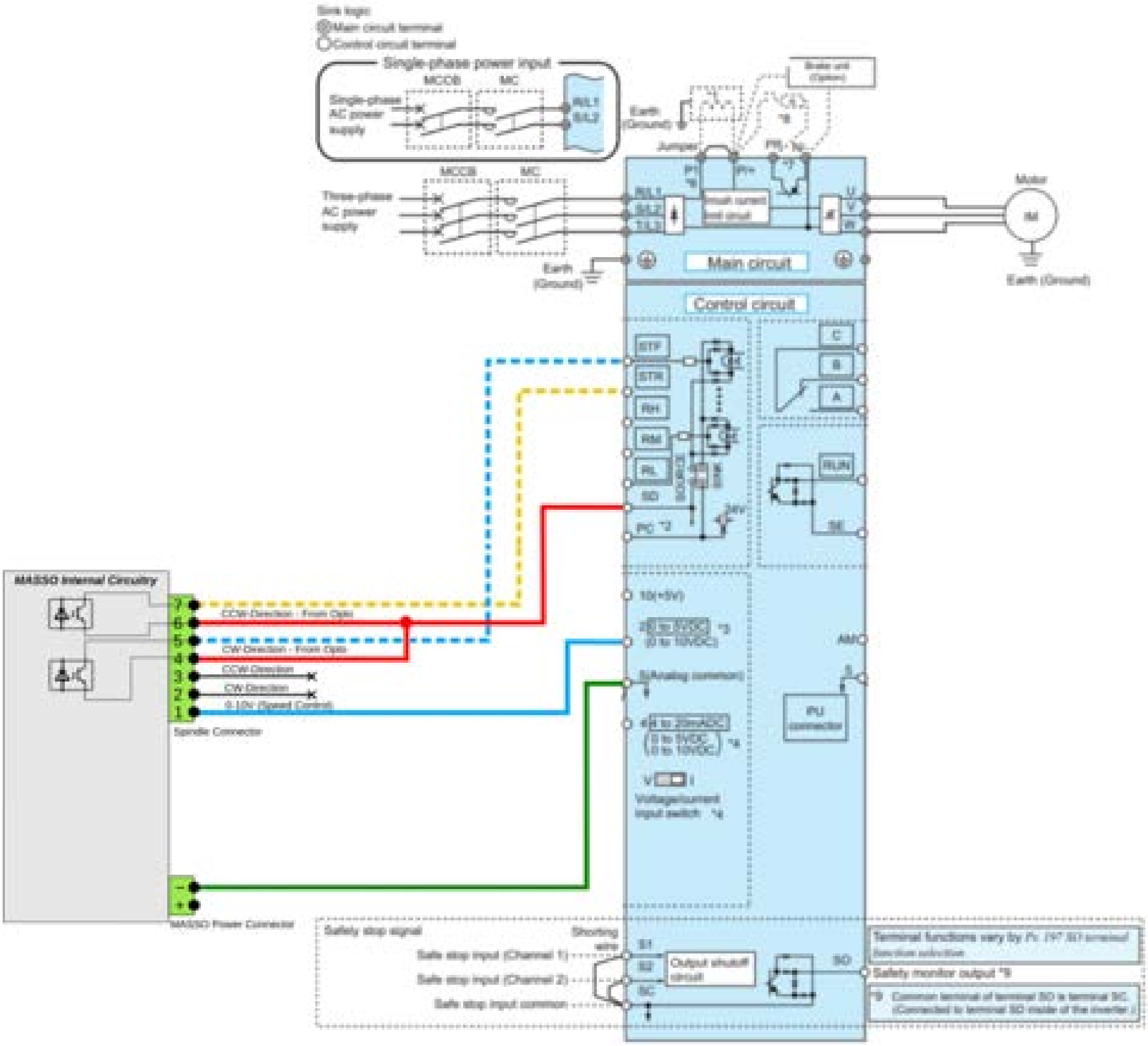
14.6.6. Lenze VFD

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.



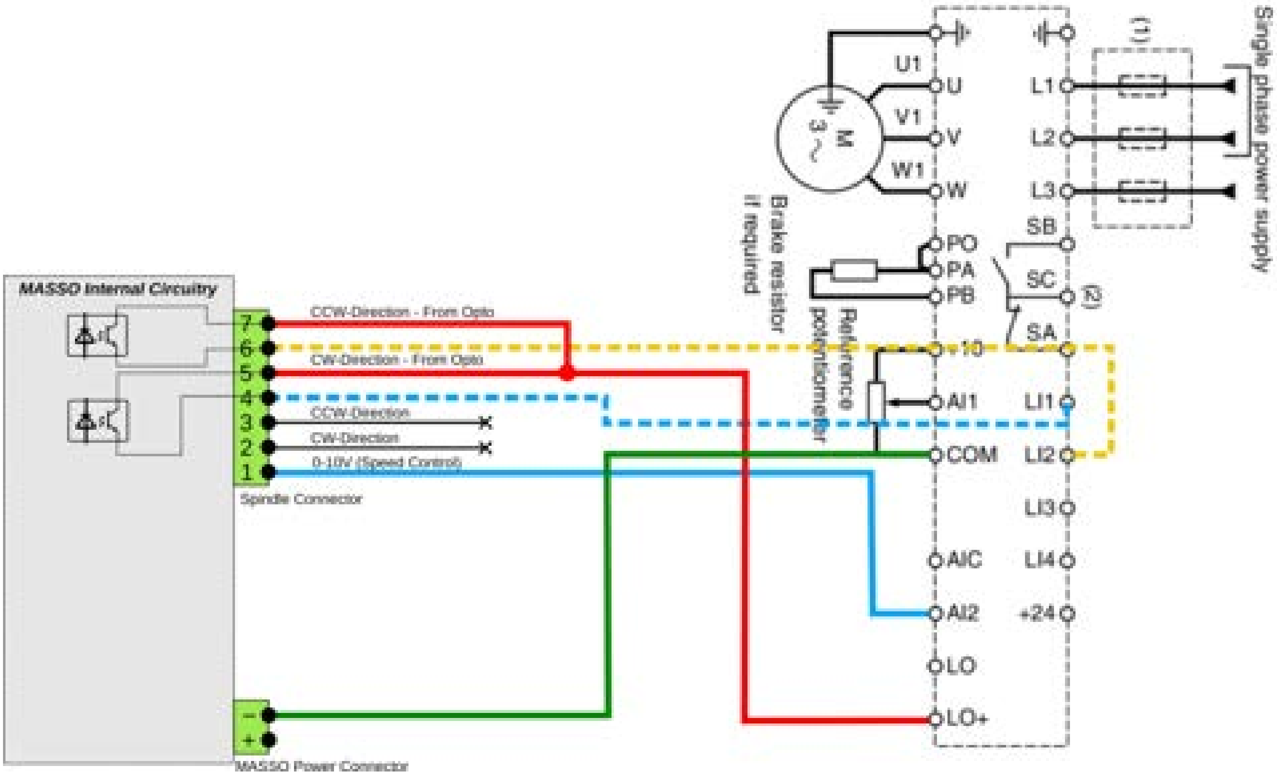
14.6.7. Mitsubishi FR-D720S-100

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


Single-phase power input
Three-phase AC power supply
Main circuit
Control circuit
Motor
Earth (Ground)
MASSO Internal Circuitry
CCW Direction - From Opto
CW Direction - From Opto
CCW Direction
CW Direction
0-10V (Speed Control)
Spindle Connector
MASSO Power Connector
Safety stop signal
Safe stop input (Channel 1)
Safe stop input (Channel 2)
Safe stop input common
Output shutoff circuit
Safety monitor output
PU connector
STF
STR
RH
RM
RL
SD
PC
RUN
SE
AM

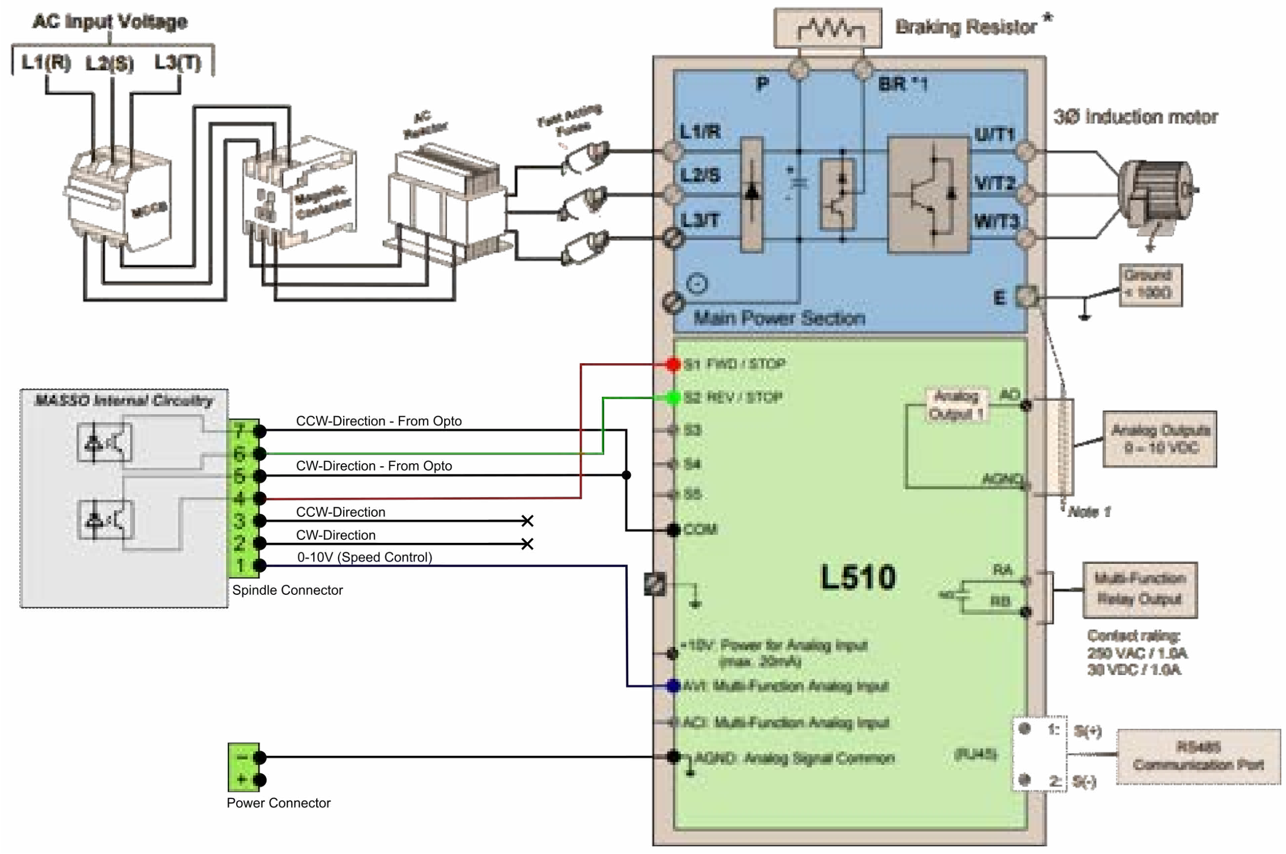
14.6.8. Schneider Altivar 18

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.



14.6.9. TECO Westinghouse VFD

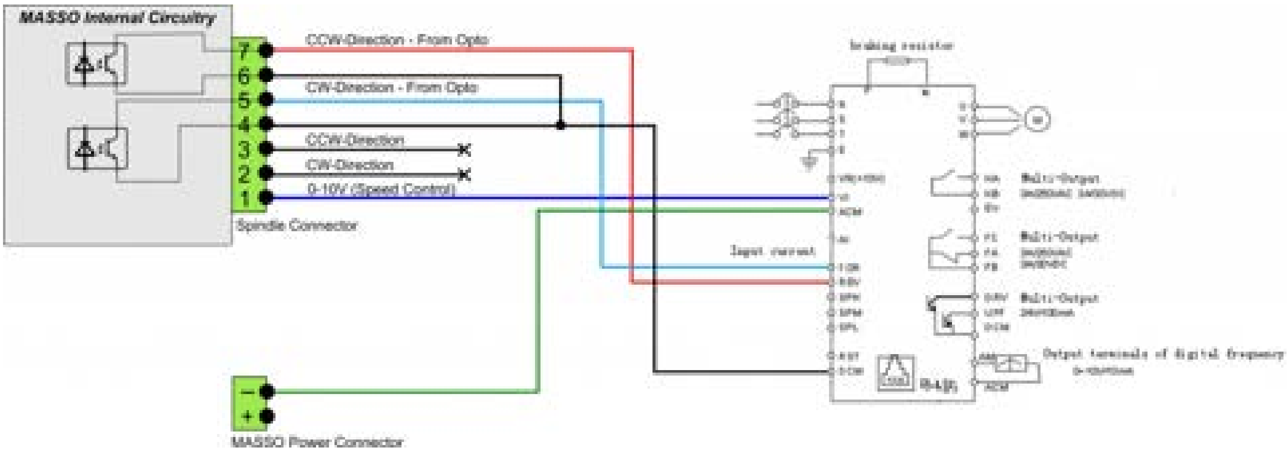
INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


AC Input Voltage
L1(R) L2(S) L3(T)
Braking Resistor *
P
BR *1
3Ø Induction motor
L1/R
L2/S
L3/T
U/T1
V/T2
W/T3
E
Ground
Main Power Section
S1 FWD / STOP
S2 REV / STOP
S3
S4
S5
COM
MASSO Internal Circuitry
CCW-Direction - From Opto
CW-Direction - From Opto
CCW-Direction
CW-Direction
0-10V (Speed Control)
Spindle Connector
Analog Output 1
AO
AGND
Analog Outputs 0 – 10 VDC
Note 1
L510
RA
RB
Multi-Function Relay Output
Contact rating:
250 VAC / 1.0A
30 VDC / 1.0A
+10V: Power for Analog Input (max. 20mA)
AVI: Multi-Function Analog Input
ACI: Multi-Function Analog Input
AGND: Analog Signal Common
(RJ45)
S(+)
S(-)
RS485 Communication Port
Power Connector

14.6.10. Yuhuan Huanyang

Yuhuan Huanyang HY02D211B-T wiring example

INFORMATION: As VFD's have different control parameters, the VFD must be first properly configured to take 0~10v control signals, wiring the VFD alone will not make it work with the controller.


MASSO Internal Circuitry
7
6
5
4
3
2
1
CCW-Direction - From Opto
CW-Direction - From Opto
CCW-Direction
CW-Direction
0-10V (Speed Control)
Spindle Connector
braking resistor
Input current
Multi-Output
Output terminals of digital frequency
−
+
MASSO Power Connector

14.7. Door Input

The Door sensor input is used to detect the opening and closing of an enclosure door which is used to protect the operator from debris and contain coolant.

When the Sensor detects the door has been opened the Spindle & Coolant will turn off and Motion will cease.

The method used for resuming will depend on options selected in the F1, General Settings screen.

The Door Sensor can be Mechanical, Optical or a proximity sensor but must show Logic Low when the door is closed or High when the Door is open.

If the Sensor logic is reversed you can invert the input by selecting and pressing the Space Bar

The Door sensor is optional on MASSO G3 and MASSO Touch but a Door Sensor must be assigned in MASSO G2 even if not used.

> On the Masso G2 a Door sensor input must be assigned even if there is no door on your machine. If you do not have a door then assign a spare input as a Door sensor input and set the logic to show low. This will effectively disable the door alarm.

Wiring the Door Sensor

This example show a switch used as the door sensor.

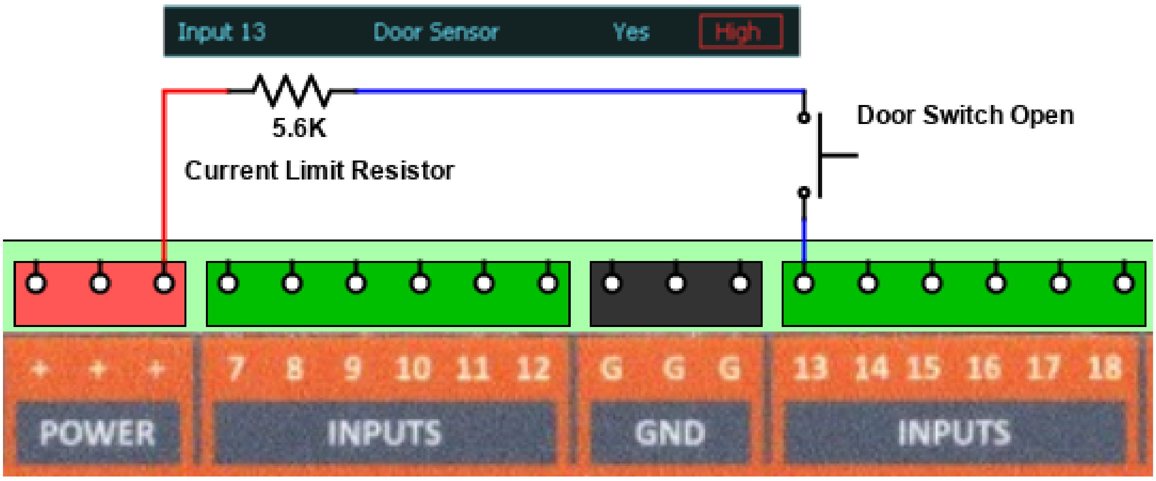
The Resistor is used to limit fault current in case the wire to the switch comes in contact with Gnd and prevents the fuse from blowing.

+ve to for the switch can come from the MASSO Auxiliary terminals or direct form the main power distribution point.

The Resistor is optional but recommended and must be mounted at the MASSO end to be effective.

The Switch is shown in the Door open position and the input is inverted so that when the door is closed the input will change to Low.

This switch configuration is fail safe and should the wire to the switch break the input will show the door as open.



Resuming Machining after Door is opened

- When the Sensor detects the door has been opened the Spindle & Coolant will turn off and Motion will cease.

- If Enable Cycle Start on Door Close is not enabled 

the operator will need to press the Cycle Start button after closing the door to Resume machining. This will Automatically restart the Spindle and Coolant.

- If Enable Cycle Start on Door Close 

the machine will restart the spindle, Coolant and machining when the door is closed.
- Cycle Start on Door Close will be temporarily suspended under the following circumstances.
- A new program has been loaded or the Rewind button is pressed and the operator has not yet pressed cycles start. This prevents the machine starting after a program is loaded and the door is closed before the machine is set up correctly.
- If Feed hold is used before or after opening the door the Cycle Start button must to be used after closing the door to resume machining. Cycle Start on Door close will resume normal operation next time the door is opened.
- If the machine is Jogged while the Door is opened the Cycle Start button must be used after closing the door to resume machining. Each press of the Cycle start will jog an axis back to it's original location starting with the X then Y then Z axis before the spindle & coolant starts and machining resumes. Cycle Start on Door close will resume normal operation next time the door is opened.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

MASSO 101 - Door Sensor Input & Alarm

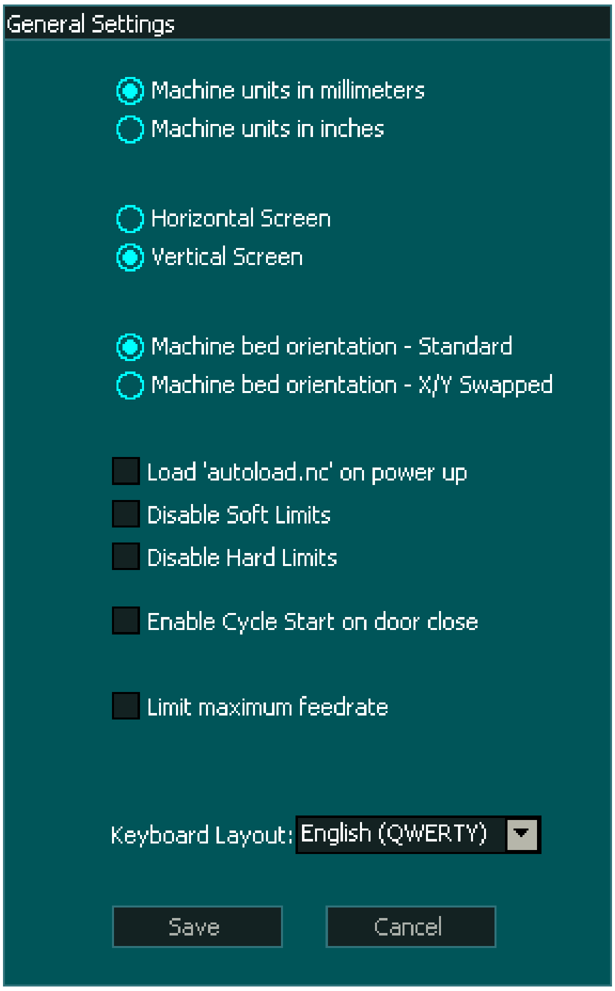
14.8. Setting default units to mm or inches

Setting default units of the controller

As per the user requirements the default machine units can be set between millimeters or inches in the controller settings. All controller calibration values and screen units are displayed as per the selected unit.

The machine units settings is available in the **F1-Setup** screen under **General Setting** window.

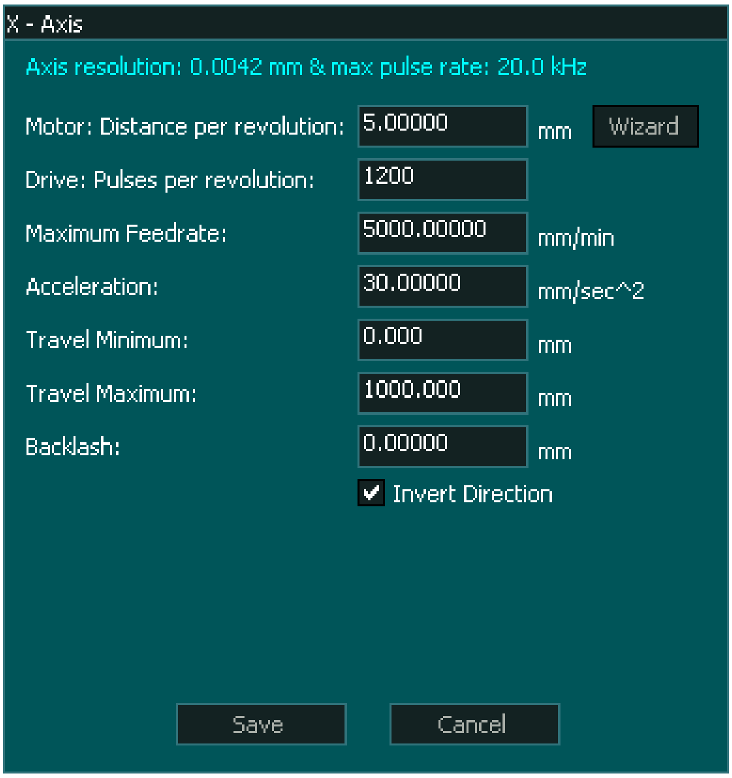
INFORMATION: The controller units can also be temporarily changed between millimeters or inches using G20 and G21 gcodes.



14.9. Axis Calibration

Once all the electrical connections have been done, the system can be calibrated. Axis calibration can be done in the following simple steps:

Motor: Distance per revolution



- First note down the pitch of your ball screw. Pitch defines how much the ball nut moves when the ball screw is turned exactly one full rotation.
- In the **F1-Setup** screen, open the axis setup window and enter the ball screw pith in the **Motor: Distance per revolution** box.
- If the machine axis moves are controlled using timing belts or has a rack and pinion type setup then enter the amount of axis movement when the motor shaft is turned exactly in one full rotation. If this value is unknown or hard to calculate then the **calibration wizard** can be used which is explained on the bottom of this page.

Drive: Pulses per revolution

Servo and stepper motor drives have either switches or software tools to setup the drives **Pulses Per Revolution (PPR)** settings. These settings define how many pulses the drive will take to turn the motor shaft one complete revolution.

INFORMATION: Please refer to your motor drives documentation on how to setup PPR.

Maximum Feed Rate

Each machine axis have limitation of maximum allowable speed depending on the hardware and safety limitations. The maximum feed rate value is used to check and make sure that the system does not exceed this value during operation. This value might be different for each axis depending on the design of that axis.

Acceleration

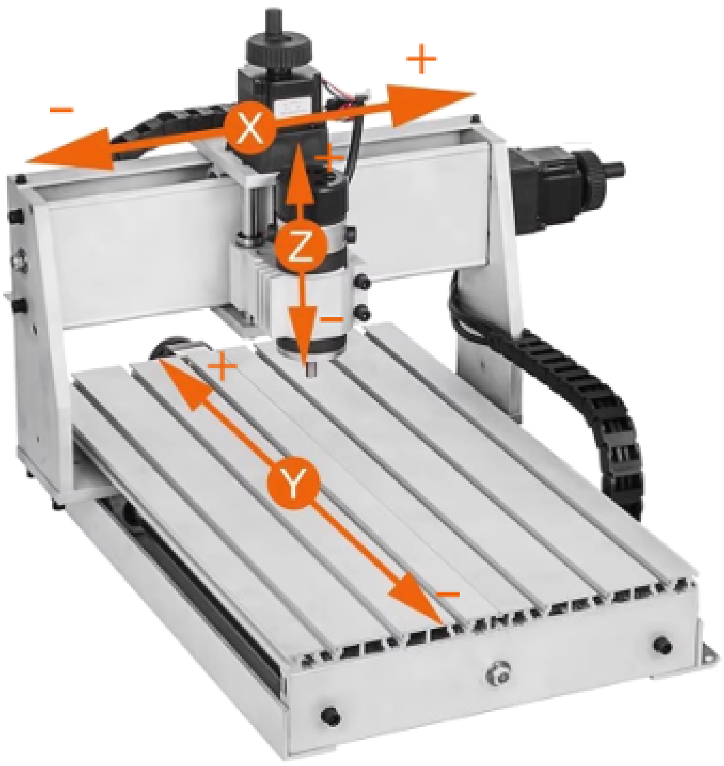
Depending on the moving mass and motor torque the acceleration value can be set for each axis.

Axis Direction

The invert direction tick box is used to reverse the direction of travel of the axis.

It is critical that before setting maximum and minimum travel or using the calibration wizard that you ensure that the axis is moving in the correct direction.

See the image below for more information



Minimum & Maximum Travel

These values define the travel as well as minimum and maximum values of the axis. In most setups this values is between 0.00 and some positive number, but in some cases such as Z axis of a milling machine this value can be negative as the axis homes towards the top which is 0.00 but the actual machining happens in the negative direction that is towards the machine bed.

NOTE: The minimum and maximum travel also sets the soft limit of the axis and its very important to set this value with the exact travel of the axis.

INFORMATION: If minimum, maximum or homing position (in homing settings window) values are not correctly entered then the axis might not home properly.

Axis Calibration Wizard

If this axis **distance per revolution** value is unknown or hard to calculate then the **Axis Calibration Wizard** can be used, please **CLICK HERE** for details.

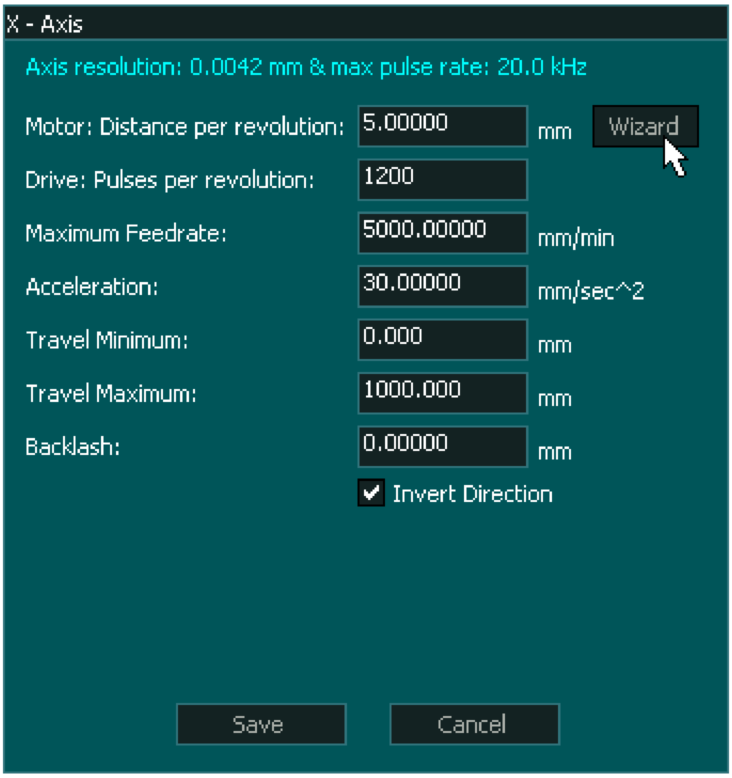
14.10. Axis Calibration Wizard

Axis calibration wizard can be used to calibrate axis where the calibration values of the mechanical setup are unknown or hard to calculate axis. This may be due to multiple ratios on the axis such as timing belts and rack & pinion designs.

WARNING: Ensure that your axis are moving in the correct directions before calibrating your machine. For additional information on Axis Direction of travel see HERE

INFORMATION: If your Axis maximum and minimum travel is not set correctly you may not be able to travel the required distance for calibration. In this case change your maximum and minimum travel distances while doing your calibration to ensure you do not reach the limits.

Open the wizard by clicking the "Wizard" button



Calibration steps

INFORMATION: For best results, move the axis from one extreme of the axis to the other extreme during calibration, the longer the distance measured during calibration the more accurate the calibration will be.

> **INFORMATION:** Before starting axis calibration ensure that backlash is turned off.

Step 1 Mark the starting point

Ensure that Backlash is turned off.

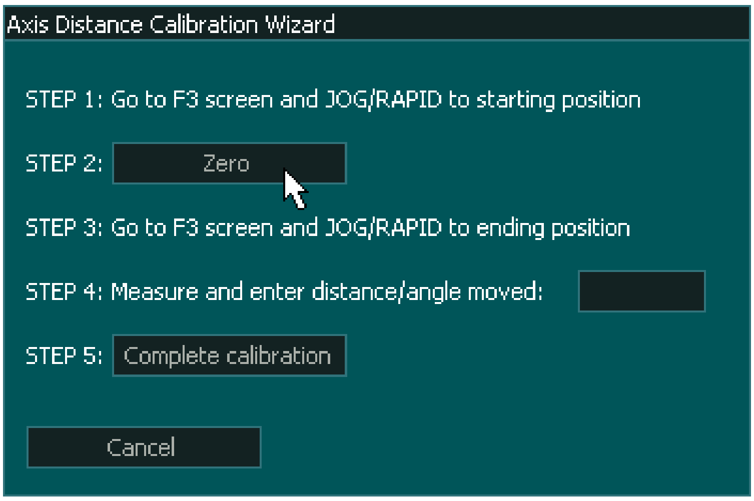
Go into the F3 Screen and Jog the axis that you wish to calibrate to one end of the axis travel and mark the starting point. This could be as simple as putting a sharp Vbit into your spindle and marking an **X** under the cutter to show the starting point. Ensure that when you move to the starting point you jog in the same direction of travel that you will be moving in to the end point. This will remove backlash from the axis under test..

> **INFORMATION:** The easiest way to do this is to use a piece on masking tape with an **X** already marked on it and slide it under the cutter point.

Step 2 Zero the Axis

Return to the F1 Screen and click the "Zero" button on the calibration Wizard screen.

The button will change to read "Zero Set"



Step 3 Move to the end point

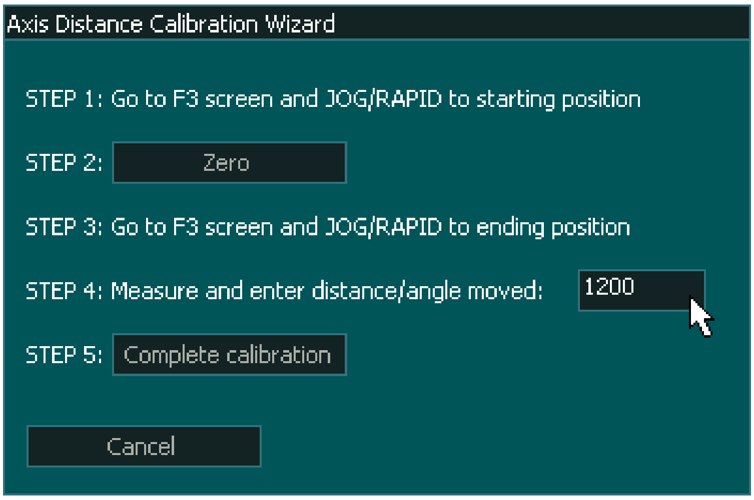
Go to the F3 screen and jog to the the other end of the chosen axis. Mark the endpoint with another **X**

The longer the distance moved for your calibration the more accurate the final result will be.

Step 4 Measure

Using a ruler measure the distance between the starting **X** and the end **X**.

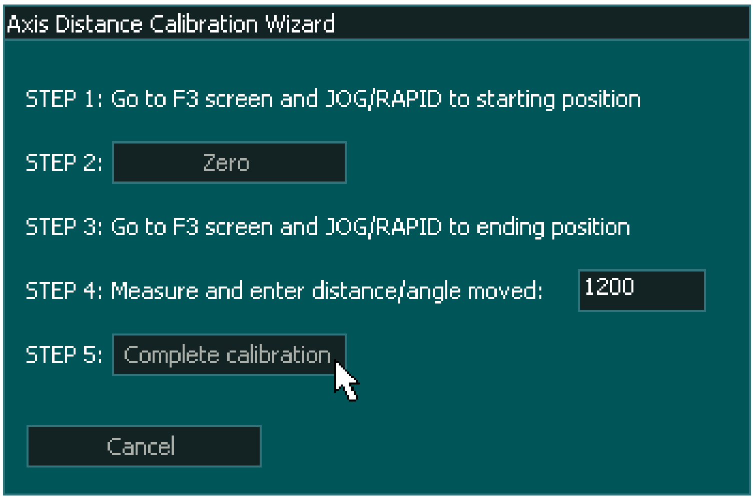
Enter the measured distance the axis moved into box on the calibration wizard.



Step 5 Complete Calibration

Press the "Complete Calibration" button on the calibration wizard and the new distance per revolution value will be written into Axis settings page.

Press the Save on the Axis settings page to complete the axis calibration.



While a ruler will give good results with the X & Y axis the use of a dial indicator is recommended for axis such as the Z axis where the amount of axis movement is small.

Do not use the calibration wizard on a rotary axis. The most accurate setting for a rotary axis is obtained through calculation.

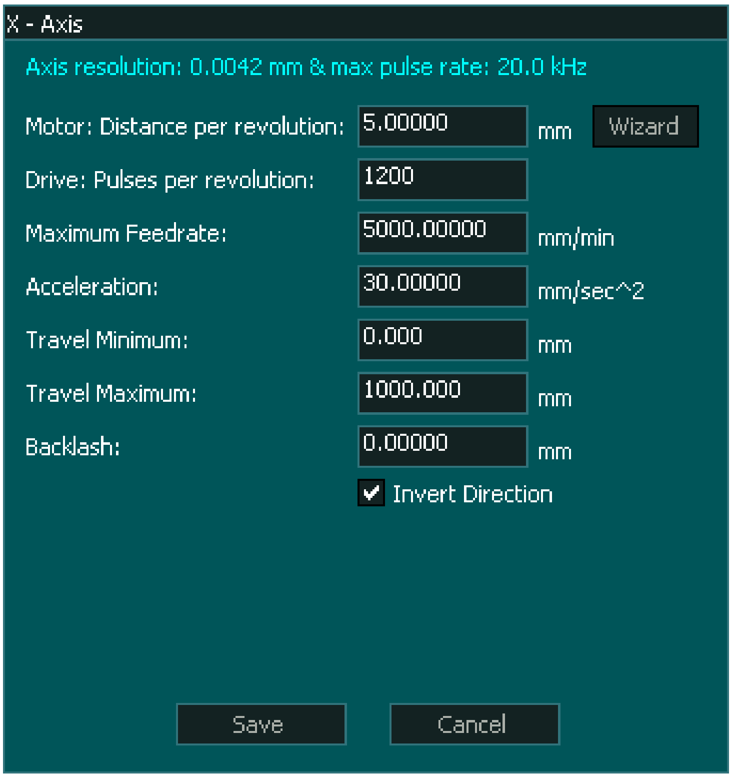
14.11. Backlash Compensation

When to use backlash compensation

Axis backlash should first be adjust mechanically as its best to first find the source of backlash and if needed replacing parts. As with any mechanical system there will always be some minor backlash and only very small backlash should be managed by MASSO's backlash compensation feature.

Information: Maximum backlash value is 10mm or 0.3937", If the value exceeds this, the backlash value setting will reset.

Enter the measured axis backlash value in the **Backlash** box. If not using set this value to 0.00



14.12. Slave Axis

Software axis slaving option can be used to slave **X axis** with **A axis** or the **Y axis** with **B axis**. This option allows the user to have two separate homing switches or sensors on the axis to be able to align the axis.

The user can choose between 2 methods of slaving, Hardware slaving and Software Slaving.

Hardware Slaving.

- This is where 2 motor drives are connected to the same axis to drive 2 motors on the gantry. An example of this is a dual Y axis drive system.
- Only one homing sensor is required for the slaved axis.
- If you need one motor to turn in the opposite direction there are 3 methods you can use to achieve this

1. You can wire the motor to the drive in such a way as to make it run in the opposite direction.
2. If using common ground connection you can connect one drive to S,D & GND while the other is connected to -S,-D & GND.
3. If the drives are connected in differential mode then you can reverse the polarity of the S & -S and D & -D connections into the 2nd drive to run the motor in the opposite direction if needed.

Software Salving

- This is where 2 motor drives are connected to the same axis to drive 2 motors on the gantry but each motor has a separate axis to drive it. An example of this is a dual Y axis drive system.
- In this case the X axis can be slaved to the A axis or the Y axis can be slaved to the B axis.
- The advantage of this is that your Machine will automatically square the slaved axis when ever the machine is homed.
- Sensors are required on each axis when using software slaving. On a Y/B slaved axis both the Y & B axis must have sensors installed or MASSO will not home correctly as it relies on both sensors for auto squaring.
- If one of your motors is running in the wrong direction you can reverse it by ticking or unticking the Invert Direction setting on the axis setting as required.

Axis Relationship when Slaving

- It is important to note that the slaving relationship between axis is fixed and cannot be changed.
- The X axis can only be slaved with the A axis.
- The Y axis can only be slaved with the B axis.

> **INFORMATION:** When using software slaving, a separate homing sensor/switch needs to be

installed on the slave side.

14.13. Homing / Home Inputs

Homing the machine is one of the most important parts of a CNC. Without homing the machine no CNC machine can be used to its full potential and can result in the crashing of the machine as the controller does not know the position of the axis on power-up. This page shows how to set up homing on your machine.

For additional information on how to start the homing process please see: How to home your machine

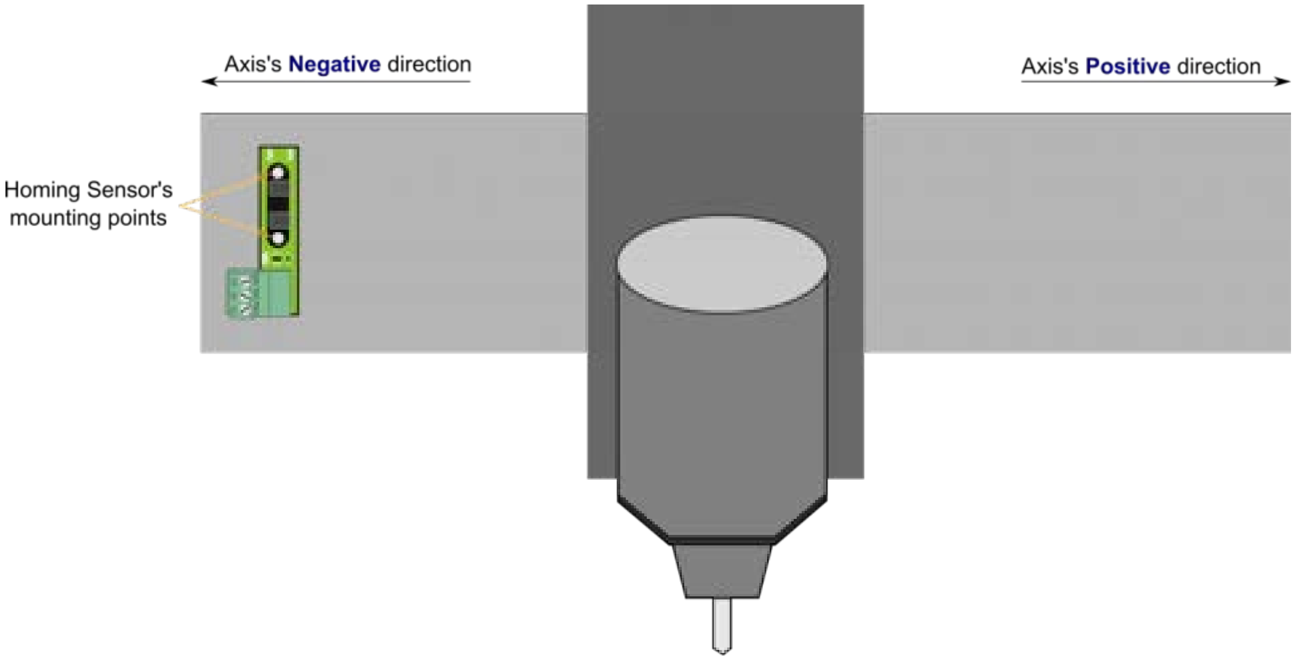
PLEASE NOTE: The sensors shown in the video below show a separate 5-volt power supply. New version sensors such as the Masso Homing Sensor can run on a wide range of voltages and may be powered directly from the Masso power supply without the need for a separate power supply. Please consult the datasheet for your homing sensor to determine its required operating voltage.

How to Setup Homing on CNC using a MASSO CNC Controller

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

Step 1: Mounting sensors

Mount homing sensors/switches on each axis of your machine as shown in the below image. It's preferred the sensors/switches are mounted on the 0.00 location of the axis but can be mounted at any location.



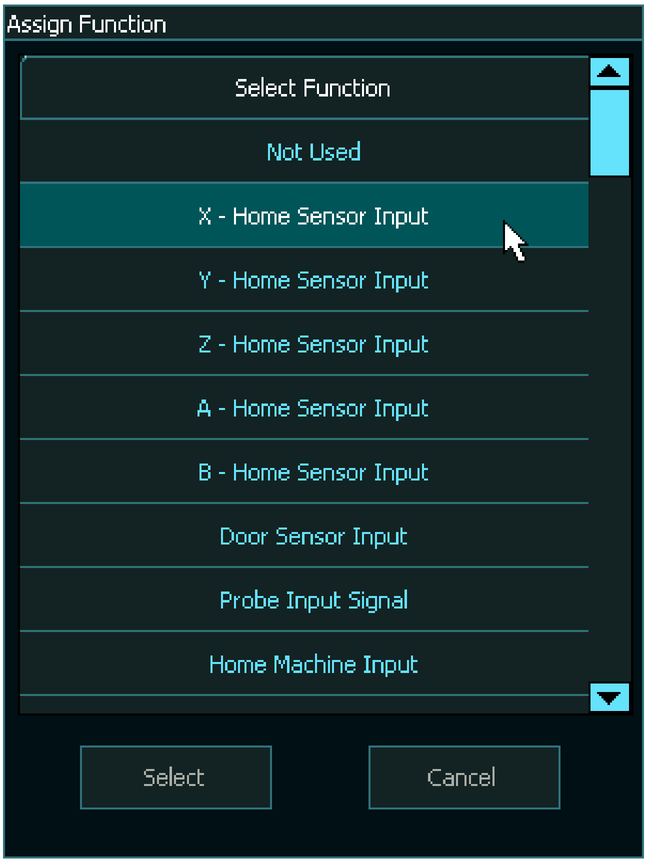
Step 2: Assign inputs

After wiring the sensor/switches the system must be configured for proper operation as described below:

- Go to the **F1-Setup** screen.
- From the **INPUTS** list select any free input and assign them as X, Y, Z... **Home sensor Input**.
- You can also see the status of the sensors change from **L** to **H** when a signal is received on that input from homing sensor/switch.

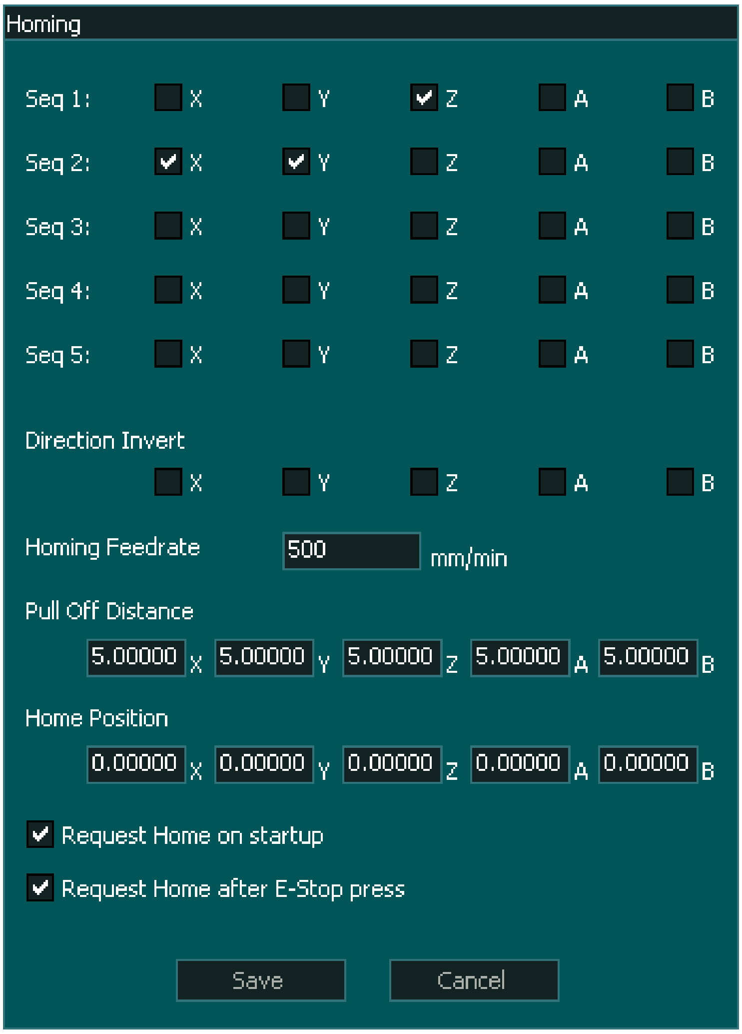
INFORMATION: All input signals can be easily inverted by selecting the input in the **INPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

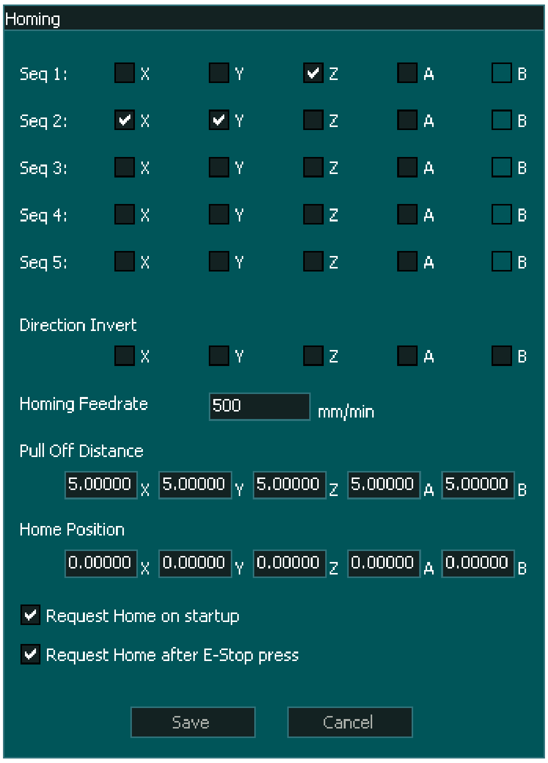
CAUTION: The homing inputs must show a **LOW** signal when the sensor/switch is not engaged or the homing will fail.



Step 3: Setting up the homing sequence

- Open the **Homing** window.
- Now in the homing sequence tick the appropriate boxes for the axis as you would like to home.
- In the below example we set the homing sequence for a milling machine/router. As you would first need to move the tool away from the job by moving the Z-axis up, set **Seq 1** by only selecting the Z axis, this way MASSO only homes Z axis first.
- Next in **Seq 2** select the X and Y-axis to start homing the X and Y axis together.
- When an axis is slaved it will appear grayed out in the homing screen.


Homing
Seq 1: X Y Z A B
Seq 2: X Y Z A B
Seq 3: X Y Z A B
Seq 4: X Y Z A B
Seq 5: X Y Z A B
Direction Invert
X Y Z A B
Homing Feedrate
500
mm/min
Pull Off Distance
5.00000 X 5.00000 Y 5.00000 Z 5.00000 A 5.00000 B
Home Position
0.00000 X 0.00000 Y 0.00000 Z 0.00000 A 0.00000 B
Request Home on startup
Request Home after E-Stop press
Save
Cancel

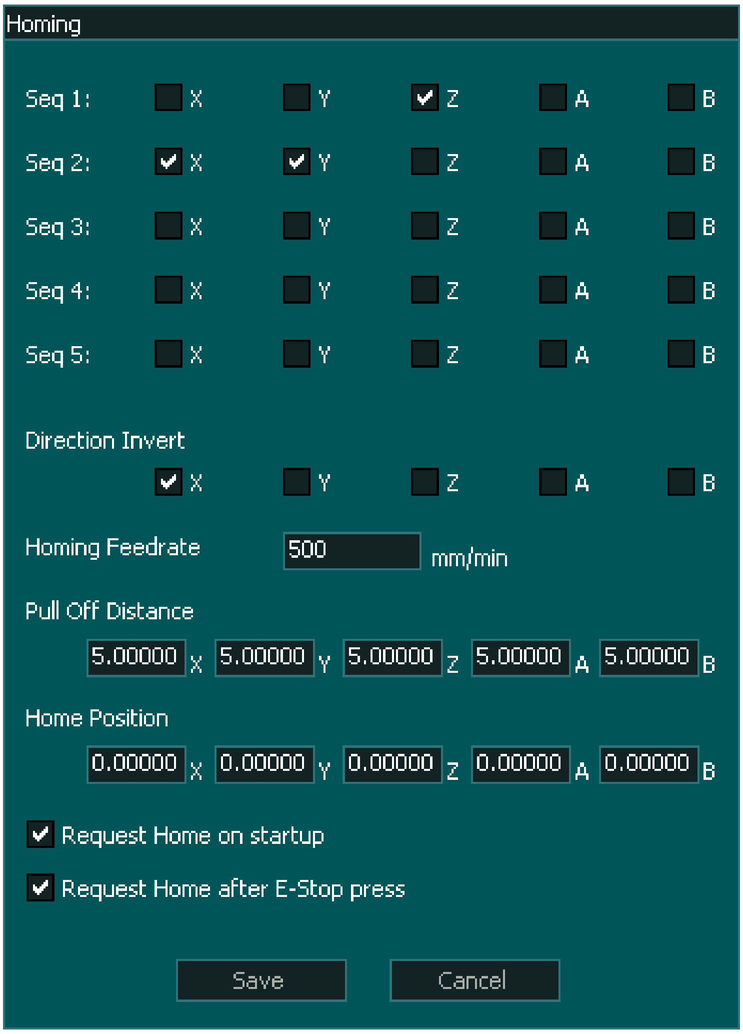


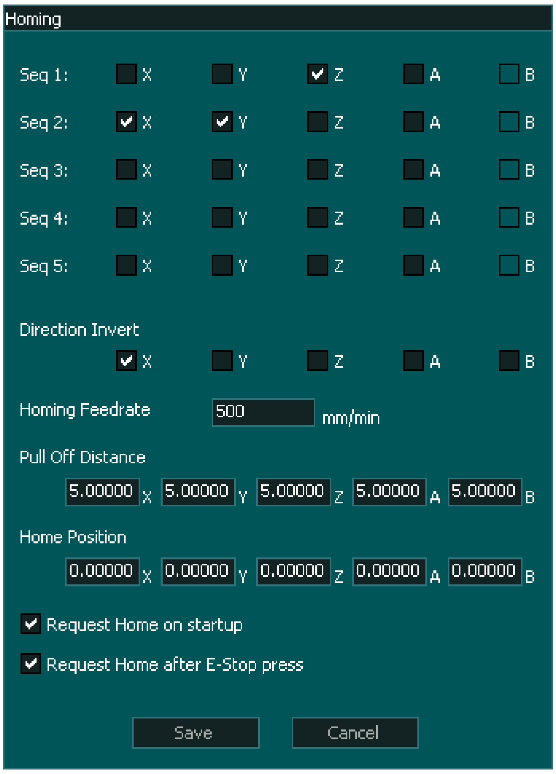
Step 4: Setting homing direction

During homing if any of the axis starts moving away from the homing sensor/switch, press **ESCAPE** or feed hold button to stop homing cycle and invert the direction in the homing setting as shown below.

In the Examples below the X-axis homing direction has been inverted.

- When inverting the homing direction of a slaved axis please make sure that both axis have the same setting for the axis that make up a slaved pair or they will travel in opposite directions.


Homing
Seq 1: X Y Z A B
Seq 2: X Y Z A B
Seq 3: X Y Z A B
Seq 4: X Y Z A B
Seq 5: X Y Z A B
Direction Invert
X Y Z A B
Homing Feedrate
500
mm/min
Pull Off Distance
5.00000 X 5.00000 Y 5.00000 Z 5.00000 A 5.00000 B
Home Position
0.00000 X 0.00000 Y 0.00000 Z 0.00000 A 0.00000 B
Request Home on startup
Request Home after E-Stop press
Save
Cancel



Step 5: Pull off Distance

Once Masso finds the homing sensor it will stop and back off the sensor until the sensor logic returns to Low. It will them back off the sensor by the distance specified in the pull-off distance setting on the homing screen. The new position will be assigned the Home position value

- On the Masso G3 (above left) separate pull-off distances can be specified for each axis. Please ensure that you enter the same distance values for the axis that make up a slaved pair or the axis will skew.
- On the Masso G2 (above right) a single pull-off distance is specified which is applied to all axis.

Step 6: Specifying the homing location

As the homing sensors/switches can be mounted on either side of the axis, the position of the homing sensor/switch needs to be entered. If the sensor/switch is mounted on the 0.00 location as per the above example then enter **Home Position as 0.00**. If the sensor/switch is mounted on the other side, for example, the axis travel is 400mm and the sensor/switch is mounted at 400mm location then set **Home Position as 400.0**

INFORMATION: It's a good idea to set to enable ***"Request Home on startup"*** and ***"Request Home after E-Stop press"*** option in the "***Homing settings"*** window. This will blink a homing request alarm on the screen to tell the user to home the machine before use and won't let the user run and gcode without homing the machine.

Wiring the Masso Homing sensor

Information on wiring the Masso Homing sensor

If you are using a third party homing sensor please see our Quick start guide on identifying and connecting.

14.14. Soft & Hard Limits

Soft Limits

For each axis minimum and maximum travel are required as part of the axis calibration process. These values are used by the system to check if the requested motion command is within the travel limits of the axis. If the requested motion is outside the travel limits then the motion is not executed and a soft limit alarm is flashed on the screen.

INFORMATION: Soft limits can be disabled in the F1-Setup screen under general settings, once disabled the gcode motion from a file or MDI command is not checked for soft limits. To jog the machine, minimum and maximum travel values are required and even if soft limits are disabled, still the system will only jog within the minimum and maximum travel only.

INFORMATION: From MASSO G3 software version 3.47, tool changer and tool holders can be outside the soft limit travel. This way the user can have a work area within the soft limits and the tools outside the soft limits and avoid crashing into tools when machining.

Hard Limits

All homing inputs on MASSO are automatically used as hard limit input. During the homing of the machine these inputs are used to home each axis and once homing is complete, these inputs are used to trigger a hard limit alarm that stops all motion and spindle. A hard limit alarm is flashed on the screen.

14.15. List of Configurable Inputs

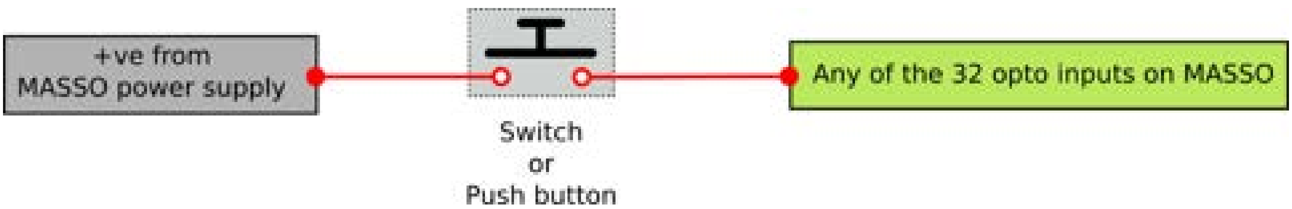
Different functions can be assigned to inputs in the **F1-Settings** screen. These can be used to set up things such as:

- Homing sensors.
- Input buttons for cycle start.
- Input buttons to automatically load gcode files from USB Flash drive.
- Tool changer sensor inputs.

INFORMATION: All input signals can be easily inverted by selecting the input in the **INPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

INFORMATION: All Masso inputs are optically isolated and trigger with inputs from +5v to +24v

INFORMATION: Some inputs used for external buttons require the button to remained pressed for 1 second before the input is accepted. This is to safe guard against accidental operation.



List of Configurable Inputs

INFORMATION: Input 9 on MASSO has special circuitry for connection as Plasma-MASSO DTHC on the MASSO G3 and MASSO touch. If you are not using the MASSO DTHC you can assign any the input to any other feature.

- Air Pressure Low Alarm
- Auxiliary Input 1-16
- Auxiliary Output 1-6 Toggle - (This input toggles the corresponding auxiliary output 1-6 status from high to low or lot to high depending on it's current state)
- Autoload G-Code (1, 2, 3, 4, 5, 6) Inputs
- Cycle Start Button Input.

- Cycle Stop Button Input - (Feed hold)
- Chuck Clamp/Unclamp - (This input is used to open the chuck by changing the Chuck Clamp output to High while the button is pressed and is interlocked with the spindle.)
- Coolant Flood On Input.
- Coolant Mist & Flood Off
- Coolant Mist On Input
- Door Open/Close
- Door Sensor Input
- Gcode Rewind Button
- Go to Home Machine
- Go to Parking Position
- Home Machine Input.
- Jog/Rapid A+ & A- Inputs
- Jog/Rapid B+ & B- Inputs
- Jog/Rapid X+ & X- Inputs
- Jog/Rapid Y+ & Y- Inputs
- Jog/Rapid Z+ & Z- Inputs
- Jog/Rapid Mode Input (This input changes the jog/rapid axis inputs above from single step to continuous mode while the input is high.)
- Lubricant Alarm Input
- Oxy Flameout
- Plasma-MASSO DTHC (**NOTE:** This feature can only be assigned to input 9 on MASSO G3 & MASSO Touch)
- Plasma Ohmic
- Plasma - Torch Touch Signal
- Plasma - Torch Breakaway Signal
- Plasma - Plasma Arc OK Signal
- Probe
- Spindle Coolant Flow Alarm Input.
- Spindle Coolant Pulses Alarm - (minimum 1 pulse need every 10 seconds)
- Spindle Motor Alarm.
- Spindle VFD Run Status
- THC UP
- THC Down
- Tool Changer - Inputs
- Tool Setter
- WaterJet-Cut Sense
- WaterJet-Head Breakaway
- WaterJet-Air Pressure Low
- WaterJet-Water pressure Low
- WaterJet-Abrasive Metering
- X, Y, Z, A, B - Home Sensor Input
- X, Y, Z, A, B Motor Alarm Input

Inputs available in Beta software

- Auxiliary Output 1-16 Toggle - (This input toggles the corresponding auxiliary output 1-16 status from high to low or lot to high depending on it's current state)
- Dust Hood-1
- Dust Hood-2
- Spindle CW - On/Off
- Spindle CCW - On/Off

- Plasma On/Off

14.16. List of Configurable Outputs

Different functions can be assigned to outputs in the **F1-Settings** screen. These can be used to set up things such as:

- Tower lights.
- Coolant control.
- Tool changer control signals.

INFORMATION: All output signals can be easily inverted by selecting the output in the **OUTPUTS** list and pressing the space-bar key on the keyboard to invert the output signal. These settings are automatically saved.

List of Configurable Outputs

INFORMATION: Output 11 on MASSO has special circuitry to output PWM for the controlling a Laser on MASSO G3 & MASSO Touch. If you do not require a a Laser-Engraving (PWM) output you can assign the output to any other feature.

- Auxiliary Output (1 to 16) Output.
- Camera-Light On/Off
- Chuck Clamp.
- Coolant Flood.
- Coolant Mist.
- Door Open/Close
- Laser-Air Assist
- Laser Crosshair +
- Laser-Engraving (PWM) (**NOTE:** This feature can only be assigned to output11 on MASSO G3 & MASSO Touch)
- Laser Pointer On /Off
- Laser Up/Down
- Light On / Off
- Lubrication.
- Oxy-Gas1 On/Off
- Oxy-Gas2 On/Off
- Oxy-Igniter
- Oxy-Up/Down
- Pen 1-Up/Down
- Pen 2-Up/Down
- Plasma On/Off Signal
- Plasma-Up/Down
- Scribe Up/Down
- Scribe on/Off

- Sounder
- Spindle Select (Main & Multi-Spindle 1-4)
- Tool Air Blast Cleaning
- Tool Changer - Outputs
- Touch Screen Beep Output
- Tower Light Red, Yellow or Green
- WaterJet-Abrasive On/Off
- WaterJet-Air On/Off
- WaterJet-Low Pressure On/Off
- WaterJet- On/Off
- WaterJet-Pump On/Off
- WaterJet-Shield On/Off
- WaterJet-Tap Water On/Off

Outputs available in Beta software

- Dust Hood-1
- Dust Hood-2

INFORMATION: When an output shows HIGH it will output 5 volts on the output pin and when the output is low it will output 0 volts.

CAUTION: When Masso turns on it will set the outputs to the logic levels shown on the F1 page. Please ensure that you take this into account when setting up the initial logic level of your output as it will determine if the output will turn on or off when Masso is powered up.

14.17. TTL Outputs

18 Transistor–transistor logic (TTL) outputs are available on MASSO controller, these outputs can be assigned different functions in the MASSO setup screen, please see this link **CLICK HERE**

- These outputs are designed to be interfaced to other electronics for low current signals. The maximum allowed current load on each output is **5 (mA)**.
- For controlling things such as actuators, motors or relays please use a driver/amplifier board or the MASSO Relay module which is designed to work with these outputs.
- MASSO G3 outputs will provide a 5 volt signal when the output goes high and 0 volts when the output goes low. The output is reversed if you invert the output in the F1 screen.
- MASSO G3 outputs have built in protection that prevent the output from sinking current.
- MASSO G2 outputs do not include and protection on the output can can both source and sink current.

To control high load electronics use the MASSO relay module **CLICK HERE**

CAUTION: Connecting high current devices such as motors or relays to these outputs will damage the controller.

CAUTION: Do not use cheap relay modules as they are known to feed back voltages into MASSO and completely destroying the controller.

INFORMATION: All output signals can be easily inverted by selecting the input in the **OUTPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

14.18. Controlling Relays

MASSO Relay module can be used to control up to 6 relays per module and multiple modules can be connected to control more relays.

These relays can be used to control high load devices such as actuators and motors.

CAUTION: Connecting the power polarity in reverse will damage the relay module.

INFORMATION: For more details about MASSO relay module, **CLICK HERE**

14.19. MPG Pendant

Information: Jogging with the MPG can only be done in the F3 JOG screen.

Information: The MPG can be used on the F2 screen in combination with the F11 (Feed Rate Override) and F12 (Spindle Speed Override).

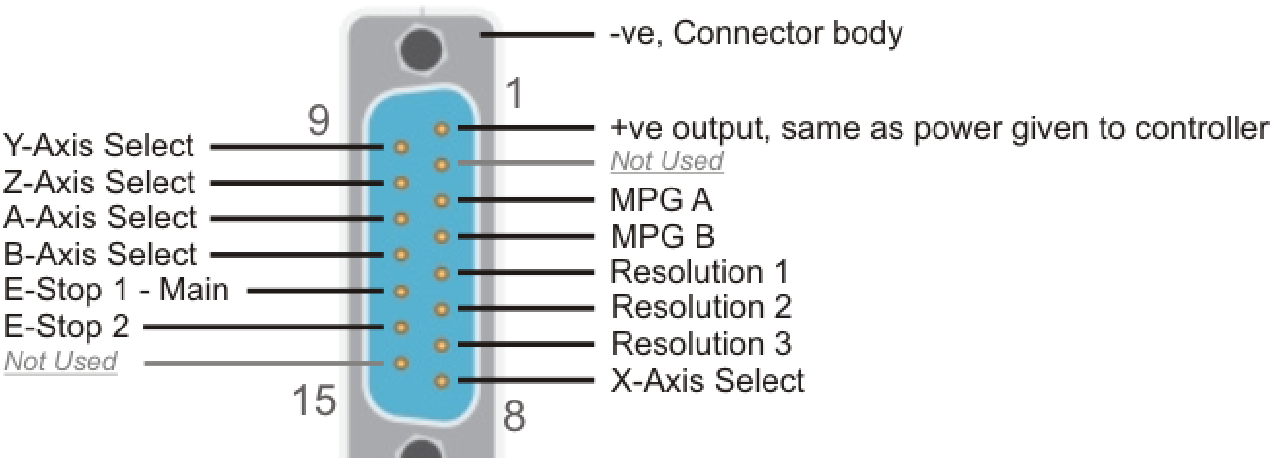
A wired MPG (Manual pulse generator) can be connected to MASSO to jog machine axis and to control things such as feed and spindle overrides.

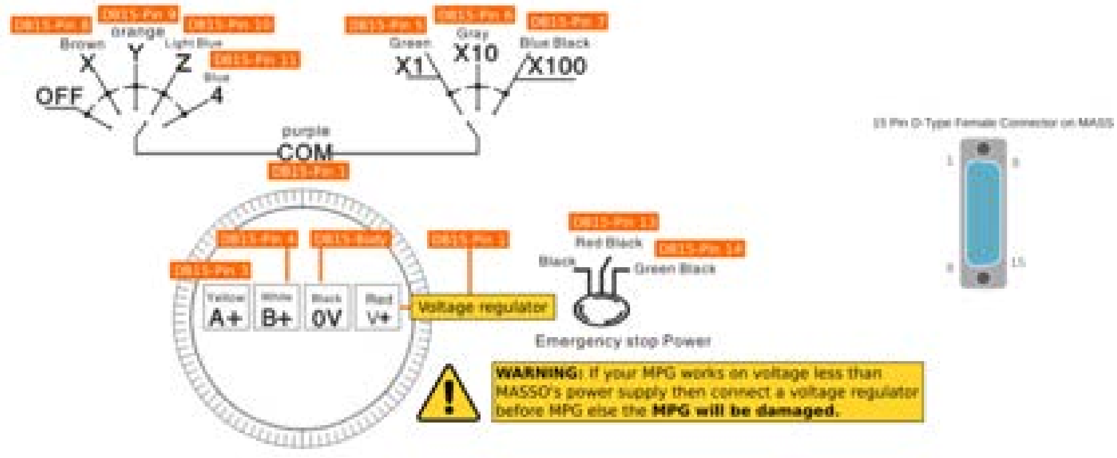
A ready to plug in MASSO MPG pendant can be purchased from this link **CLICK HERE**

MPG Pendant Wiring

To wire a different MPG pendant or a MPG handwheel on you machine, please see the below instructions.


X10
X100
0
10
20
90


-ve, Connector body
1
9
Y-Axis Select
Z-Axis Select
A-Axis Select
B-Axis Select
E-Stop 1 - Main
E-Stop 2
Not Used
15
8
+ve output, same as power given to controller
Not Used
MPG A
MPG B
Resolution 1
Resolution 2
Resolution 3
X-Axis Select



Pendant Resolution

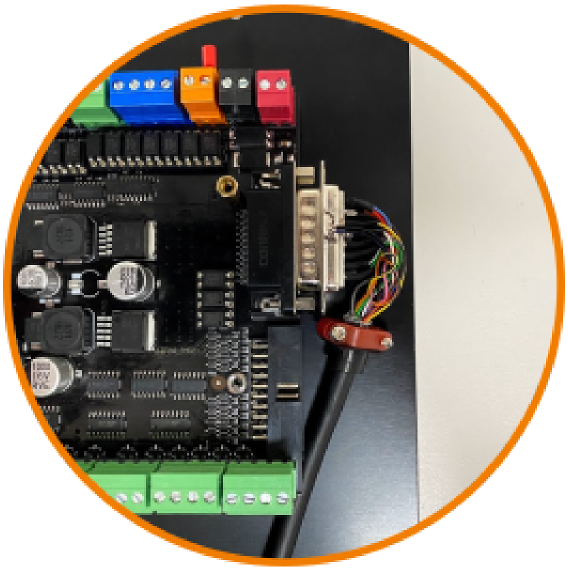
Resolution	Metric	Imperial
x1	0.01mm	0.0005”
x10	0.1mm	0.001”
x100	0.5mm	0.01”

Extension Cable

If you wish to use an DB15 extension cable between Masso and your Pendant please check with your supplier that it connects not only the 15 pins of the plug, but the shield of the plug also connects end to end or the pendant will not work.

Installing MPG connector on MASSO Touch

- Pass the cable through the slot in the rear of MASSO.
- To connect the MPG connector, remove the D-Connector plastic shell and install it as shown below.
- Move the Estop wire going to Estop 2 and move it to Estop 1 to allow the pendant Estop to work



MPG inputs

All inputs are optically isolated and are rated up to 24 volts.

All inputs are visible in the F1 screen for troubleshooting purposes and the input logic can be inverted to suit different pendant outputs if needed.

MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low
MPG	Select X	No	Low
MPG	Select Y	No	Low
MPG	Select Z	No	Low
MPG	Select A	No	Low
MPG	Select B	No	Low
MPG	Resolution 1	No	Low
MPG	Resolution 2	No	Low
MPG	Resolution 3	No	Low

Troubleshooting the MASSO Pendant

This troubleshooting guide covers the official MASSO pendant and not everything may apply to a third party device

- MPG inputs must show **No** in the invert column or it will not work correctly. All MPG inputs must show Low when the MASSO pendant is unplugged.
- When the pendant is plugged in and turned on you will see the selected inputs go high.
- When the MASSO MPG is turned off or Axis 6 is selected only the selected Resolution input will show as High.
- There will be one MPG Select and one Resolution input High at any one time. If more than one of each is present at the same time the pendant will not behave correctly. The most likely cause is that one of the MPG inputs is inverted. Check that all MPG inputs show **NO** in the invert column.
- While looking ant the F1 screen select each axis in turn on the pendant and each resolution and make sure each of the corresponding inputs change to High as they are selected. If an input does not change when it is selected on the MPG you may have a broken wire in the pendant.

MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low
MPG	Select X	No	High
MPG	Select Y	No	Low
MPG	Select Z	No	Low
MPG	Select A	No	Low
MPG	Select B	No	Low
MPG	Resolution 1	No	Low
MPG	Resolution 2	No	Low
MPG	Resolution 3	No	High

- When the Manual pulse generator is turned it is normal to see the MPG Dial Signal-A and MPG Dial Signal-B inputs changing between high and low in a random manner.

MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

- If the Estop on your pendant is not working on the pendant please check that you are using EStop1. If the wire is on Estop2 move it to Estop1 and the pendant will work correctly.
- If you cannot get MASSO out of Estop please check that the Pendant is plugged in properly as the Estop signal goes through the pendant and unplugging it will put the machine in Estop.
- For more information on the EStop wiring please see: [Estop Wiring]

Estop pin 1

14.20. Tower Lights

Tower lights can be wired to MASSO outputs to provide visual indication of machine status.

Name	State	Description
Red	Flashing	Major alarm example: E-Stop
Yellow	Flashing	Minor alarm example: Door is open or Homing required
Green	Solid	Program running normally
Green	Flashing	User action required example: M00, M01, Manual tool change

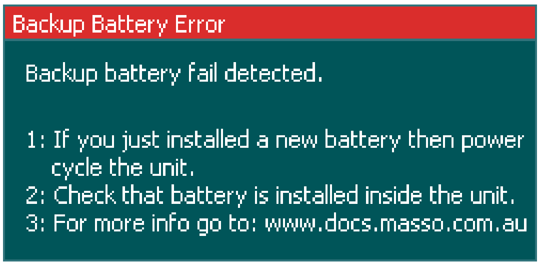
INFORMATION: All output signals can be easily inverted by selecting the input in the **OUTPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

14.21. Installing or Replacing Backup Battery

An internal backup battery is required for the controller to work properly.

If the controller's battery is not installed or the battery fails and needs to be reinstalled then the below message will be displayed when the controller is powered up.

After installing a new battery, power on the unit and you will still see the same error message, next power off the controller and power back on after 5-10 seconds and the message will be automatically removed once the battery is detected by the controller.



INFORMATION: A backup battery **(model CR2032)** is required for the controller to function and **MUST** be installed in the unit before use.

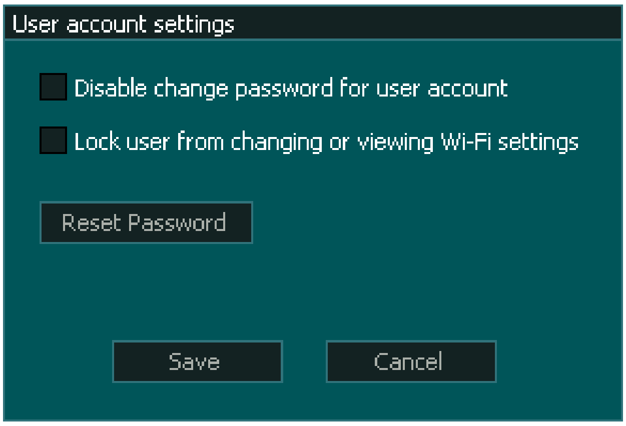
WARNING: After changing the battery make sure the controller is showing the correct loaded tool number as the loaded tool number will be reset to 0 after replacing the battery.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

MASSO 101 - Battery Backup Alarm

14.22. User Account Settings

INFORMATION: These settings are available on MASSO G3 software version 3.47 and above.



Disable change password for user account

If this option is ticked, the user can only enter password to start using the machine but is unable to change the password. This option can be useful if multiple users are using the machine and one user might change the password locking access to other users.

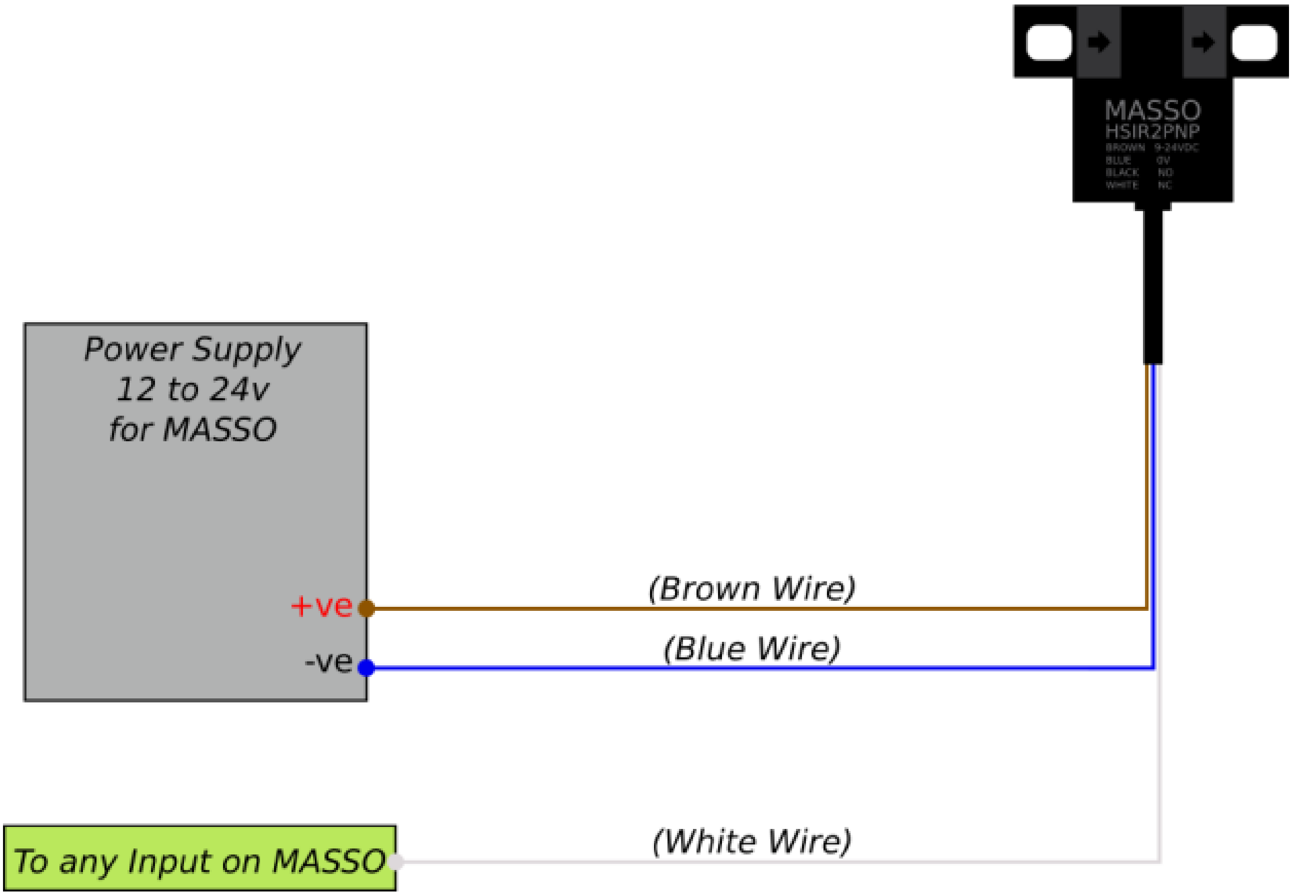
Lock user from changing or viewing Wi-Fi settings

If this option is ticked, the user can only view Wi-Fi status and IP address but can't change any of the settings including disconnecting or connecting the Wi-Fi network. The admin user should setup and click the connect button so that MASSO is connected to Wi-Fi network and then tick *"Lock user from changing or viewing Wi-Fi settings"* in F1-Setup screen. Next, if the controller is powered up or a user logs in then MASSO will automatically connect to the Wi-Fi network but will not allow the user to change any settings or disconnect from the network.

Reset Password

If the user has changed or forgot the password then admin can log in and click the *"Reset Password"* button to reset user password to "HTG".

14.23. MASSO Homing Sensor



High precision water-resistant homing sensor

- High accuracy with no moving parts, infrared light sensor.
- Homing repeatability better than 10 microns.
- Water-resistant with IP65 rating.
- Wide working voltage range 9 to 24VDC.
- 5 metre (16 ft) long high quality flex cable.
- Easy mounting using M3 screws.

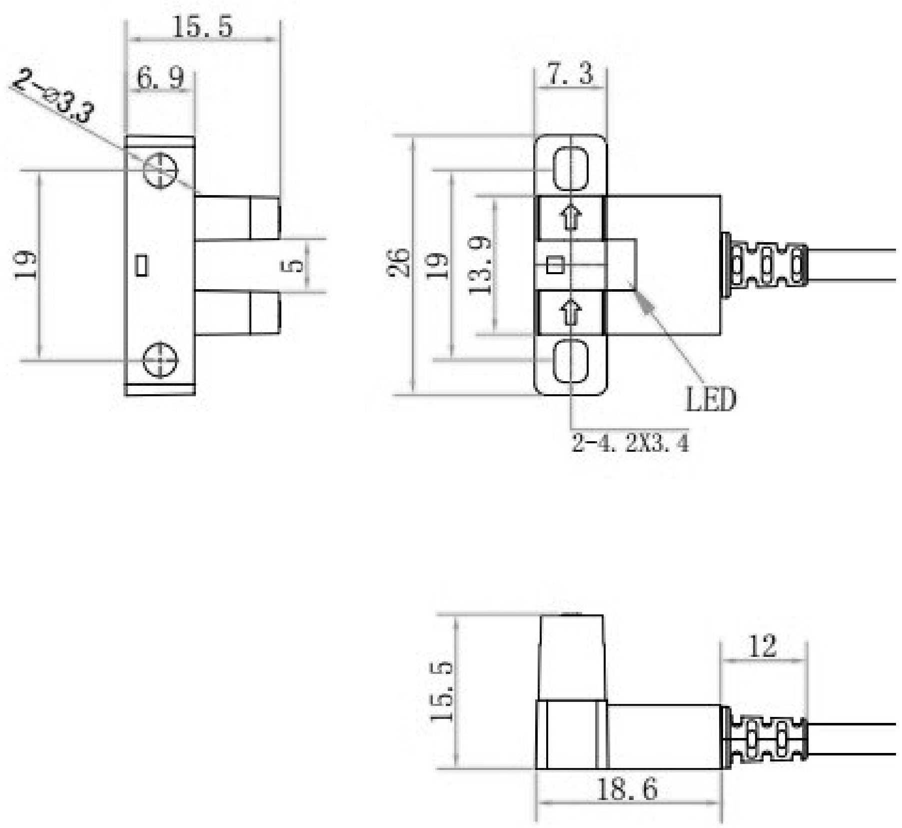
> **CAUTION:** Connecting the power polarity in reverse will damage the sensor.

Connections

- **BROWN** – (9~24VDC)
- **BLUE** – (0V)
- **BLACK** – (NO – Normally Open)
- **WHITE** – (NC – Normally Connected)

Mounting & Triggering mechanism

- Mount the sensor so that it can't get damaged by the operation of the machine.
- It needs to be situated so that when the homing position is reached it is triggered by a metal or any other material trigger plate attached to the machine.
- The sensor works by shooting infrared light from one side of the sensor towards the other receiving side. Any material that blocks this light triggers the sensor and the output signals are changed.
- Ensure the sensor does not receive infrared light from outside sources such as direct sunlight as this may cause false triggering of the sensor.
- The trigger plate needs to pass between the forks of the sensor.
- Mounting dimensions.



Powering your Homing sensors

Power for the homing sensors on **MASSO G2** can be provided from:

- Directly from the MASSO power supply distribution point.
- A separate power supply that shares a common ground, (-ve rail), with your MASSO power supply.

Power for the homing sensors on **MASSO G3** or **MASSO G3 Touch** can be provided from:

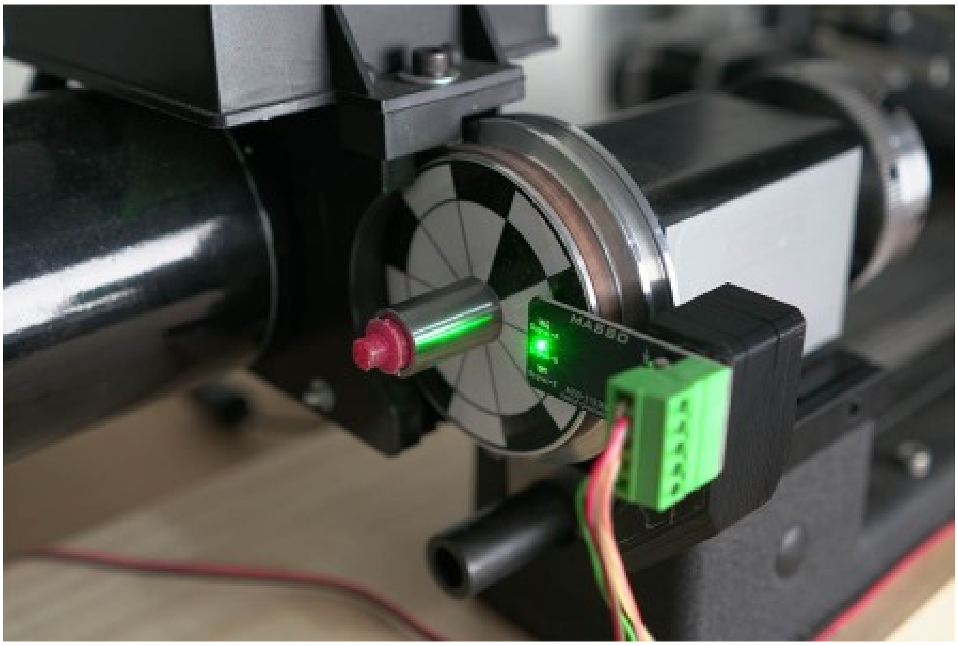
- Directly from the MASSO power supply distribution point.
- A separate power supply that shares a common ground, (-ve rail), with your MASSO power supply.
- The Auxiliary power terminals are built into MASSO. These are the Red and Black terminals found between the input and output terminals.

WARNING: The installation of a 1 amp fuse between your Power Supply and MASSO is required to protect against an accidental short circuit of the auxiliary power connectors on MASSO, such an event can damage the controller beyond repair.

CAUTION: Auxiliary Power and **Ground** terminals provided on the controller are only to be used for very low current devices and signals. Connecting high current loads can damage the controller beyond repair.

Homing setup instructions

14.24. MASSO Optical Encoder



MASSO contactless **optical quadrature encoders** are based on a non-mechanical design. By not having any moving parts, the sensors have very high accuracy and very low failure rate. The encoders can be easily mounted in front of your Lathe's spindle pulley to provide full quadrature encoder signals for multi pass threading.

- High accuracy with no moving parts.
- Easy to mount with no pulley or timing belts required.
- Wide working voltage range 12 to 24VDC.
- Easy mounting using M3 screws.

> **CAUTION:** Output signals are 0v for **LOW** signal and 10v for **HIGH** signal.

> **INFORMATION:** The maximum pulse frequency on encoder inputs for MASSO G3 controllers is 60kHz.

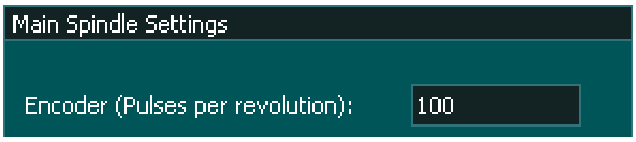
> **INFORMATION:** The maximum pulse frequency on encoder inputs for MASSO G2 controllers is 8Khz. The MASSO G2 can be upgraded to 20Khz by replacing the Encoder Optocouples. For more information on this please see: [Upgrading the spindle encoder G2]

Generate Encoder Disk Label

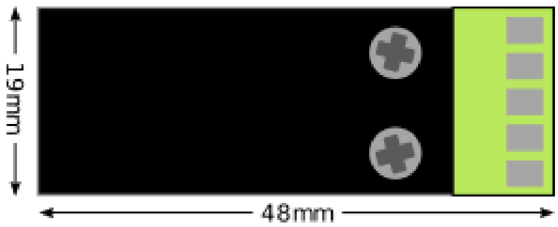
Simply click the below **"Generate Encoder Disk"** link to quickly generate the encoder disk label by entering the pulley **Outer Diameter (OD)** and **Inner Diameter (ID).**

Generate Encoder Disk

When using the encoder label generated using the link above, count the number of Black segments on the outside ring and enter this into the PPR box in the Spindle settings.

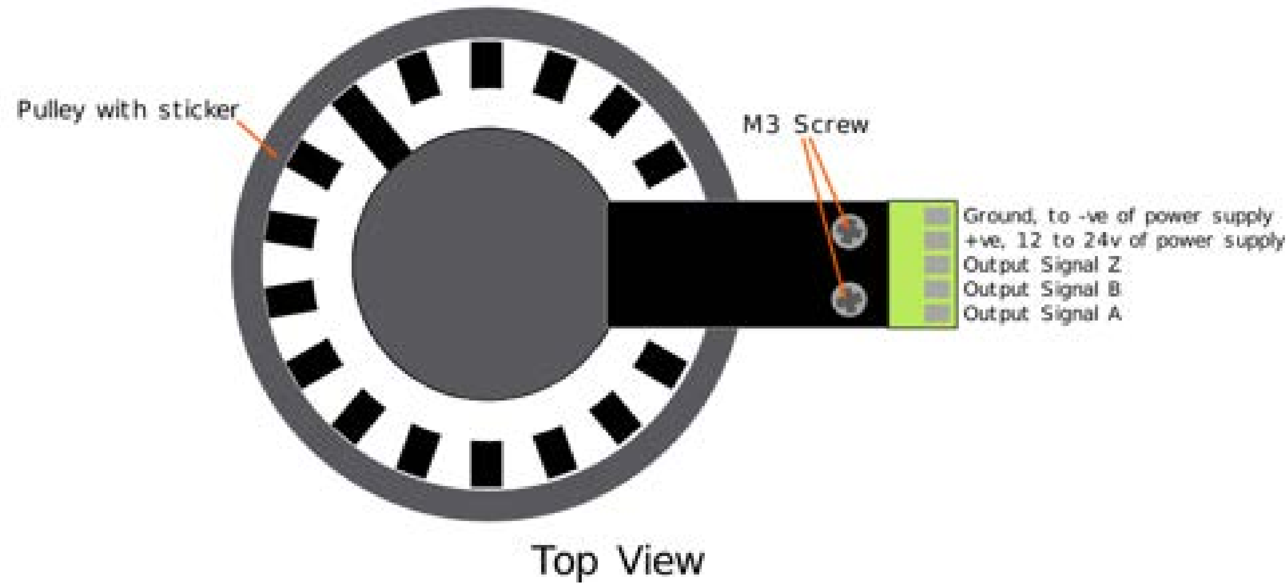


Mechanical Dimensions



Installing and Wiring

CAUTION: Connecting the power polarity in reverse will damage the sensor.



MASSO Spindle Encoder

14.25. MASSO Relay Module

MASSO 6 relay module provides optical isolation to high voltage/current signals from MASSO controller.

The Relay module is designed to work with the ES, Spindle control pins 2 & 3 and all TTL outputs of MASSO which have an operating voltage range of 2.2 to 5 volts.

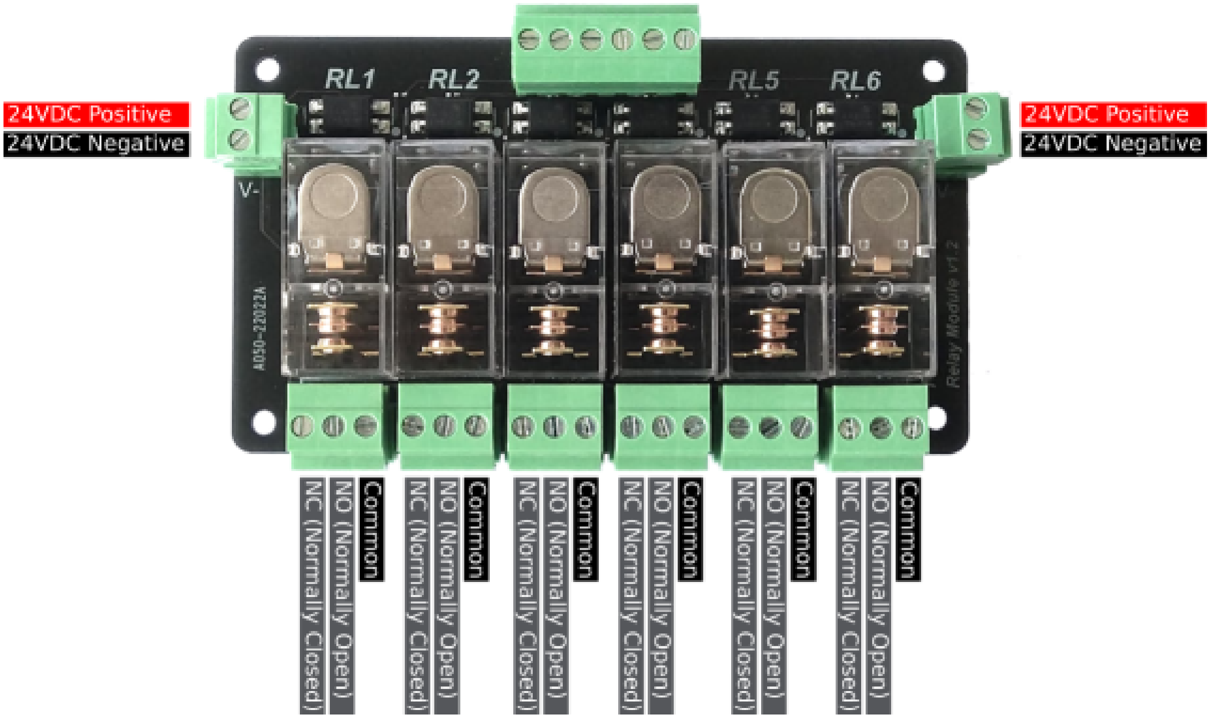
- Multi color LED's for each relay helps easily troubleshoot issues.
- **Green color LED** indicates that a signal is received to switch on the relay and the relay has been switched on.
- **Red color LED** indicates that a signal to switch on the relay has been received but the relay has failed and not working.
- Each relay can be used to control 5 Amp 28VDC or 5 Amp 240VAC load.
- Works with a single 24VDC power supply.
- Board dimensions: **95mm** (3.74 inch) x **25mm** (0.98 inch)

CAUTION: Connecting the power polarity in reverse will damage the relay module.

INFORMATION: Ordering MASSO relay module [CLICK HERE]

Scan the QR code to watch the MASSO video tutorial on YouTube
Or Click here to view the video

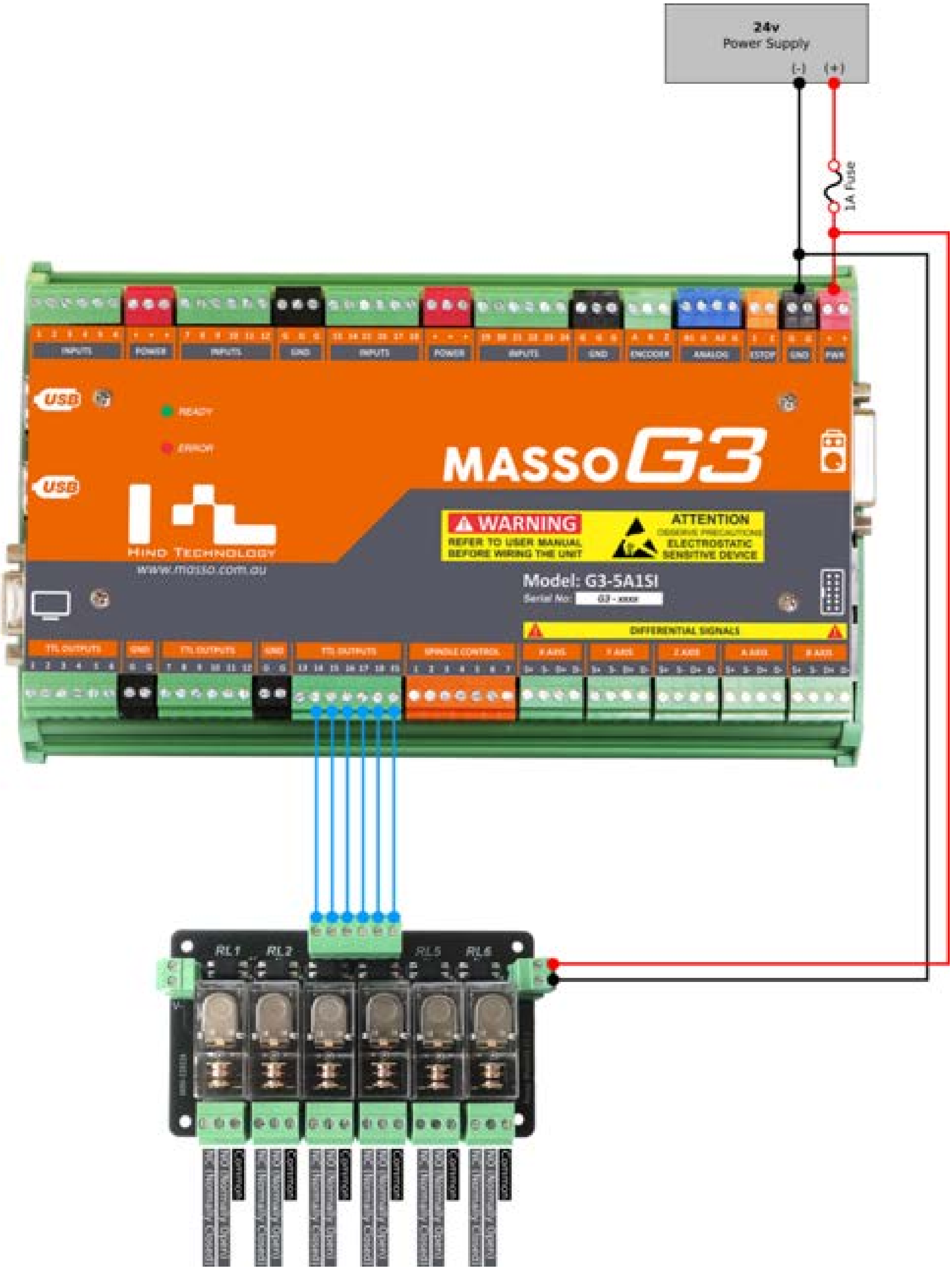
MASSO 101 - Wiring MASSO Relay Module



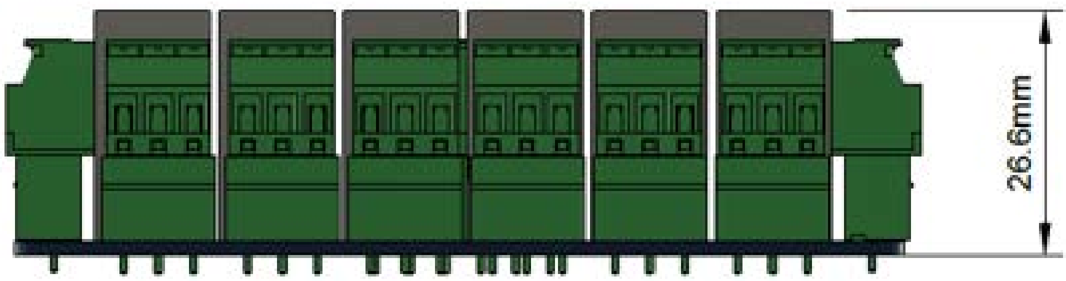
Green LED indicating relay ON

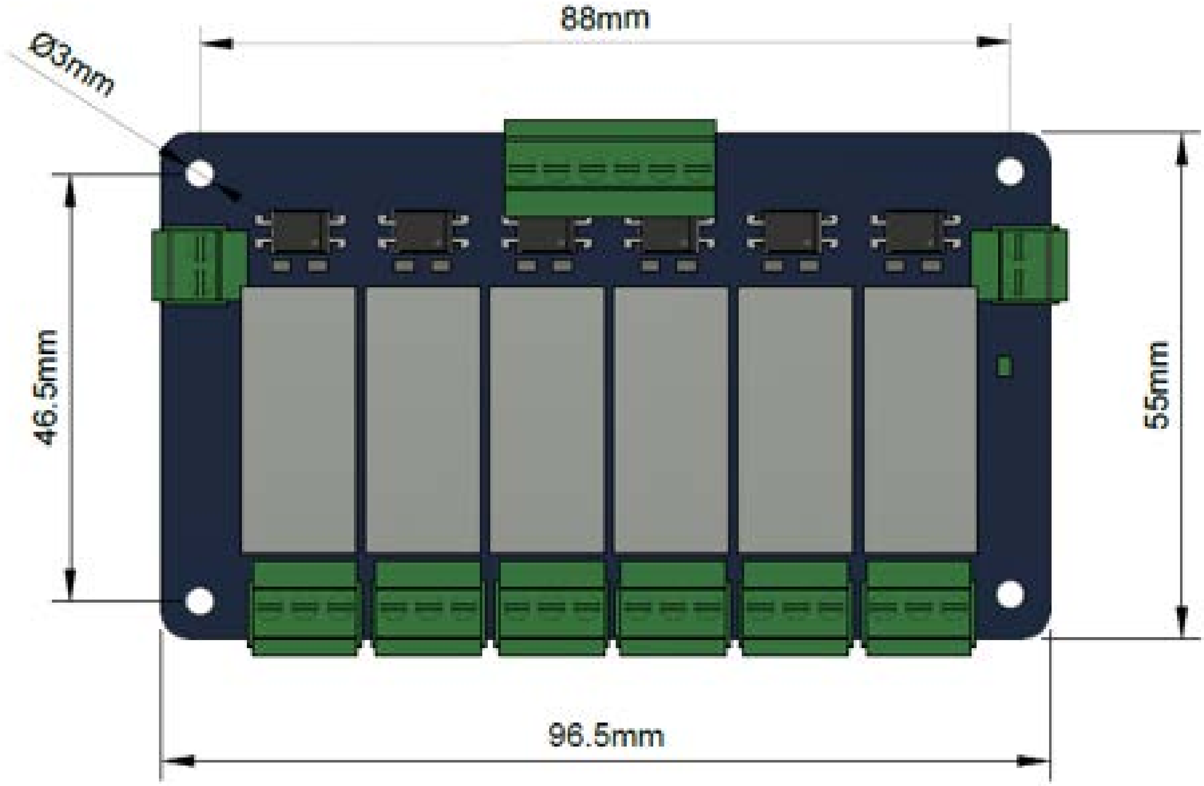
Red LED indicating relay failed

Wiring example


24v
Power Supply
(-)
(+)
1A Fuse
USB
USB
READY
ERROR
MASSO G3
HIND TECHNOLOGY
www.masso.com.au
WARNING
REFER TO USER MANUAL
BEFORE WIRING THE UNIT
ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICE
Model: G3-5A1SI
DIFFERENTIAL SIGNALS
RL1
RL2
RL5
RL6

Mounting and Mechanical Data





14.26. MASSO G2 Drive and Relay wiring

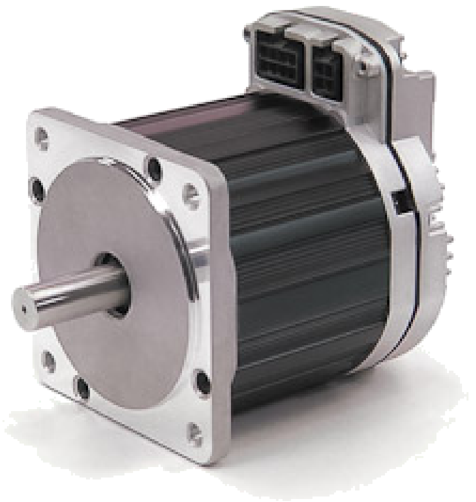
INFORMATION: This describes the wiring of the A & B axis on the Masso G2. For wiring of the X, Y & Z axis on the Masso G2 refer to examples in the G3 Section of this documentation.

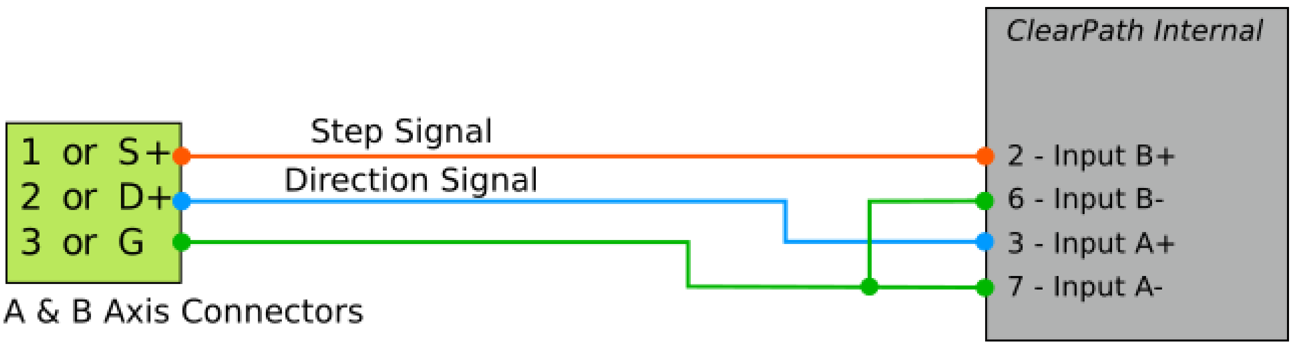
WARNING: Axis Step and Direction signals are common Ground and precautions must be taken to wire the controller to avoid any electrical damage to the system:

- All axis outputs are common Gnd with **+4** voltage signals.
- Never short-circuit the signals with each other or any other voltage.
- All signals must be isolated to other signals and connected directly to the drives

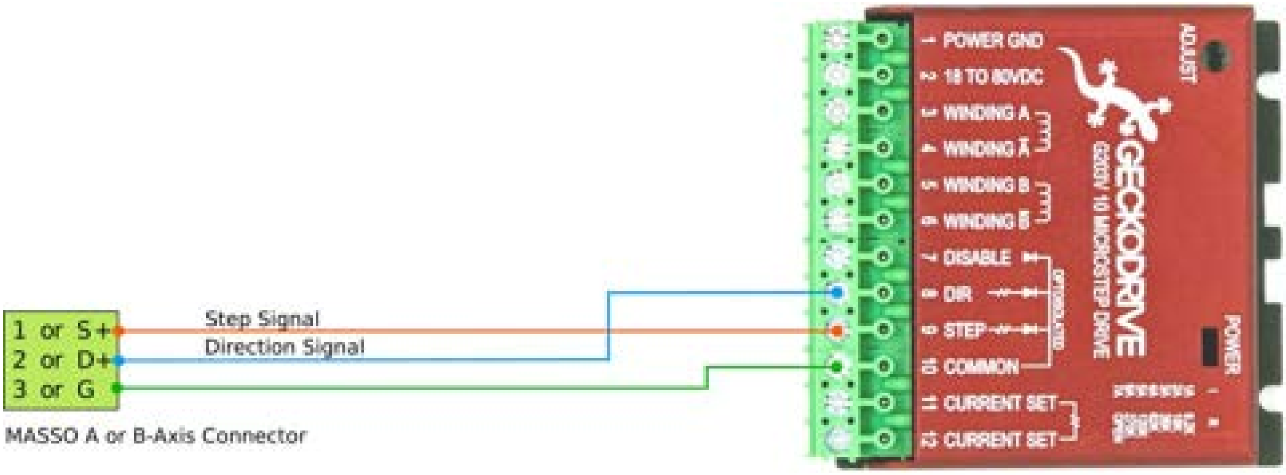
MASSO G2 A & B axis wiring examples

Teknic - ClearPath wiring

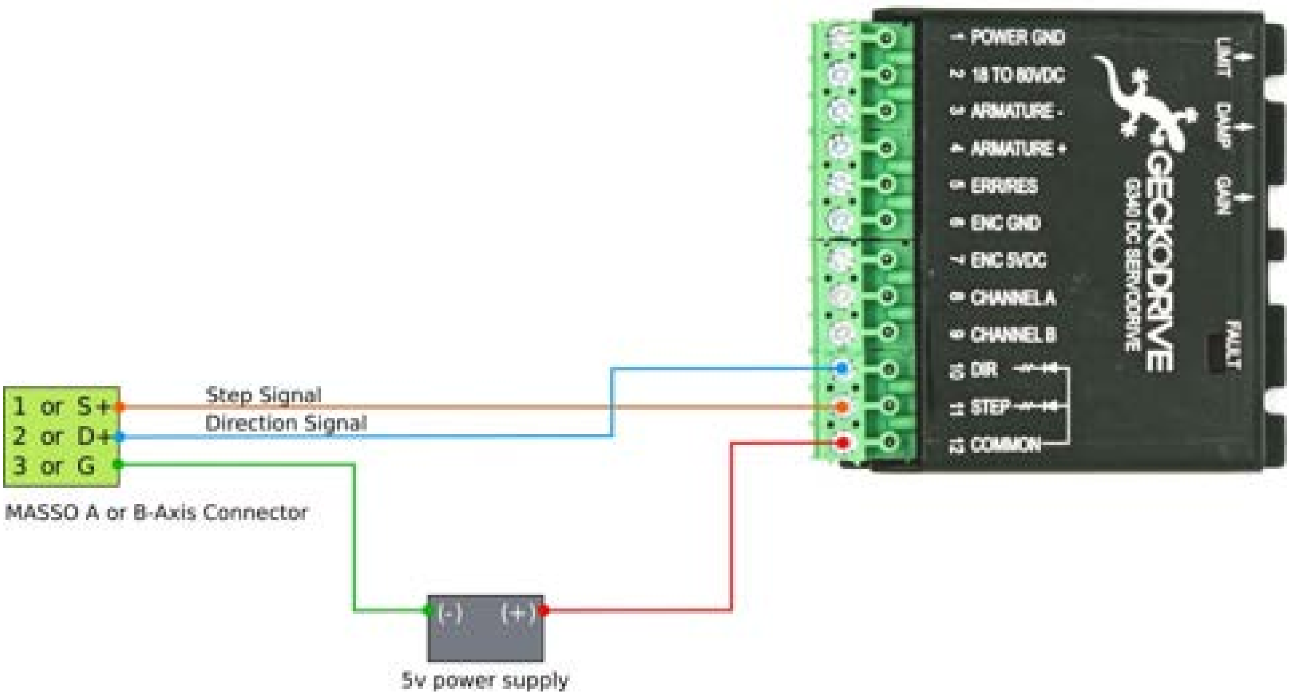




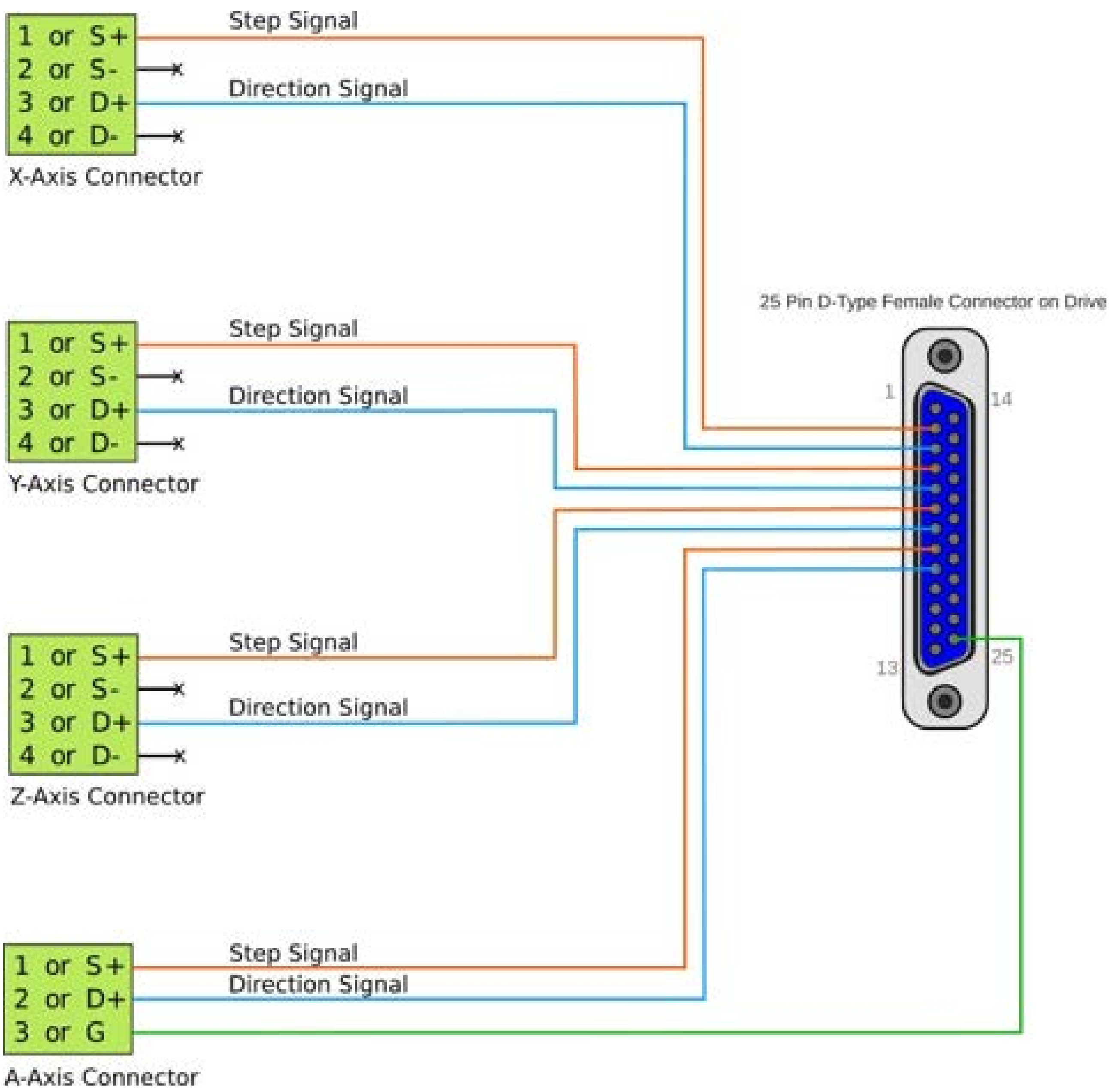
Gecko Drive 203V wiring



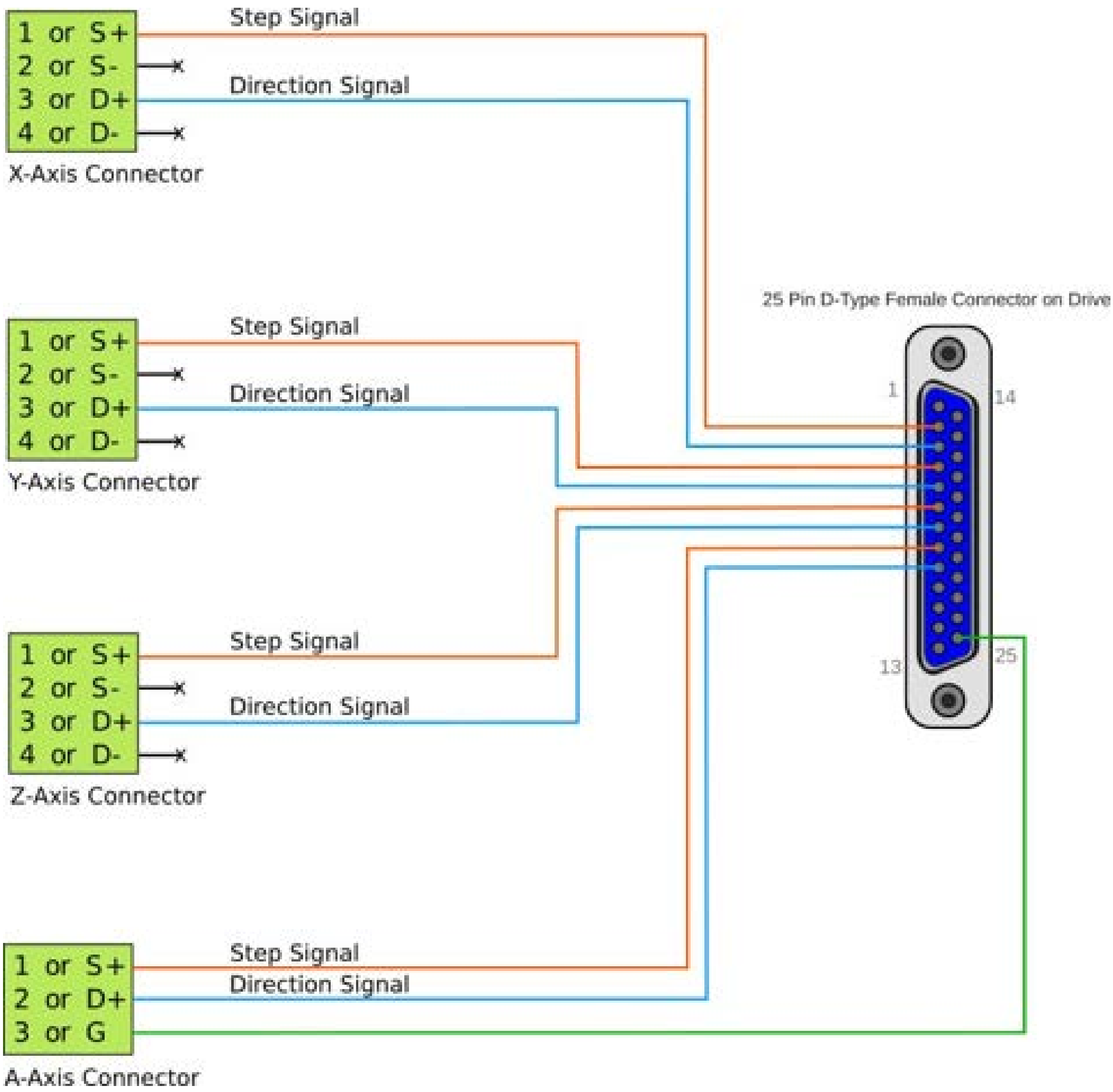
Gecko Drive G340 wiring



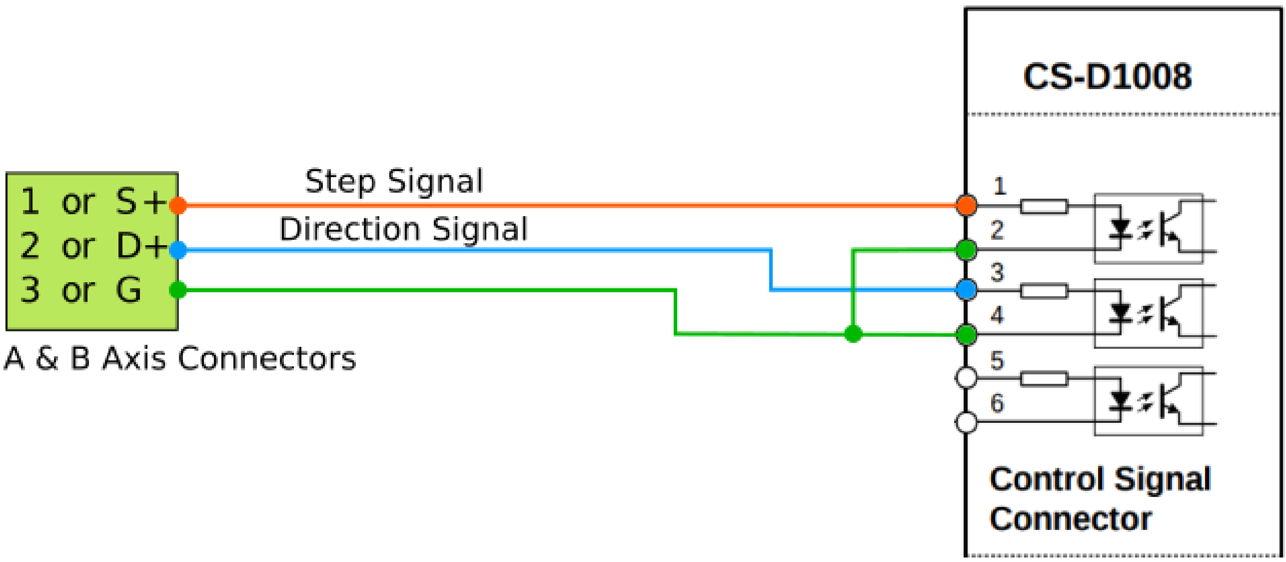
Gecko Drive G540 wiring



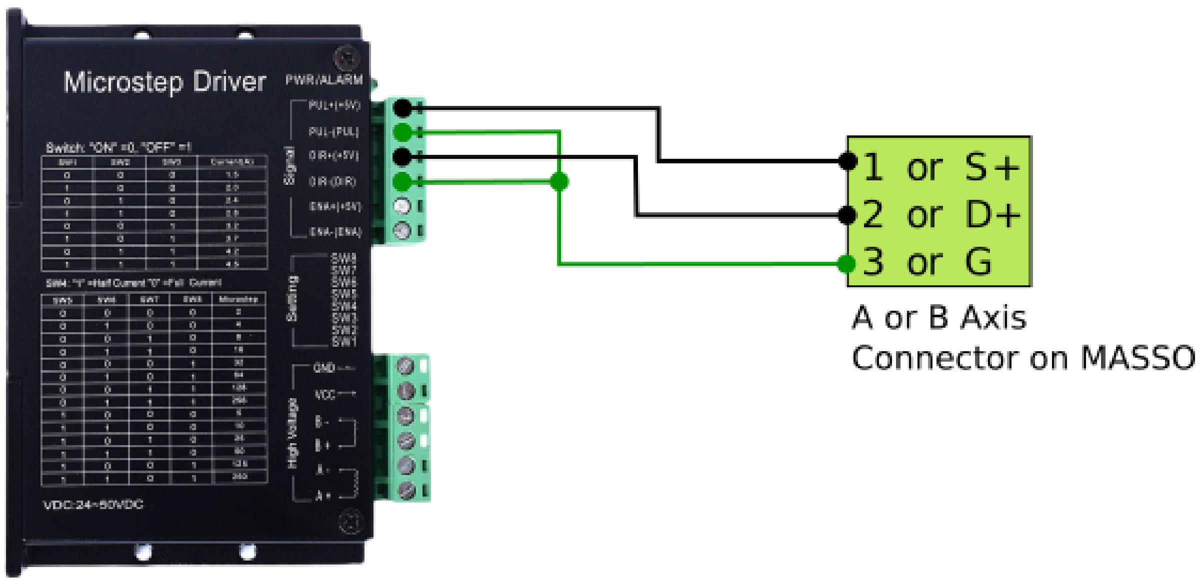
Leadshine Drive MX4660 wiring



Leadshine Drive CS-D1008 wiring

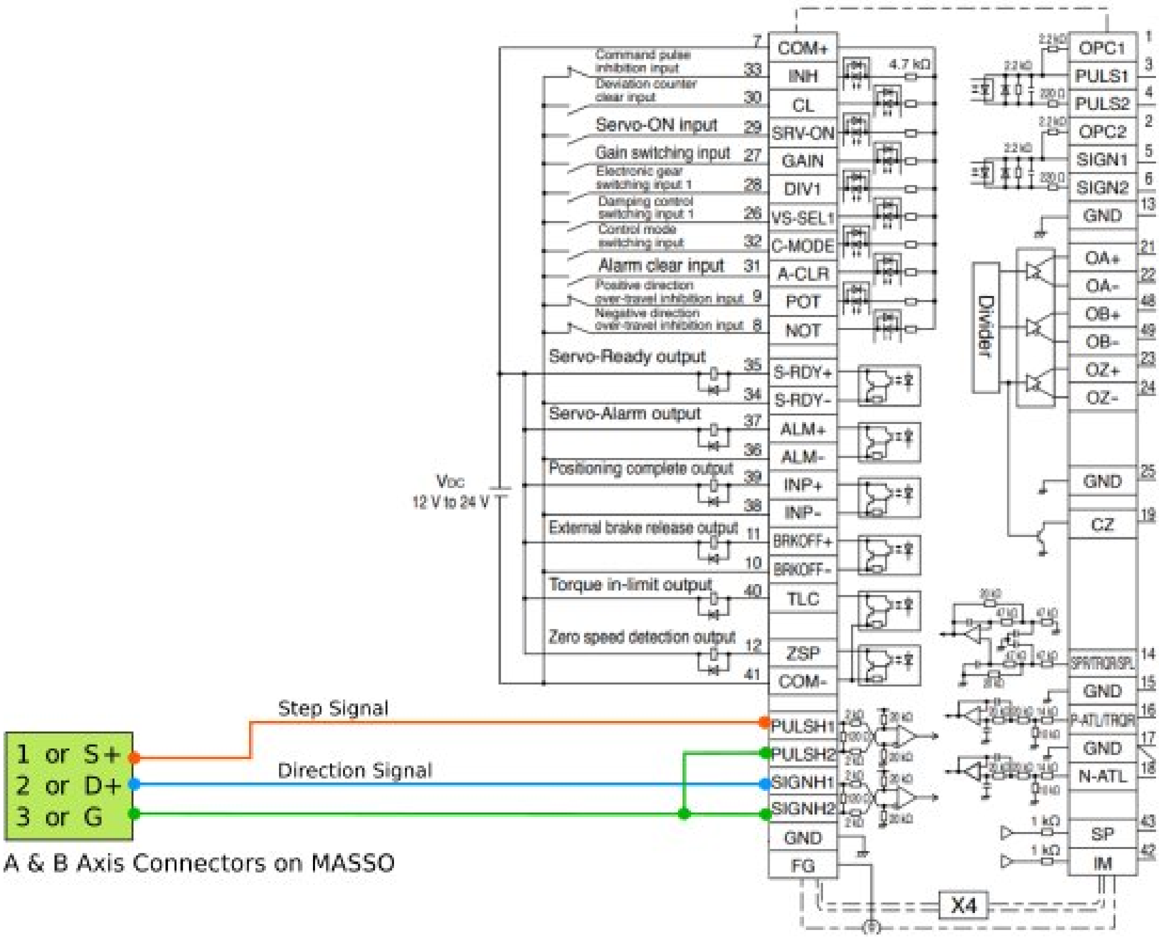


DM542A, DQ860MA wiring

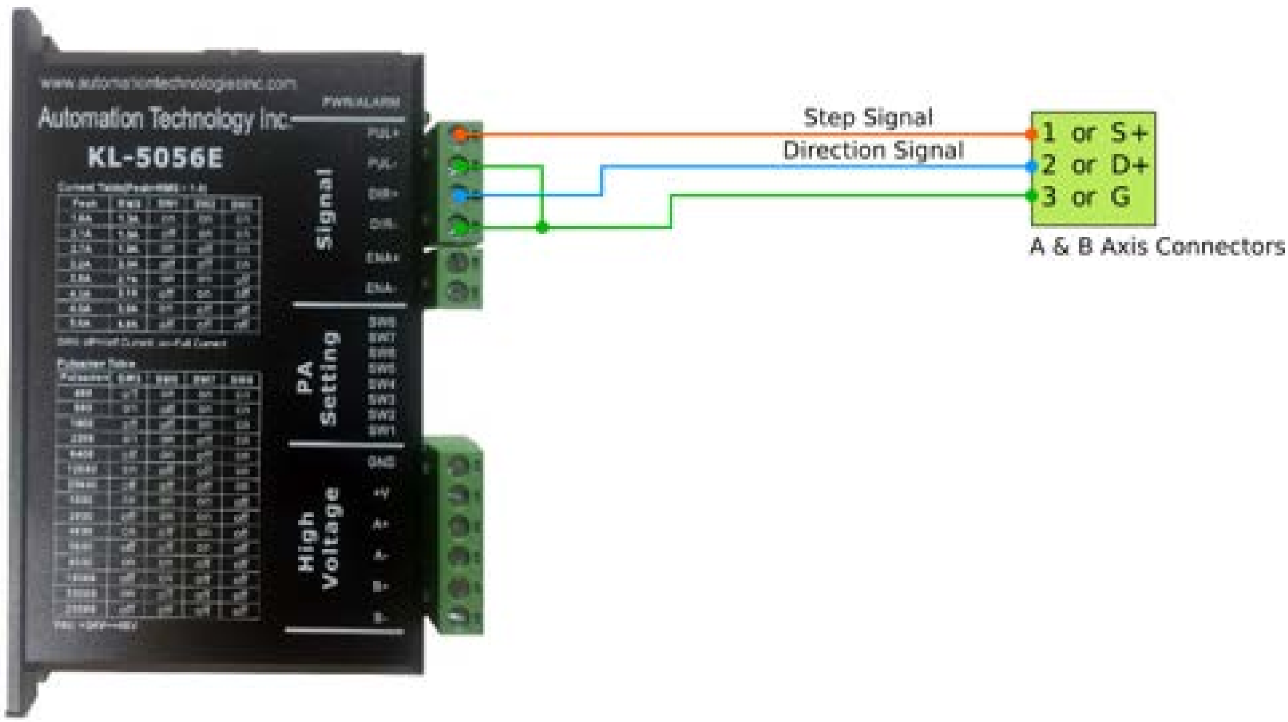


Mitsubishi - MR-J3 wiring

Panasonic - MCDHT3520 wiring



Automation Technology Inc. - KL5056E wiring



Information: If you have a MASSO-G3 or are wiring the X, Y or Z axis on A MASSO-G2 please CLICK HERE

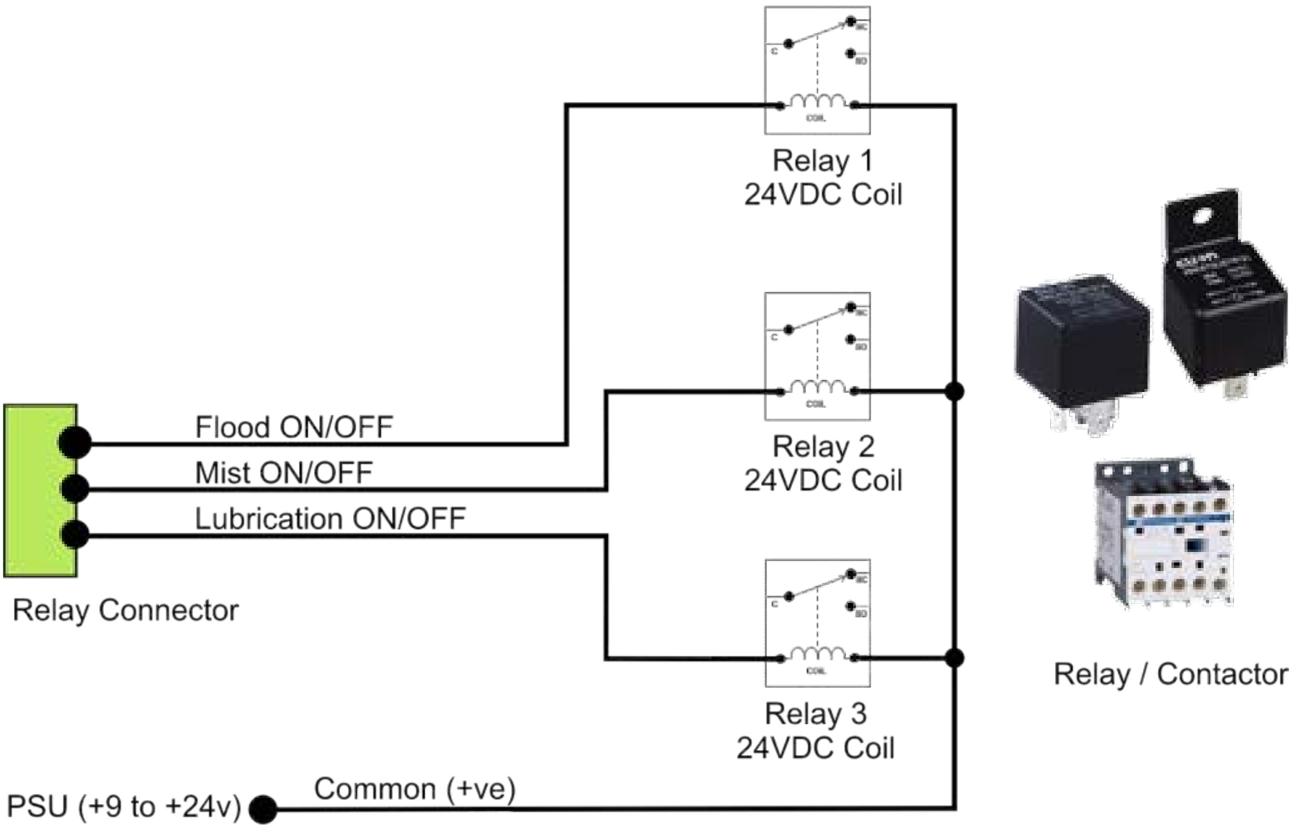
MASSO G2 Relay wiring example

INFORMATION: Assign the desired function to the Relay output you want to use by double clicking on the output and selecting the required function from the list.

INFORMATION: All output signals can be easily inverted by selecting the input in the **OUTPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

CAUTION: The Maximum current on any relay output must not exceed 400mA or the output will be damaged.

Pin No.	Description	Type
Pin 1	Relay 1 - Function configurable through software	Open collector (Max load 400 mA)
Pin 2	Relay 2 - Function configurable through software	Open collector (Max load 400 mA)
Pin 3	Relay 3 - Function configurable through software	Open collector (Max load 400 mA)
Pin 4	Relay 4 - Function configurable through software	Open collector (Max load 400 mA)
Pin 5	Relay 5 - Function configurable through software	Open collector (Max load 400 mA)
Pin 6	Relay 6 - Function configurable through software	Open collector (Max load 400 mA)
Pin 7	Relay 7 - **Output for E-Stop only**	Open collector (Max load 400 mA)



INFORMATION: If using TTL outputs on the MASSO-G2 or you are using the Masso-G3 please follow the link below.

[Using the MASSO Relay Module]

14.27. Lubrication

Lubrication

An output can be assigned as lubrication to turn on a pump at set intervals to lubricate your machine.

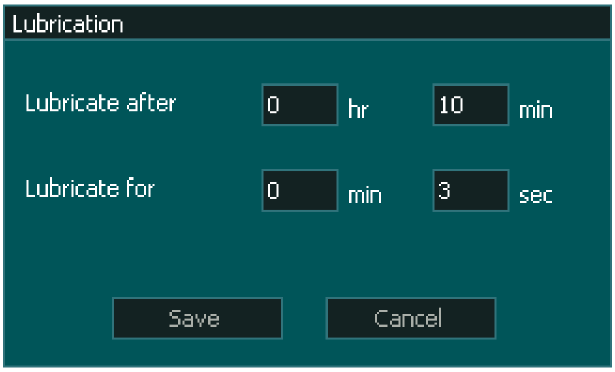
The output will go High automatically at the specified interval for the specified duration.

Lubrication operates while the program is running and will stop when the machine is idle or in an EStop condition.

Configuration

In the F1 screen select Lubrication.

Fill in the Interval and the duration. In this example the output will go high every 7 minutes for 5 seconds.



The lubrication output can be assigned to any of the TTL outputs in the F1 screen.

- Select the output you wish to use and double click with your mouse.
- Select Lubrication form the list of outputs and double click with your mouse.
- Your output is now assigned as lubrication.

Connect your lubrication pump to the TTL output using either the Masso relay module or other suitable interface module.

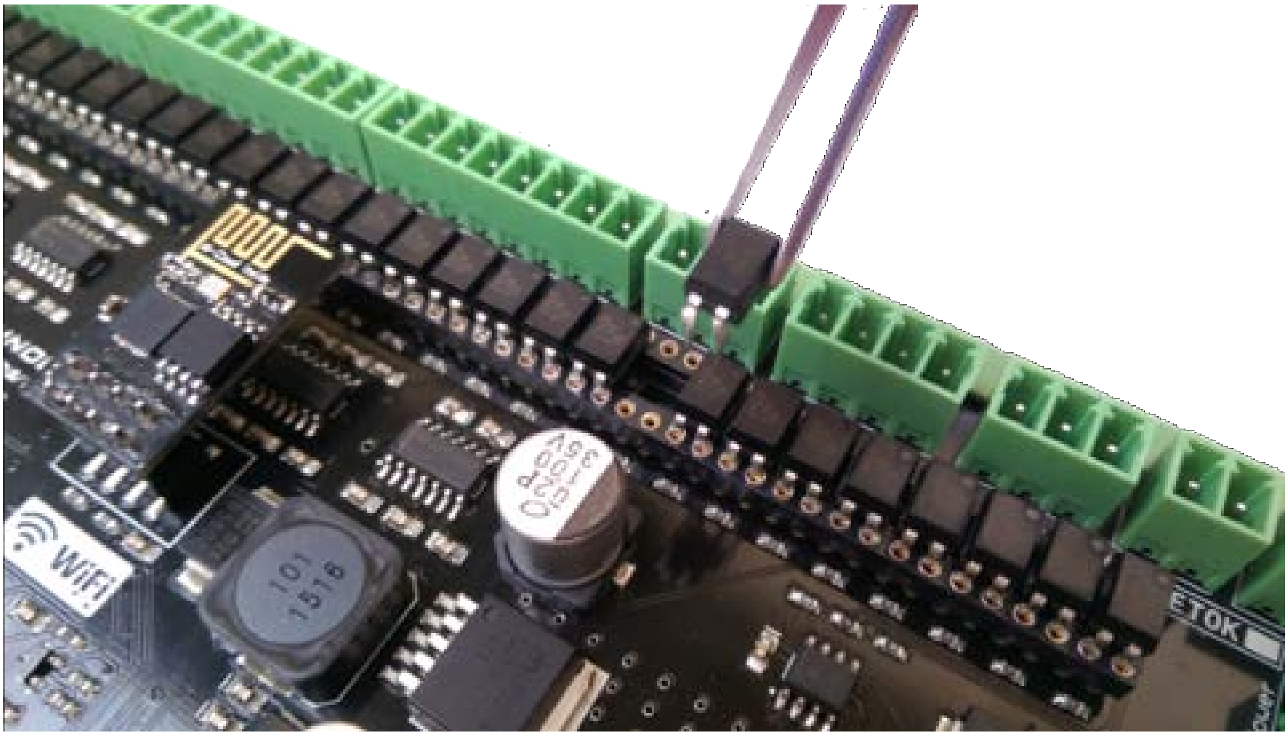
Lubricant Low alarm

If you have a lubricant vessel that has an alarm output you can connect it to Masso and a Lubrication alarm will display on Masso.

Top up your lubricant vessel and the alarm will automatically clear.

14.28. MASSO G2 Replacing Damaged Optocouplers

INFORMATION: This page is for the MASSO G2 only.



Sourcing replacement parts

INFORMATION: Damaged Optocouplers can be purchased from one of the following suppliers, please click the link below to directly jump to the part order page:

Digi-Key: Optocoupler LTV-816

Newark Element 14: Optocoupler KB817

Mouser Electronics: Optocoupler LTV-816

Identifying Optocouplers

Input Type	Optocoupler Number on Controller	Input Type	Optocoupler Number on Controller
Input 1	U1	Input 19	U19
Input 2	U2	Input 20	U20
Input 3	U3	Input 21	U21
Input 4	U4	Input 22	U22
Input 5	U5	Input 23	U23
Input 6	U6	Input 24	U24
Input 7	U7	Input 25	U25
Input 8	U8	Input 26	U26
Input 9	U9	Input 27	U27
Input 10	U10	Input 28	U28
Input 11	U11	Input 29	U29
Input 12	U12	Input 30	U30
Input 13	U13	Input 31	U31
Input 14	U14	Input 32	U32
Input 15	U15	Encoder-A	U33
Input 16	U16	Encoder-B	U34
Input 17	U17	Encoder-Z	U35
Input 18	U18		

Input Type	Optocoupler Number on Controller
MPG-A	U36
MPG-B	U37
X-Axis Select	U38
Y-Axis Select	U39
Z-Axis Select	U40
A-Axis Select	U41
B-Axis Select	U42
Resolution 1	U43
Resolution 2	U44
Resolution 3	U45
E-Stop	U46

Input Type	Optocoupler Number on Controller
Spindle CW	U47
Spindle CCW	U48

Testing procedure for Inputs 1 - 32

- Remove any wire connected to the input you want to test
- Go to the F1 screen and observe the logic state of the suspected input. It will show either HIGH or LOW depending on whether the input is inverted or not.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to the input you want to test.

- On the F1 screen you should see the input change from LOW to HIGH or from HIGH to LOW.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.

Testing procedure for Spindle Encoder Inputs

- Remove any wires connected to the Encoder inputs.
- Go to the F1 screen.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to the chosen encoder input.
- Encoder-A input you will see the Signal-A input of MASSO change from LOW to HIGH.
- Encoder-B input you will see the Signal-B input of MASSO change from LOW to HIGH.
- Encoder-Z input you will see the Index:0 Pos: 100 input of MASSO change from LOW to HIGH.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.
- If one is faulty only replace that optocoupler

Testing procedure for MPG Inputs

- Go to the F1 Screen
- Using your Pendant rotate the Manual pulse Generator, (MPG), and you will see the MPG-A and MPG-B flicker between HIGH and LOW randomly. If you see them flicker the Optocouplers are ok and do not need replacing.
- Use the Pendant Axis selector switch and rotate through Axis X,Y,Z,A & B and you will see the corresponding Axis select input change from LOW to HIGH as each is selected. If the inputs change they do not need replacing. If one is faulty only replace that optocoupler
- Use the Pendant Resolution selector switch to select between 1,10 & 100 and you will see Resolution inputs 1, 2 & 3 Change from LOW to HIGH as they are selected. If the inputs change they do not need replacing. If one is faulty only replace that optocoupler

Testing procedure for the Estop Input

- Remove the wire connected to Estop 2
- Go to the F1 screen and make sure the Estop input shows LOW and is not inverted.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to EStop2 input
- On the F1 screen you should see the input change from LOW to HIGH.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.

Testing procedure for CW & CCW outputs

Testing the CW output

- Remove the wires from spindle control terminals 4 & 5
- Go to the F1 screen and ensure the CW output is not inverted. If it is remove the invert and remember to put it back on when you are finished testing.
- Go to the F2 screen and set the spindle to off
- Use your Digital multimeter set to continuity 2K

- Connect one lead of your multimeter to terminal 4 and the other lead to terminal 5 of spindle control
- You should read no continuity on your multimeter.
- Swap the meter leads around and you should still have no continuity reading on your meter.
- If you get a continuity reading in either polarity of your meter the optocoupler is faulty and needs replacing.
- Go to the F2 screen and set the spindle to CW by clicking the Spindle CW button on the screen
- You should read 200 ohms or less on your meter
- If you get no continuity reading reverse the leads of your meter and retest as this is a polarity conscious output.
- If you still do not get a reading to 200 ohms or less when the spindle is on the optocoupler is faulty and needs replacing.

Testing the CCW output

- Remove the wires from spindle control terminals 6 & 7
- Go to the F1 screen and ensure the CCW output is not inverted. If it is remove the invert and remember to put it back on when you are finished testing.
- Go to the F2 screen and set the spindle to off
- Use your Digital multimeter set to continuity 2K
- Connect one lead of your multimeter to terminal 6 and the other lead to terminal 7 of spindle control
- You should read no continuity on your multimeter.
- Swap the meter leads around and you should still have no continuity reading on your meter.
- If you get a continuity reading in either polarity of your meter the optocoupler is faulty and needs replacing.
- Go to the F2 screen and set the spindle to CCW by clicking the Spindle CCW button on the screen
- You should read 200 ohms or less on your meter
- If you get no continuity reading reverse the leads of your meter and retest as this is a polarity conscious output.
- If you still do not get a reading to 200 ohms or less when the spindle is on the optocoupler is faulty and needs replacing.

Replacement Process

WARNING: Ensure that you turn the power off to MASSO and observe standard Antistatic precautions before changing an optocoupler.

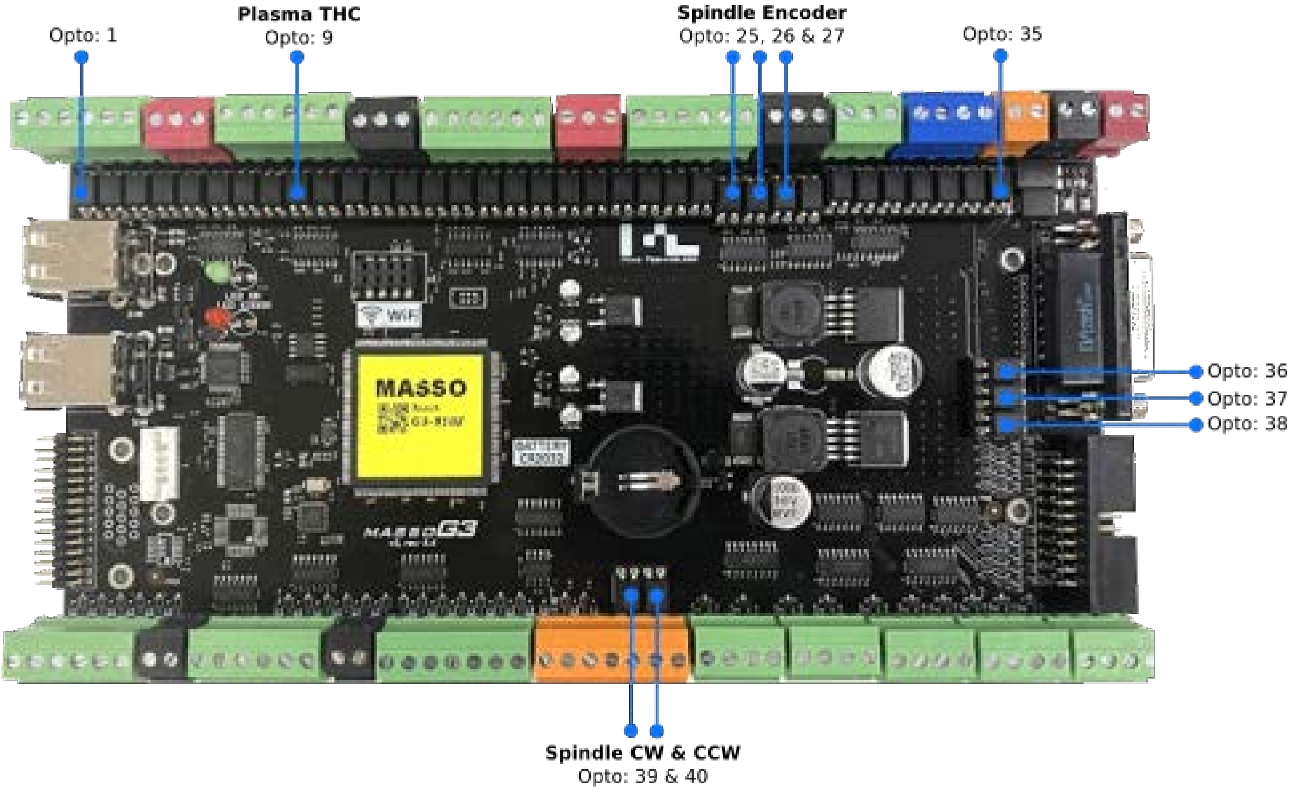
CAUTION: Ensure that you observe the correct orientation of the optocoupler when replacing as they are polarity sensitive.

- Observe the polarity of the optocoupler. Take a photo if you are not sure. Each Optocoupler has a dot on it to identify pin 1
- Using a suitable pair of long nose pliers or tweezers gently remove the faulty Optocoupler from it's socket. It should come out easily.
- Push the replacement Optocoupler into place until it is correctly seated. Make sure all pins are in the

socket.
- Test to check that it is now working.

14.29. MASSO G3 Replacing Damaged Optocouplers

INFORMATION: This page is for the MASSO G3 and MASSO G3 Touch only.



Identifying Optocouplers

- **Inputs -** Opto 1 to 8, 10 to 24: **LTV-816 or KB817**
- **THC Input -** Opto 9: **SFH615A-2**
- **Spindle Encoder Inputs -** Opto 25, 26 & 27: **SFH615A-2**
- **Estop -** Opto 38: **LTV-816 or KB817**
- **MPG Inputs -** Opto 28 to 37: **LTV-816 or KB817**
- **Spindle CW & CCW Outputs -** Opto 39 & 40: **LTV-816 or KB817**

Sourcing replacement parts

INFORMATION: Damaged Optocouplers can be purchased from one of the following suppliers, please click the link below to directly jump to the part order page:

Digi-Key: Optocoupler LTV-816

Newark Element 14: Optocoupler KB817

Mouser Electronics: Optocoupler LTV-816

Testing procedure for Inputs 1 - 24

- Remove any wire connected to the input you want to test
- Go to the F1 screen and observe the logic state of the suspected input. It will show either HIGH or LOW depending on whether the input is inverted or not.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to the input you want to test.
- On the F1 screen you should see the input change from LOW to HIGH or from HIGH to LOW.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.
- If the input does not change you can replace it using the replacement process at the bottom of this page.
- If replacing the Optocoupler does not work you can use the advanced test procedure for the Optocoupler found >>HERE<<

Testing procedure for Spindle Encoder Inputs

- Remove any wires connected to the Encoder inputs.
- Go to the F1 screen.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to the chosen encoder input.
- Encoder-A input you will see the Signal-A input of MASSO change from LOW to HIGH.
- Encoder-B input you will see the Signal-B input of MASSO change from LOW to HIGH.
- Encoder-Z input you will see the Index input of MASSO change from LOW to HIGH.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.
- If one is faulty only replace that optocoupler

Testing procedure for MPG Inputs

- Go to the F1 Screen
- Using your Pendant rotate the Manual pulse Generator, (MPG), and you will see the MPG-A and MPG-B flicker between HIGH and LOW randomly. If you see them flicker the Optocouplers are ok and do not need replacing.
- Use the Pendant Axis selector switch and rotate through Axis X, Y, Z, A & B and you will see the corresponding Axis select input change from LOW to HIGH as each is selected. If the inputs change they do not need replacing. If one is faulty only replace that optocoupler
- Use the Pendant Resolution selector switch to select between 1,10 & 100 and you will see Resolution inputs 1, 2 & 3 Change from LOW to HIGH as they are selected. If the inputs change they

do not need replacing. If one is faulty only replace that optocoupler

Testing procedure for the Estop Input

- Opto No: 38 is used for the E-Stop signal.
- Remove the wire connected to Estop 2.
- Go to the F1 screen and make sure the Estop input shows LOW and is not inverted.
- Test the optocoupler by connecting the +ve of the MASSO power supply through a 5.6K resistor to the EStop2 input
- On the F1 screen, you should see the input change from LOW to HIGH.
- If the input changes from one state to the other the optocoupler is ok and does not need replacing.

Testing procedure for CW & CCW outputs

Please see the Spindle troubleshooting guide for test procedures.

Replacement Process

WARNING: Ensure that you turn the power off to MASSO and observe standard Antistatic precautions before changing an optocoupler.

CAUTION: Ensure that you observe the correct orientation of the optocoupler when replacing as they are polarity sensitive.

- Observe the polarity of the optocoupler. Take a photo if you are not sure. Each Optocoupler has a dot on it to identify pin 1
- Using a suitable pair of long nose pliers or tweezers gently remove the faulty Optocoupler from its socket. It should come out easily.
- Push the replacement Optocoupler into place until it is correctly seated. Make sure all pins are in the socket.
- Test to check that it is now working.

14.30. Spindle RPM Encoder

An incremental encoder is used to monitor spindle RPM and also for synchronized threading on lathes.

Pin No.	Description	Type
Pin 1	Signal A	Opto input (5 to 24v)
Pin 2	Signal B	Opto input (5 to 24v)
Pin 3	Signal Z - Index	Opto input (5 to 24v)

Spindle Encoder Signal

The A & B signals is a Quadrature signal, ie 90 degrees out of phase with one another. MASSO can use this signal to determine speed and which direction the spindle is turning.

The A, B signal sequence runs as follows.

- A - High B - Low
- A - High B - High
- A - Low B - High
- A - Low B - Low

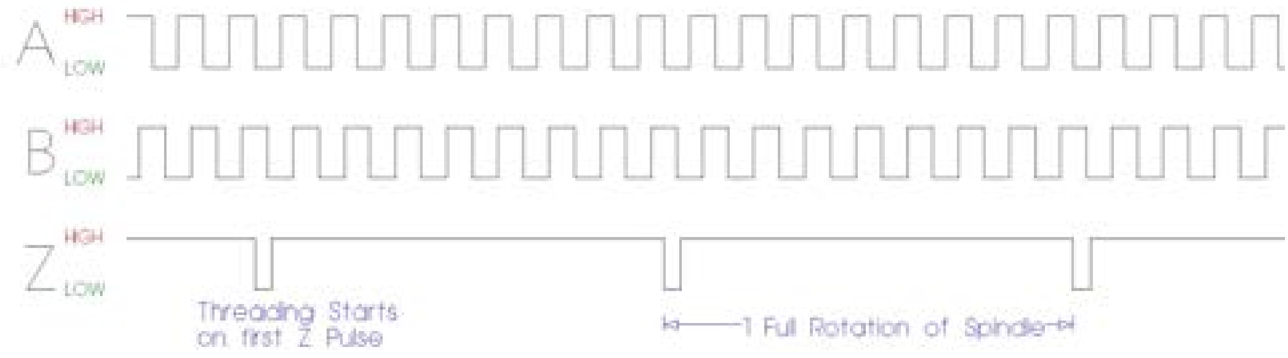
The sequence repeats.

The sequence will reverse if the spindle is run in the opposite direction.

The Z Index signal outputs a pulse once every rotation of the Spindle.

The Index pulse is used on Lathe to determine the start of threading and is used in conjunction with the A & B pulses to determine the Z axis speed during the Threading cycle.

Threading will not proceed until the first Z pulse is received.



The A, B & Z pulses can be seen on the F1 Screen by slowly turning the spindle by hand and observing the Encoder Signal - A, Encoder Signal- B and the Encoder Index signals.

If using the MASSO Spindle Encoder the LED indications on the encoder should match the high and lows shown in the F1 Screen.

Encoder	Signal - A	No	High
Encoder	Signal - B	No	Low
Encoder	Index	No	High

MASSO Spindle Encoder turning in slow motion

INFORMATION: The maximum pulse frequency on encoder inputs for MASSO G3 controllers is 60kHz.

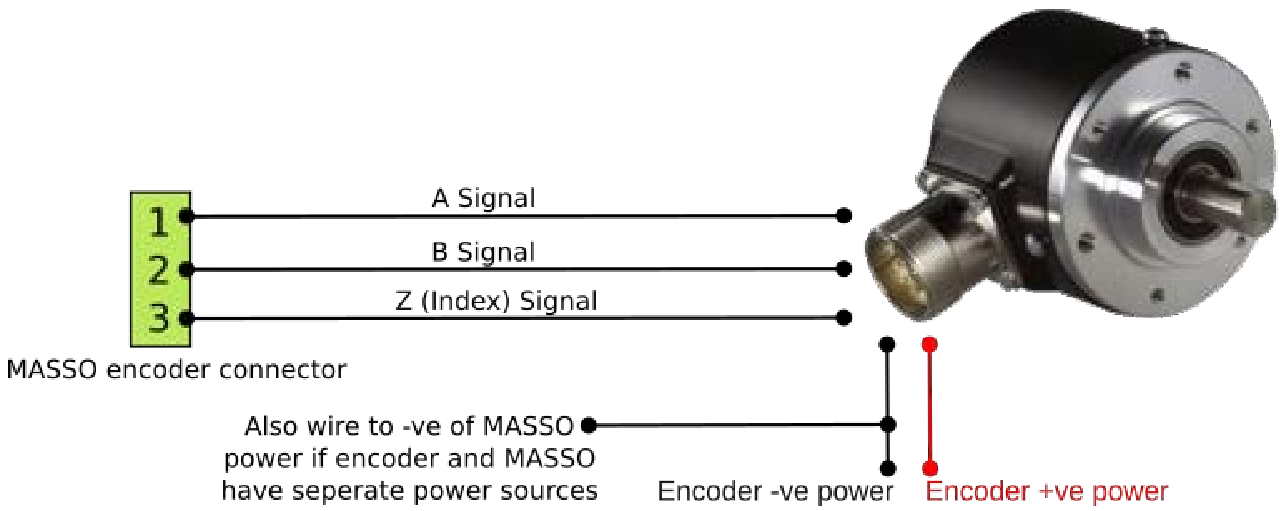
INFORMATION: The maximum pulse frequency on encoder inputs for MASSO G2 controllers is 8Khz

INFORMATION: The MASSO G2 can be modified to 20Khz by changing 3 Optocouplers and removing some capacitors.

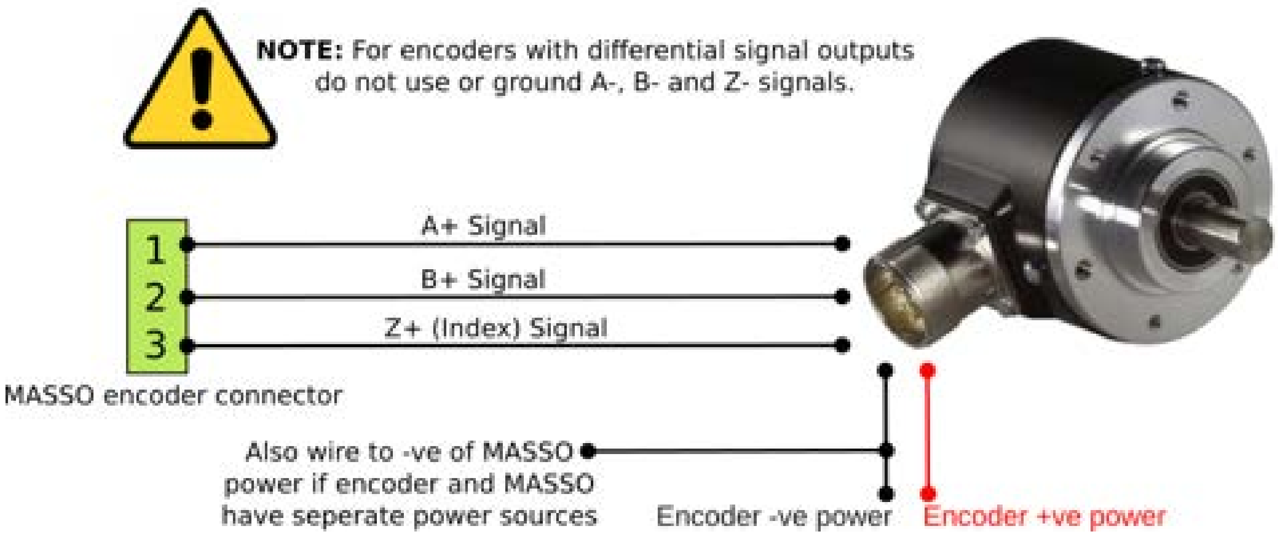
[Upgrading the Spindle encoder on MASSO G2]()

INFORMATION: All input signals can be easily inverted by selecting the input in the **INPUTS** list and pressing the space-bar key on the keyboard to invert the input signal. These settings are automatically saved.

Voltage output signal wiring example



Differential / Line Driver output signal wiring example



Maximum Encoder Frequency

To confirm that the encoder frequency will be within the Masso maximum pulse frequency please use the Encoder Frequency Calculator

[Encoder Frequency Calculator]

Or you can manually calculate it using the formula below.

$$\text{Frequency hz} = \frac{\text{Maximum spindle RPM x Encoder PPR}}{60}$$

> **INFORMATION:** For information on the MASSO encoder and printing a custom encoder disk please see here: https://docs.masso.com.au/index.php/wiring-and-setup/setup-and-calibration/masso-optical-encoder

Spindle speed Encoder for Mill

To see the actual RPM of your Spindle you must to use an encoder.

Speed signals taken direct from the VFD indicate the requested spindle speed it receives from MASSO and not the actual spindle speed

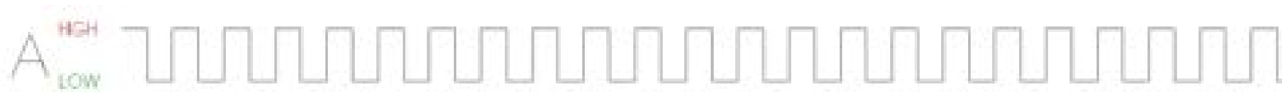
If you do not have an encoder installed on your spindle but wish to see a speed indication on the F2 screen, setting the Encoder (Pulses per revolution) value to 0 will show the speed sent to the VFD.

If your Spindle includes a pulsed output or you have an external encoder, you can connect this to the A spindle encoder input of your G3.

MASSO can use this to display the spindle speed.

In the Main Spindle set up page in the F1 screen enter the encoder pulse per revolution output by your spindle.

The spindle encoder inputs are optically isolated like the rest of MASSO inputs. You need to have the pulse signal referenced to MASSO ground as with all input signals.



Read other subtopics below:

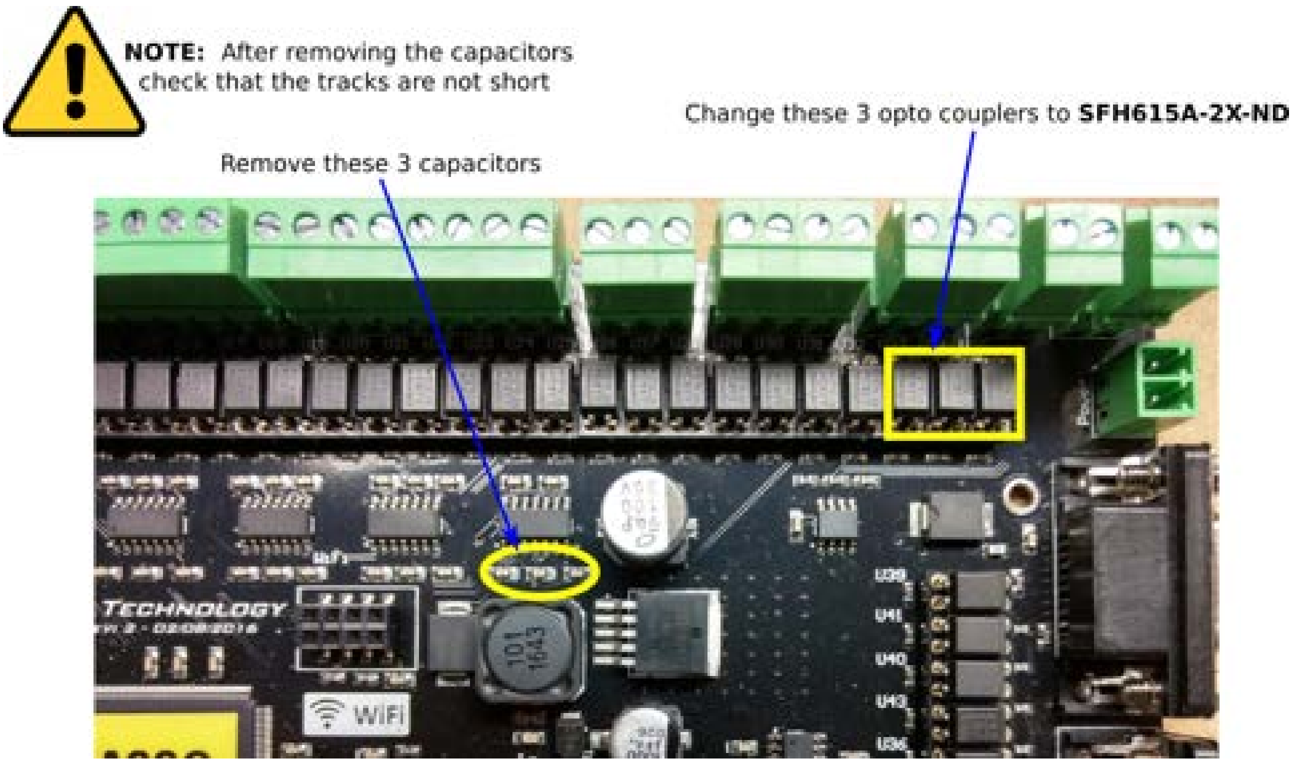
14.30.1. Upgrading the Spindle encoder on MASSO G2

Upgrading the MASSO G2 encoder inputs to take up frequency up to 20kHz

INFORMATION: This procedure is for only for the MASSO G2 as the G3 is capable of frequency up to 60Khz

- By default MASSO can take up to 8kHz encoder signals, to upgrade the inputs so that they can take up to 20kHz please follow the below procedures.
- To check the maximum frequency as per your machine spindle RPM and encoder PPR, please use THIS CALCULATOR
- If the calculated frequency is under 8Khz then you do not need to do the modification.
- Ordering the SFH615A optocouplers: https://www.digikey.com/product-detail/en/isocom-components-2004-ltd/SFH615A-2X/SFH615A-2X-ND/5037024

CAUTION: If you are at all unsure of how to remove the 3 capacitors from the main board please seek assistance from a qualified person as incorrect removal may cause damage to the main board.

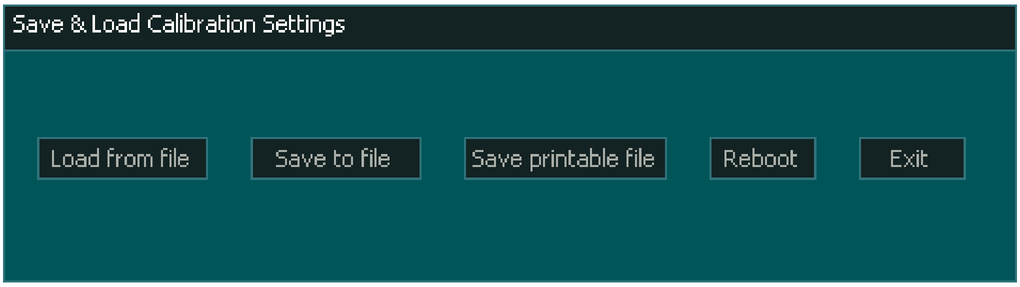


15. Save & Load Settings

To make it easy for setting up machines in production or to save machine calibration profiles, all machine calibration and setup settings can be saved to file on the USB Flash drive. These settings can then be loaded to other MASSO controllers to quickly and easily finish the machine setup process.

Caution: The Save and load settings feature are slightly different between the MASSO G2 and MASSO G3 models. Please watch the video below that relates to your particular model.

INFORMATION: When the settings are saved to file, the WiFi network **Security Key** is not saved and is set as blank in the settings file for security reasons.



Saving settings to file

Go to the **F1-Setup** screen and open the **Save & Load Calibration Settings** window. Click the **Save to file** button and all calibration and setup settings will be saved to **MASSO_Settings.htg** and tool table **MASSO_Tools.htg** on to the USB Flash drive.

Sharing these files are useful in diagnosing settings issues you may have.

Printable settings File

The printable settings file option is available on the MASSO G3 and MASSO Touch only. It cannot be loaded back into your MASSO but it is your settings in a readable text file that you can uses as a written backup or share with others to help diagnose any issue you might have. It is one of the most valuable pieces of information that you can send to MASSO Support or share with others if you have an issue.

To save your printable file press the 

button and the printable settings file will be saved as a txt file to your Flash Drive under the MASSO/Machine Settings folder.

Screen Print

The Screen print function will copy the current screen and place a Bitmap file (.BMP) onto your flash drive that you can share with others.

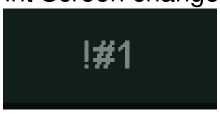
MASSO G2

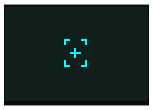
- Press the Print screen button on the keyboard of if your keyboard does not have this key you can use CTRL+P instead
- The screen will freeze while the screen is copied to the flash drive.
- The Screen print will be found on the Flash drive in the Root directory
- Screen prints will be named "Print Screen-001" with the number will increase sequentially.
- The Screen print will be found on the Flash drive in the root directory

MASSO G3

- Press the Print screen button on the keyboard of if your keyboard does not have this key you can use CTRL+P instead
- The screen will freeze while the screen is copied to the flash drive and a message will display on screen letting you know the file name.
- Press the Ok button to clear the message
- Screen prints will be named "Print Screen-001" with the number will increase sequentially.
- The Screen print will be found on the Flash drive MASSO/Screenshots directory.

MASSO Touch

- To take a Print Screen change to the alternate screen by pressing the bottom left hand button labelled !#1 

- then use the button directly below the number 9 key to make a screen print 
- The screen will freeze while the screen is copied to the flash drive.
- Screen prints will be named "Print Screen-001" with the number will increase sequentially.
- The Screen print will be found on the Flash drive MASSO/Screenshots directory.

Loading settings from file

Go to the **F1-Setup** screen and open the **Save & Load Calibration Settings** window. Click the **Load from file** button and all calibration and setup settings will be loaded from the **MASSO_Settings.htg** file and tool table settings from the **MASSO_Tools.htg** file on the USB Flash drive.

CAUTION: Please restart MASSO after loading settings from USB Flash drive so that the settings can take effect.

INFORMATION: Loading the tool table **MASSO_Tools.htg** is optional and does not need to be present to load the settings.

Load, Save, Printable file and Screen Print on MASSO G3

How to Save and Load Backup files Masso G3 - Episode 022

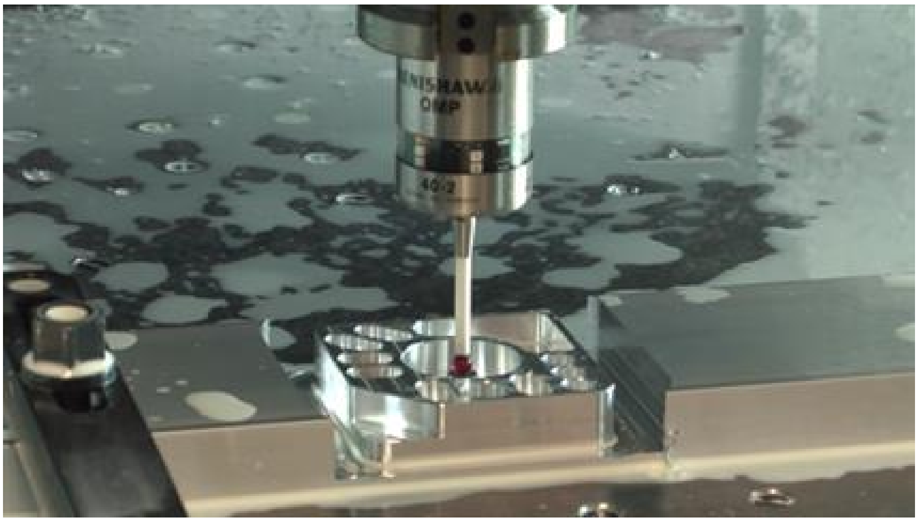
Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

Load, Save and Screen Print on MASSO G2

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to Backup and Load Masso G2 settings -Episode 21

16. Touch Probe



A wired or wireless touch probe can be wired to MASSO to be used with **interactive part probing** or with **G38.2 probing cycle** gcode command.

> **INFORMATION:** For information about **interactive part probing** [CLICK HERE]()

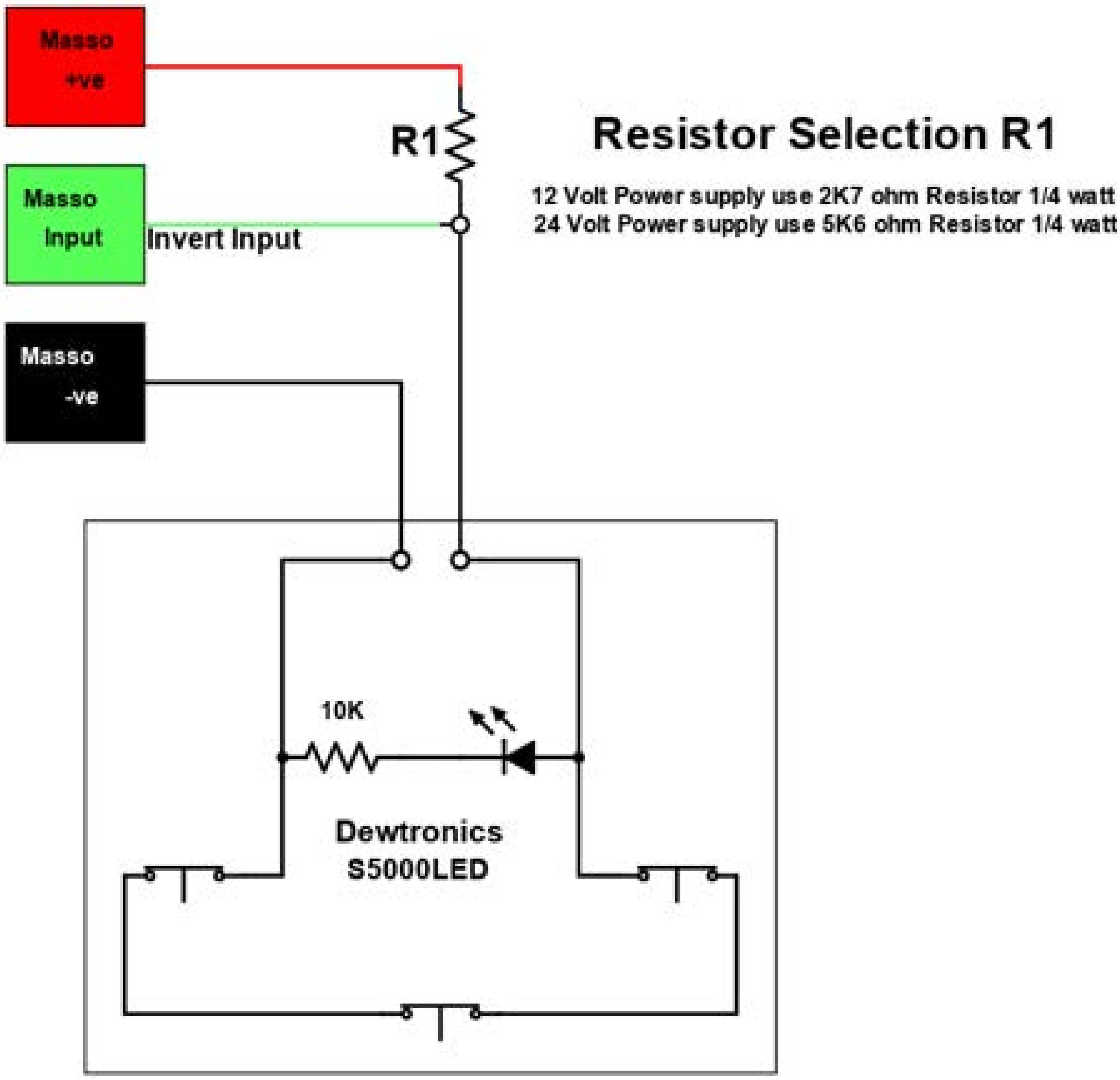
> **INFORMATION:** For information about using **G38.2 probing cycle** [CLICK HERE]()

Wiring the probe

The probe signal can be wired to one of the inputs on the MASSO. The voltage signal from the probe must be between 5 to 24v.

For additional probe wiring diagrams please set the MASSO Forum. Probe wiring

Wiring example of Drewtronics Probe

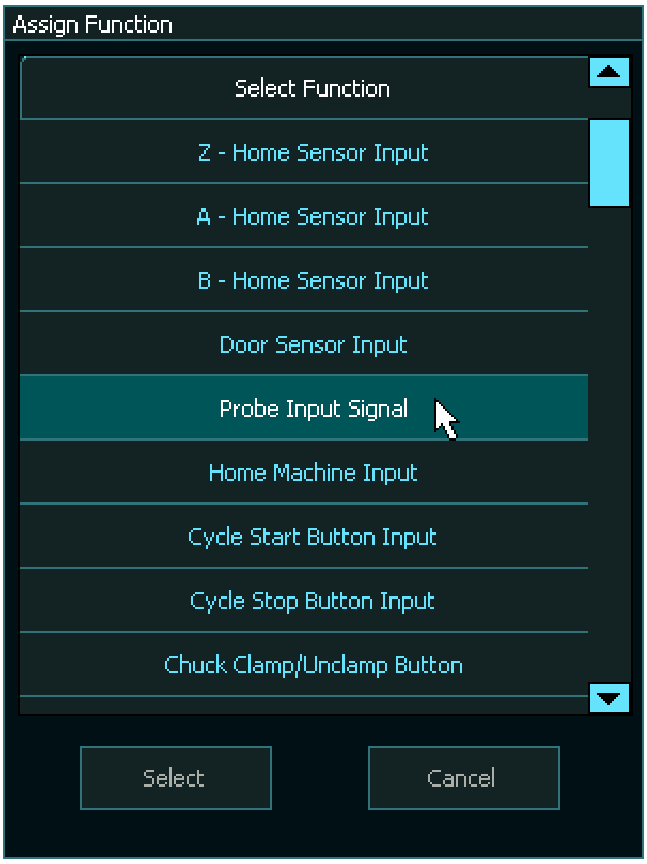


Assigning the probe input

Once the probe has been wired to one of the MASSO inputs, go to the **F1 - Setup** screen and assign the input as **Probe Input Signal**.

CAUTION: The input status must show LOW when the probe is not touched and should only show HIGH when triggered.

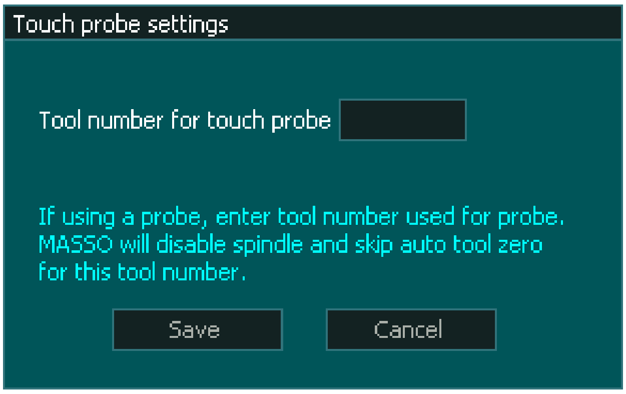
INFORMATION: To invert the input signal, invert by selecting the input in the **INPUTS** list and press the space-bar key on the keyboard. These settings are automatically saved.



INFORMATION: Touch probe to skip is available on MASSO G3 software version 3.47 and above.

When using a touch probe, if auto tool zero is enabled, the controller will try to automatically do an auto tool zero which can damage the touch probe. If a tool number is entered in the above settings then MASSO will automatically skip auto tool zero for this tool number and the user can enter the calibrated length of the touch probe in the F4-Tools & Work Offset screen.

This also disables the spindle so that it cannot be accidentally turned on when the touch probe is loaded.



CAUTION: It is advisable to quickly test your touch probe before starting a probing cycle to ensure it is working properly. This is done by triggering the Probe and observing the **Probe** indication at the top of the screen. When triggered the indication will change green **Probe**

Read other subtopics below:

16.1) Measure Touch probe length

16.1. Measure Touch probe length

For a Touch probe to be used for tool settings it needs it's length entered into the F4 tool Table.

How this is done will depend on the type of tool setter you have on your machine.

Tools setters come in 2 types

1. Plate type tool setters where the touch off is simple plate of aluminum or similar. The touch is detected by completing an electrical circuit between the tool and the plate.
2. Switch type Tool setters which have a plunger mechanism that triggers a switch.

Mounting the Touch probe

Because the Touch probe is only measured once it needs to be loaded into the spindle in a repeatable manner so that it's length does not vary.

If using an Auto Tool change this is as simple a mounting it into a tool holder.

In using manual tool change with collet nuts simple insert the Touch Probe into the Collet nut until the top of the Touch probe comes in contact with the collet nut and can go no further.

This will ensure a repeatable length each time.

Plate Tool Setter Method

> **CAUTION:** Follow these instructions step by step or you may damage your Touch probe.

The following assumes that you are already set up with one input for Probe and another for Tool setter and that both are working correctly

Input 1	Probe	No	Low
Input 2	Tool Setter	No	Low

Step 1

- Ensure that you have Auto tool Zero set up on your machine and works correctly.

Step 2

- Home your machine in the usual manner.

Step 3

- Change to the Touch probe using Txx M6 Gcode command where xx is the touch probe tool number

Step 4

- Take note of your current tool setter and Probe input assignment
- In the F1 screen assign your Touch probe input as Tool setter

Before

Input 1	Probe	No	Low
Input 2	Tool Setter	No	Low

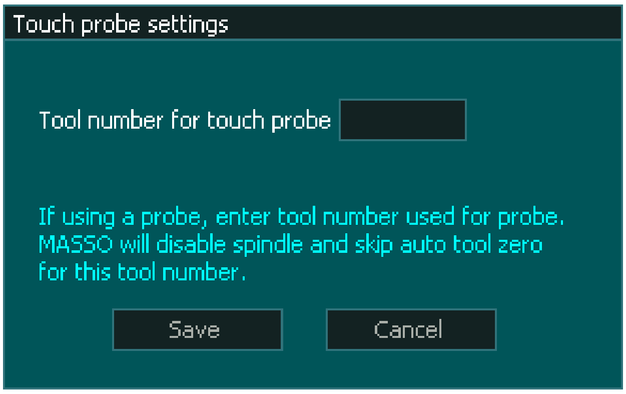
After

Input 1	Tool Setter	No	Low
Input 2		No	Low

> **Check that the tool setter input changes to High when you touch the Touch Probe before proceeding.**

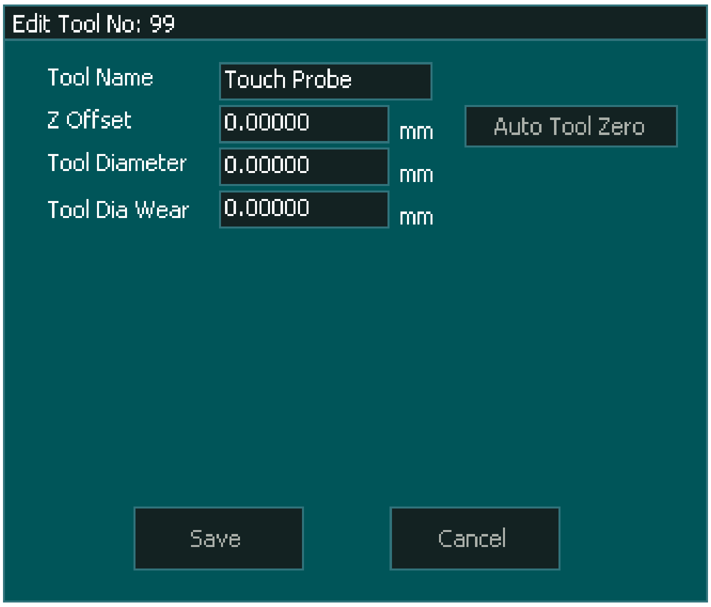
Step 5

- Ensure that no tool is currently assigned as the touch probe in the F1 / Touch probe settings screen or the next step will not work.



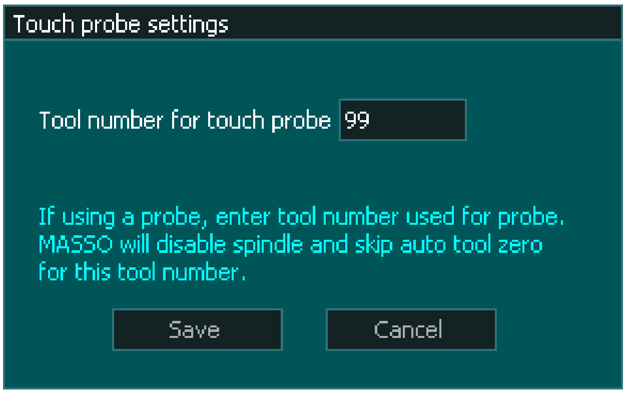
Step 6

- Go to the F4 tool table and open the probe tool number by double clicking on the tool.
- Press Auto Tool Zero
- The Touch Probe will decent onto the tool setter and will stop once it touches and retract.
- The Z offset value will update to show the Touch Probe length.
- Press Save to confirm and exit



Step 7

- In the F1 / Touch probe settings screen enter the Tool number of your touch probe
- Press Save to Confirm and exit



Step 8

- Reassign your Tool setter and touch probe back to their original settings.
- Ensure that the Probe input changes to **High** when you touch the probe
- Ensure that the Tool setter input changes to high when you touch the tool setter to ground.
- Touch Probe calibration is complete.

Switch Tool Setter Method

This style of tool setter requires a different method of calibration from the tool setter length.

Since both the Tool setter and the Touch Probe have switches built in, one will always operate before the other giving inaccurate results.

CAUTION: Follow these instructions step by step or you may damage your Touch probe.

The following assumes that you are already set up with one input for Probe and another for Tool setter.

Input 1	Probe	No	Low
Input 2	Tool Setter	No	Low

Step 1

- Ensure that you have Auto tool Zero and Touch Probe are set up on your machine and both work correctly.

Step 2

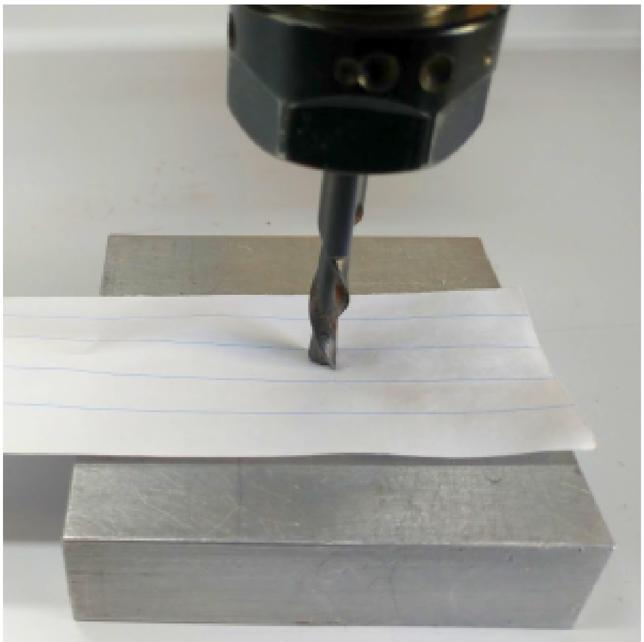
- Home your machine in the usual manner.

Step 3

- Change to a tool such as an end mill using Txx M6 in MDI if you do not have a suitable tool already in the spindle.

Step 4

- Place a reference surface on the machine table and zero your cutter to this surface using a piece of paper to detect when the cutter is touching.
- Jog the cutter down until the paper is just caught by the cutter.



Step 5

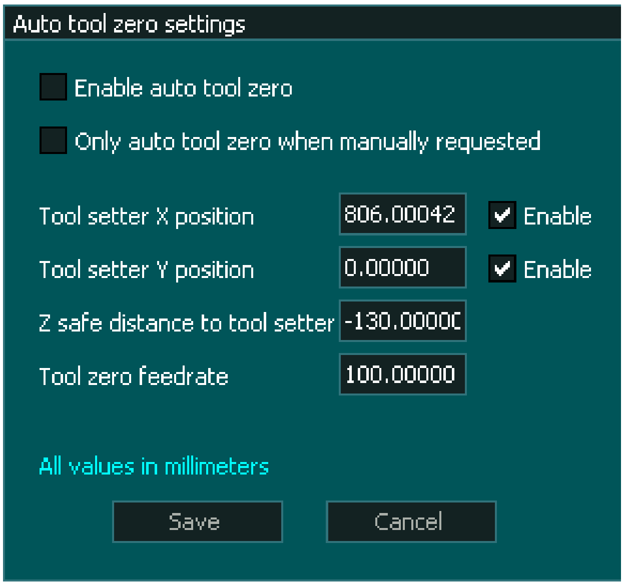
- Set the Z axis DRO to 0

Step 6

- Change to the Touch probe using Txx M6 Gcode command where xx is the touch probe tool number

Step 7

- For the The F1 / Auto tool Zero page and disable the Auto Tool zero by removing the Tick
- Press Save to confirm and exit

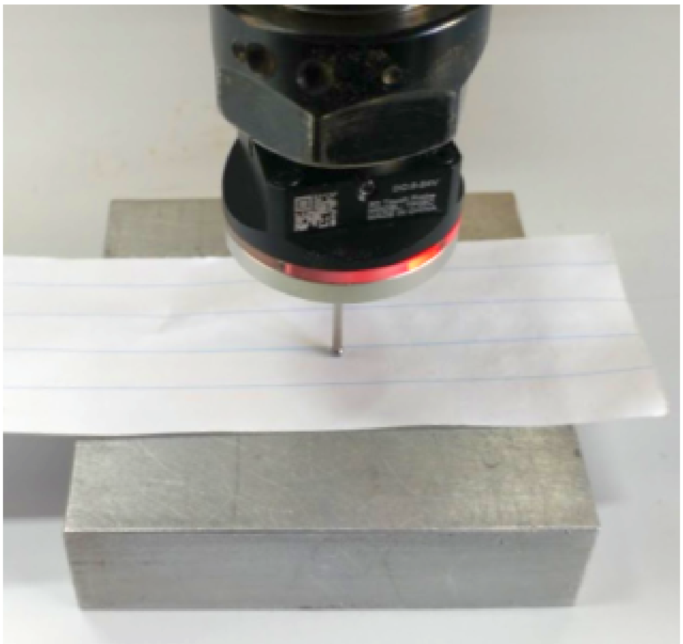


Step 8

- Go to the F4 Tool table and open the Touch Probe tool.
- Manually set the Z offset for this tool to 0 by deleting the current entry and typing in 0
- Press Save to confirm and exit

Step 9

- Go to the F3 screen and jog the Touch probe down onto the reference surface.
- Leave the piece of paper on the surface as it was part of the original reference height.
- Stop when Touch probe indicates that it has touched or if you do not have an indication, use the probe indication at the top of the F2 screen. 



Alternative Probing method

- An alternative method to manually jogging the probe down to the reference surface is to use a G38.2 probing cycle
- This is more accurate than jogging down as the resolution of the axis steps will be finer than the smallest jog increment.
- It will descend until the probe detects a touch and stop.
- Start with the probe close to the reference surface to minimize the probing time.
- In MDI enter the command in the following format G38.2 Z-xxx Fxxx
- Zxxx is the maximum machine coordinate you want the Z axis to move down to for probing.
- Fxxx is the probing feed rate.
- Example G38.2 Z-175 F100 (metric) or G38.2 Z-6.9 F4.0 (Imperial)
- See G38.2 for more information on using Straight probing cycles

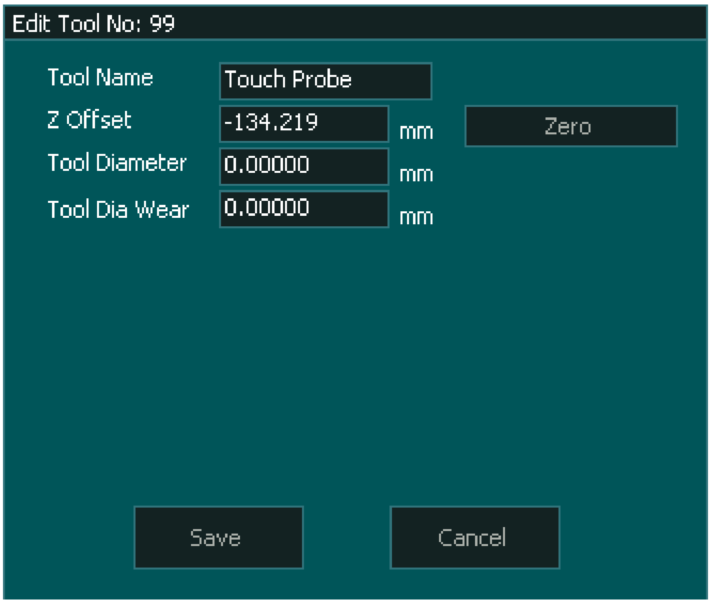
Step 10

- Read the Z axis DRO and note it down.
- The -ve of this number is the Touch Probe Z offset.
- In the example below the offset is -134.219

Step 11

- Go to the F4 Tool table and open the Touch Probe tool.
- Manually set the new Z offset for this tool by deleting the current entry and typing in the new value.

- Press Save to confirm and exit



Step 12

- If you disabled Auto Tool Zero in Step 7 then enable it again.
- The Touch Probe length is now calibrated.

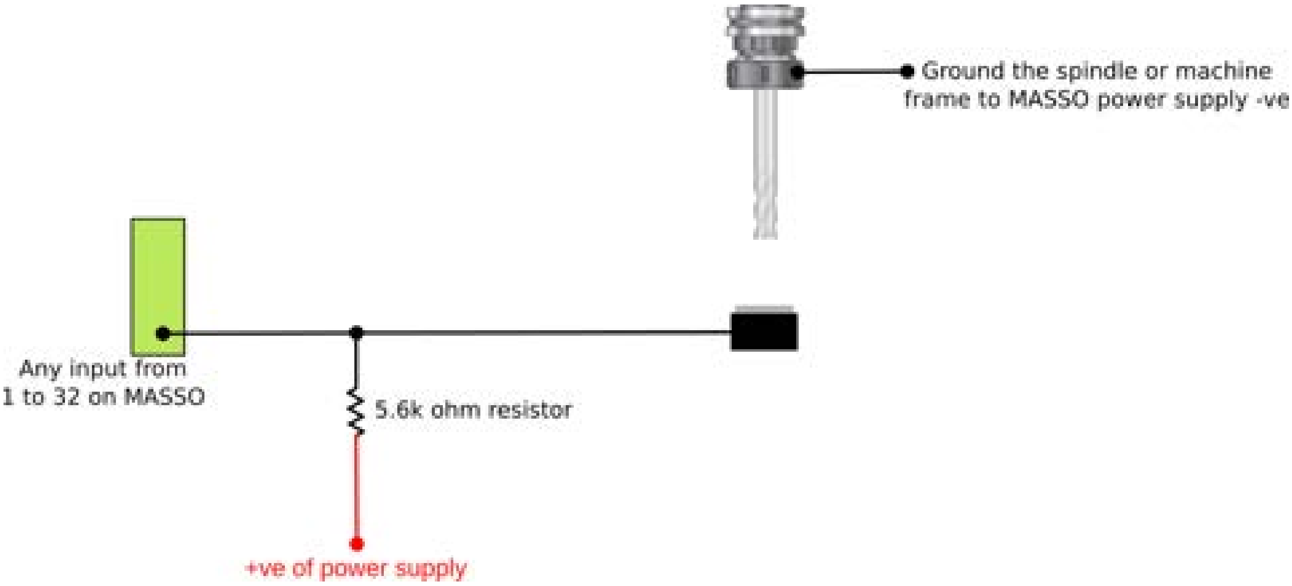
17. Tool Setter / Touch Plate

A tool setter or a simple touch plate can be wired to MASSO to be used with **interactive part probing** or with **G38.2 probing cycle** gcode command.

> **INFORMATION:** For information about **interactive part probing** CLICK HERE

> **INFORMATION:** For information about using **G38.2 probing cycle** CLICK HERE

Wiring example of a simple touch plate



This circuit is of a simple touch plate where the plate and the cutter complete the circuit when they touch.

The pullup resistor used in this circuit pulls the input high and the input logic must be inverted to show low when the tool setter is not triggered.

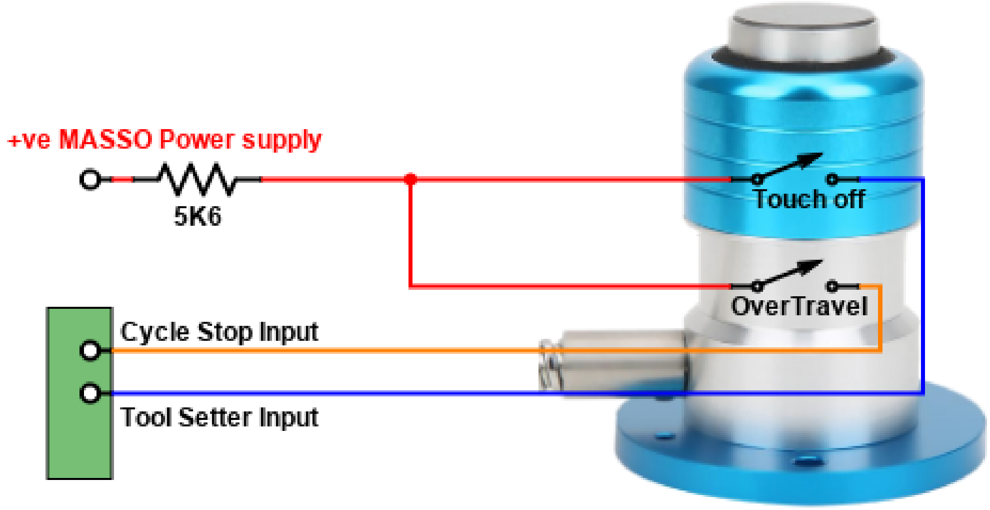
The pullup resistor should be a minimum of 1/8 watt.

This is done by selecting the input and pressing the spacebar to toggle between High and Low.

The Resistor and +ve power supply must not left out or the tool setter will not work.

The Resistor must not be replaced with a direct connection to the power supply to the input or you will cause a short circuit when the tool touches the touch off.

Wiring example of a Tool setter with built in switch



Example Switch based Tool setter

Tool setters using switches do not need to invert the Tool Setter input when wired as shown above.

Tool setters which include include a 2nd switch to detect over travel can be used with the Cycle Stop in case the first switch fails. 

This will stop the probing cycle and allow the tool to be moved off the tool setter by jogging the Z axis.

The Resistor in the +ve line is optional and is to prevent short circuiting the power supply in case the cable is damaged and comes in contact with Gnd.

Some tool setters may include active components such as LED lighting or inductive sensors.

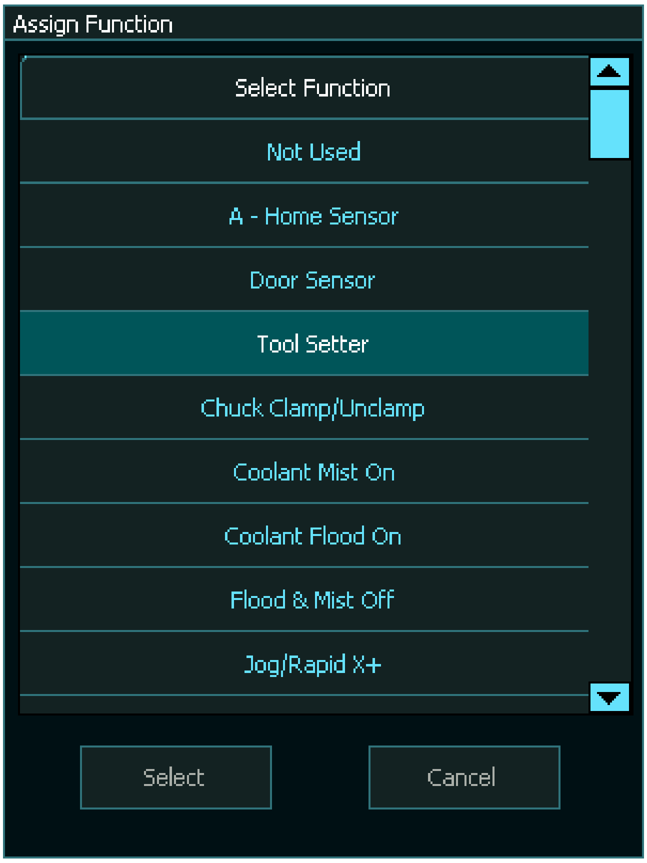
Please consult the manual for these tool setters for information on how they should be wired.

Assigning the Touch plate input

Once the probe has been wired to one of the MASSO inputs, go to the **F1 - Setup** screen and assign the input as **Tool Setter**

CAUTION: The input status must show LOW when the Tool setter is not being touched and should only show HIGH when triggered.

INFORMATION: To invert the input signal, invert by selecting the input in the **INPUTS** list and press the space-bar key on the keyboard. These settings are automatically saved.



Read other subtopics below:

17.1) How Tool Setter Works

17.1. How Tool Setter Works

Overview

A tool setter or a simple touch plate can be wired to MASSO and is used as a reference surface with the Auto Tool Zero feature.

When MASSO is homed the tool currently installed in the spindle is touched off of the tool setter.

From this touch off MASSO can measure the length of the tool in the spindle and stores this length to use as a comparison in future tool changes. This value will remain valid until the machine is homed again or it is turned off. The tool can now be zeroed to the surface of the stock as required.

WARNING: If you do change or alter the tool height without being instructed to do so by MASSO you must home your machine again. Failing to do so will cause the 2nd tool change and all following tool change heights to be wrong causing damage to your work and machine.

When MASSO is asked to change tool using the M06 GCode command it will measure the new tool length and compare it against the original measured tool, then adjust the tool height offset accordingly.

It is therefore critical that once the tool is measured that it is not changed or it's length altered as this will give incorrect tool heights on all future tool changes.

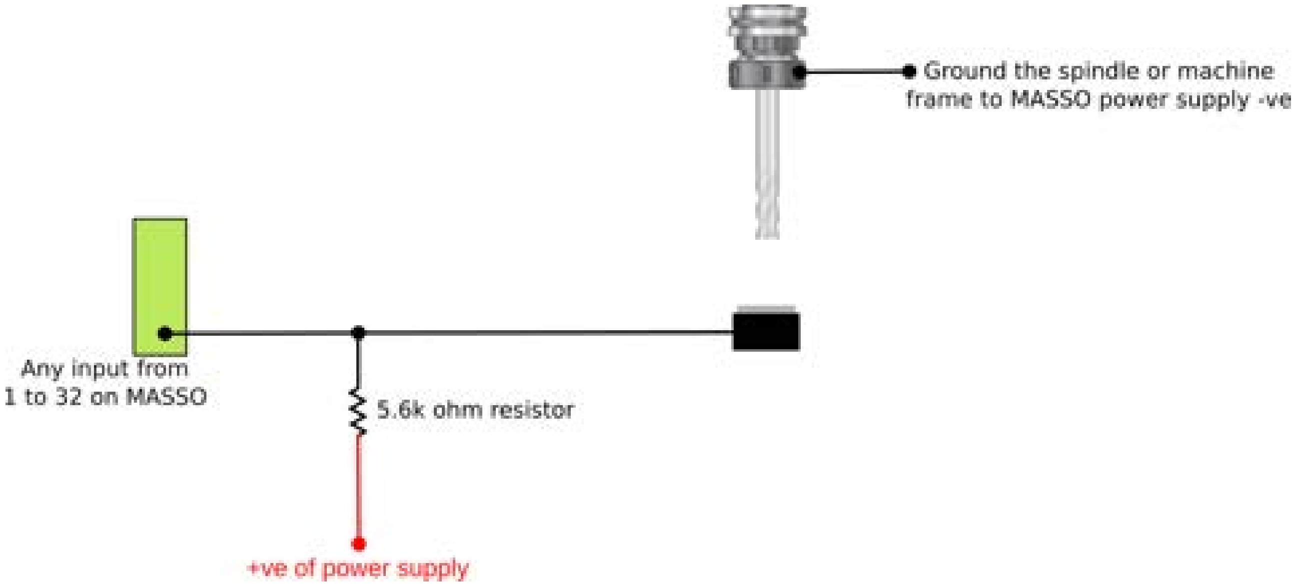
Because the Tool setter is a reference surface the height of the tool setter does not matter so long as it does not change it's height.

The tool setter should not be confused with a probing touch plate which is used to measure tool height above the surface of the material which requires the height of the probing plate to be known.

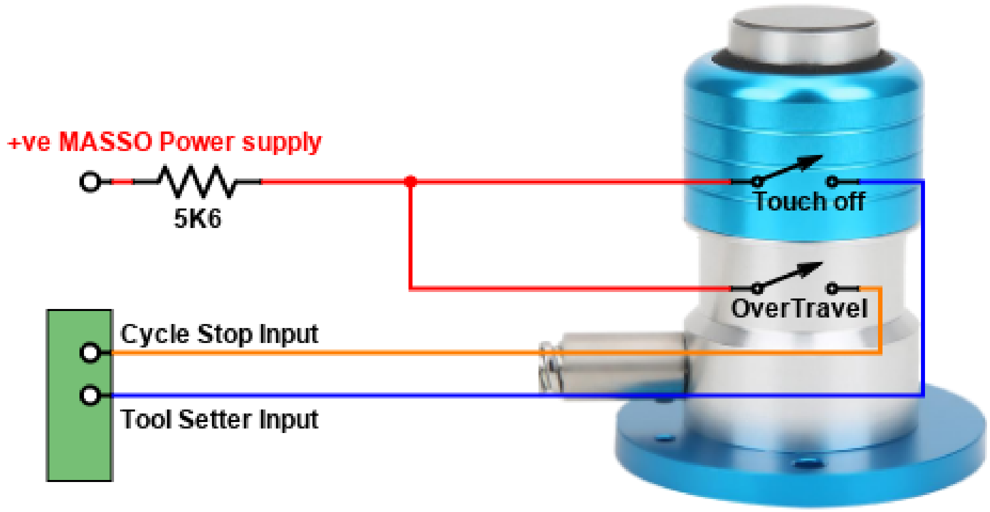
Prerequisites

To use a tool setter you must have homing setup on you machine so that the spindle can find the tool setter.

Wiring example of a simple touch plate



Wiring Example using Touch off with built in switch



Example Switch based Tool setter

Tool setters using switches do not need to invert the Tool Setter input when wired as shown above.

Tool setters which include include a 2nd switch to detect over travel can be used with the Cycle Stop in case

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the first switch fails. 

This will stop the probing cycle and allow the tool to be moved off the tool setter by jogging the Z axis.

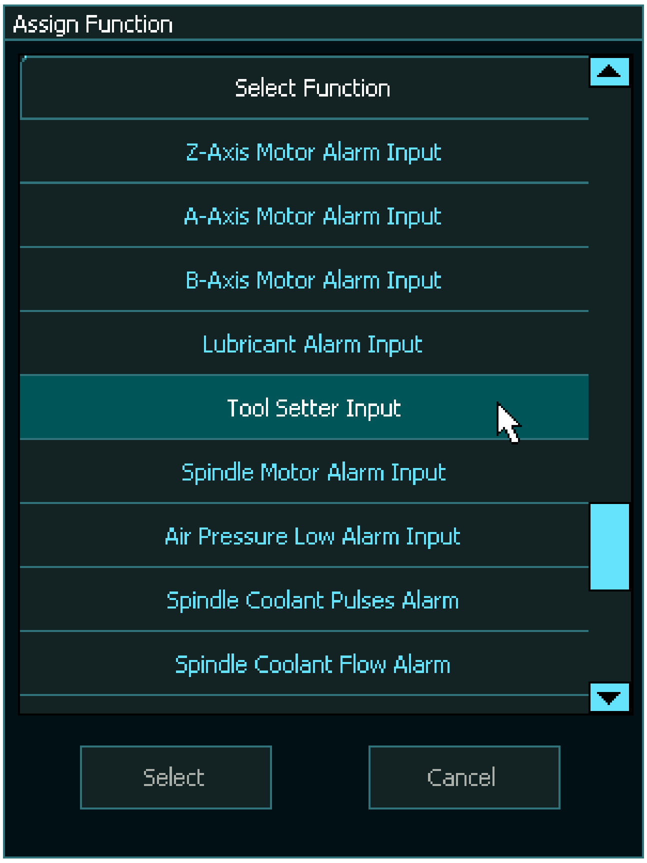
The Resistor in the +ve line is optional and is to prevent short circuiting the power supply in case the cable is damaged and comes in contact with Gnd.

Some tool setters may include active components such as LED lighting or inductive sensors.

Please consult the manual for these tool setters for information on how they should be wired.

Assign Tool Setter Input

- Select the input you want to use for your Tool setter input and double click
- Select Tool Setter Input from the from down box and Double click to assign



Tool Setter Logic

- The normal state for the tool setter when not active must be **LOW** as shown below or it will not work.
- If your input shows **HIGH** then highlight the input by clicking with the mouse and press the Spacebar to invert the logic to show **LOW**.

Manual Tool Change

The Tool setter can be used with manual tool change as well as automatic tool changers.

When you manually change a tool MASSO will move to the Tool Setter and touch off. It will then automatically calculate the new tool height and continue machining having compensated for the difference in tool height.

How to Video

This video takes you through setting up a Tool setter step by step.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video](#)

How to set up a Toolsetter in Masso - Episode 017

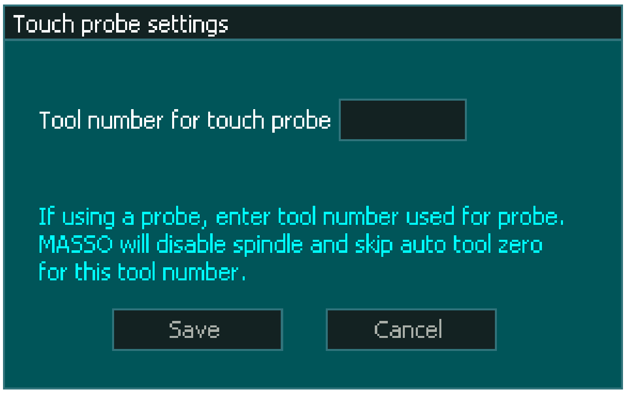
18. Automatic Tool Length Calibration

On milling machines or router where tools are manually changed and don't use tool holders, calibrating tool length can be a time consuming task. MASSO supports automatic tool length calibration feature called **Auto Tool Zero** which can be setup to automatically calibrate the length of each tool automatically after tool change.

Once setup, the user simply loads the tool into the spindle and MASSO will move the tool to the predefined tool setter location, calibrate the tool length automatically before going back to the machining position.

Touch probe to skip

INFORMATION: Touch probe to skip is available on MASSO G3 software version 3.47 and above.

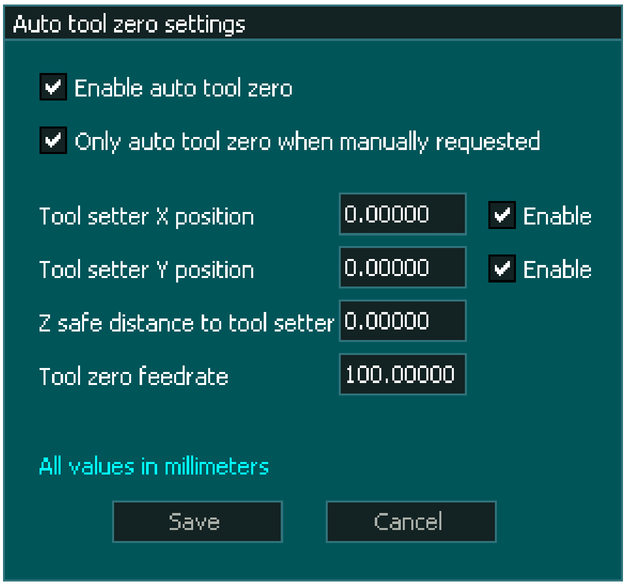


When using a touch probe, if auto tool zero is enabled, the controller will try to automatically do an auto tool zero which can damage the touch probe. If a tool number is entered in the above settings then MASSO will automatically skip auto tool zero for this tool number and the user can enter the calibrated length of the touch probe in the *F4-Tools & Work Offset* screen.

This also disables the spindle so that it cannot be accidentally turned on when the touch probe is loaded.

Only auto tool zero when manually requested

INFORMATION: Only auto tool zero when manually requested is available on MASSO G3 software version 3.47 and above.



On machines where pre-calibrated tool holders are used for changing tools, auto tool zero is not required on each tool change and only required when calibrating the tool into the tool holder.

If the above option is enabled then MASSO will not do an auto tool zero on tool change but the user can manually run the auto tool zero cycle by pressing the **"Auto Tool Zero"** button in the *F4-Tools & Work Offset* screen under the edit tool options. After pressing the **"Auto Tool Zero"** button, the system will run the auto tool cycle and the length of the tool is automatically saved into the memory.

Scan the QR code to watch the MASSO video tutorial on YouTube
Or [Click here to view the video]

How to set up a Toolsetter in Masso - Episode 017

19. Tool Changers

Read other subtopics below:

19.1. Tool Numbering in MASSO

CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tool numbers have changed and are now Tool 1 to 100. In earlier G3 versions the tool numbers are from Tool 0 to 99.

CAUTION: Depending on your software version your first user assignable tool will be either Tool 0 or Tool 1.

MASSO G3 & MASSO Touch

- For software versions 5.0 and higher, user assignable tools are Tool 1 to 100.
- Tool 0 is permanently assigned as the Dry run Laser in Mill software.
- In Mill software, if you call Tool 0 in your Gcode file you will enter Dry Run Laser mode. Once in Dry run mode, all tool change commands via gcode file or MDI will be ignored. Use the MDI Dry Run button to exit this mode. 

- User assignable tools numbers are between 1 - 100 for all tool changers.
- On a Lathe Tool Changer the first tool is Tool 1.
- In Lathe software, an Error message will be displayed if Tool 0 is requested.
- For Lathe Tool changers please renumber your tool changer position labels on the machine to start from Tool 1 if it currently starts at Tool 0.

CAUTION: If you have existing Gcode files that use Tool 0 please edit the tool numbers in your gcode files to load and use correct tool numbers.

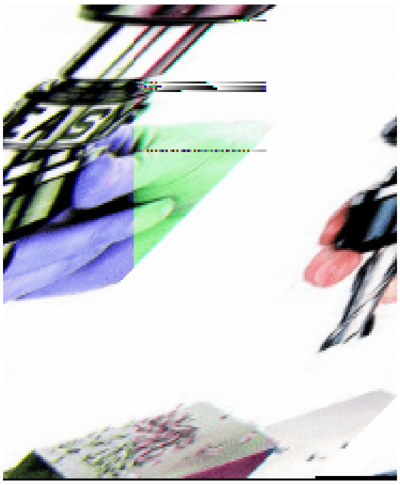
MASSO G2, G3 & MASSO Touch running lower software versions

- If your MASSO G3 software version is lower than version 5.0 your first assignable tool will be Tool 0 and the first tool on your tool changer will be Tool 0. On a Lathe Tool Changer, the first tool is Tool 0.
- On MASSO G2 tool numbers 0 - 31 are used for tool changers.
- On MASSO G3 & MASSO Touch for software versions below version 5.0, tools number 0 - 99 are used for tool changers.

19.2. Mill Tool Changers

Read other subtopics below:

19.2.1. Manual Tool Changer

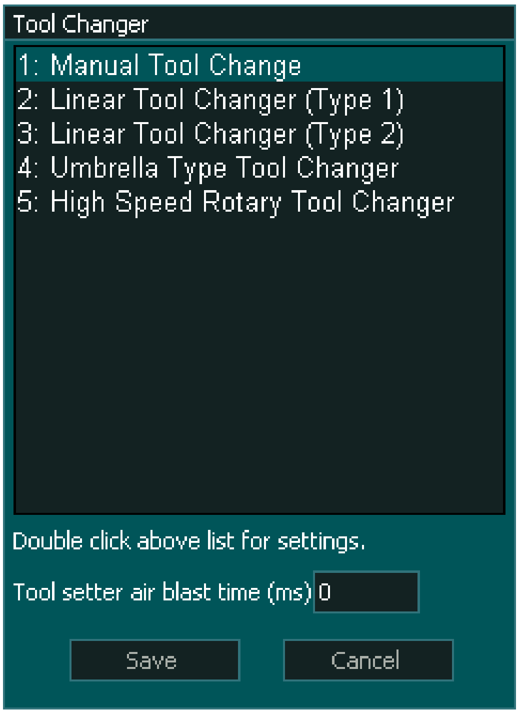


The manual tool setter is designed to used With Auto tool zero to automatically measure then calculate the new tool height and compensated for the difference in tool length.

For information on connecting and how the Tool Setter works please see >>>HERE<<<

Setting up manual tool changer

- This is used when the tool is changed manually by hand.
- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the **Manual Tool Change** from the list.

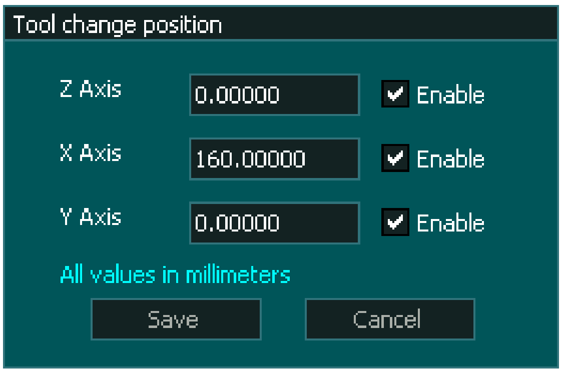


INFORMATION: The Tool setter air blast is used to clean dust from the tool setter after the tool has been changed and before the tool is measured. It is not used during the tool change process.

Setting tool change position

To be able to change tools easily, a tool change position can be set. This option is also helpful if your machine bed is very large and you want the spindle moved to a certain location for easy tool change, for example on the front of the machine every time a tool change is required.

Double click the **1: Manual Tool Change** in the list and the below **Tool change position** window will open where the axis position for a tool change can be entered.



Automatic Door

The manual tool changer logic has provision for opening and closing an automatic door.

For more information on integrating an automatic door with manual tool change please visit the section on adding Automatic Doors

Outputs

- **Tool setter Air blast time (ms) -** This output is used to blow chips off of the tool setter before measuring the tool length.

If you do not have a Tool setter air blast do not assign this output.

Tool Changer Logic

1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the requested tool in the spindle. If it is the tool change request is ignored. If it isn't the Tool change proceeds to step 3
3. Z-Axis moves up to the homing position.
4. X & Y-Axis moves to the tool change position
5. Waits for the user to change the tool and press the **Cycle Start** button
6. Tool Setter Air Blast output changes to High for the duration specified by the Tool setter Air blast time (ms)
7. If Auto Tool Zero is enabled MASSO moves to the Tool setter and measure the tool length and compensate for the difference in tool length. If Auto tool Zero is not enabled it uses the Z offset in the F4 tool table to calculate the new tool length.
8. Spindle moves the X & Y axis back to the position it was before the tool change was called.
9. Tool change complete

Tool Numbering

CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tools have changed and are now Tool 1 to 100.

INFORMATION: Depending on your software version your first user assignable tool will be either Tool 0 or Tool 1

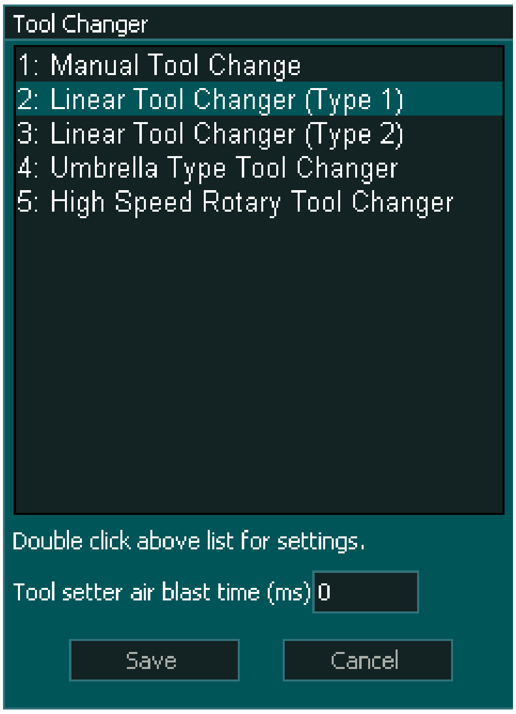
Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.2.2. Linear Tool Changer (Type 1)

Two types of linear tool changers are supported with some different control logic inputs and outputs. Please see both **Type 1** and **Type 2** logic explanations and see the one that fits best to your machine requirements.

Selecting the tool changer

In the **Tool Changer window** select **Linear Tool Changer (Type 1)** and double-click for settings.



INFORMATION: The Tool setter air blast is used to clean dust from the tool setter after the tool has been changed and before the tool is measured. It is not used during the tool change process.

Setting up the tool changer logic

INFORMATION: To set up the tool changer logic please see this page: **CLICK HERE**

Tool Changer Inputs and Outputs

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

> **INFORMATION:** If your machine does not have a sensor for one or more of the inputs below then do not assign an input to that function and the tool change logic will ignore the input and will continue.

INPUTS

1. **Tool Changer - Input 1** for **Spindle drawbar Status** *(Low for clamped and High for un-clamped)*
2. **Tool Changer - Input 2** for **Dust Hood UP OK** signal
3. **Tool Changer - Input 3** for **Dust Hood DOWN OK** signal
4. **Tool Changer - Input 4** for **Tools Tray UP OK** signal
5. **Tool Changer - Input 5** for **Tools Tray DOWN OK** signal (**INFORMATION:** If only one sensor for **UP**/**DOWN** status is used then do not assign this function to any input, this logic is available in **G3 v5.01.12a** and above)

OUTPUTS

1. **Chuck Clamp M10/M11** for spindle **drawbar clamp and un-clamp** *(Low to clamp and High to un-clamp)*
2. **Tool Changer - Output 1** to move **Dust Hood UP**
3. **Tool Changer - Output 2** to move **Dust Hood DOWN**
4. **Tool Changer - Output 3** to move **Tools Tray UP**
5. **Tool Changer - Output 4** to move **Tools Tray DOWN** (**INFORMATION:** If only one valve is used for tray **UP**/**DOWN** then do not assign this function to any output, this logic is available in **G3 v5.01.12a** and above)

Tool Changer logic

When a tool change command is received, the tool changer logic works in the followings steps:

1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Z-Axis moves up** to the homing position.
5. **"Tool Changer - Output 1"** goes **HIGH** to move **Dust Hood UP,** then the system waits for 6 seconds for the **"Tool Changer - Input 2" (Dust Hood UP OK)** signal to go **HIGH**, else gives an error.
6. **"Tool Changer - Output 1"** goes **LOW.**
7. **"Tool Changer - Output 3"** goes **HIGH** to move **Tools Tray UP,** then the system waits for 6 seconds for the **"Tool Changer - Input 4" (Tools Tray UP OK)** signal to go **HIGH**, else gives an error.

8. **"Tool Changer - Output 3"** goes **LOW.**
9. **X & Y-Axis moves** to tool unload position.
10. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
11. **X & Y-Axis moves** to the new tool load position.
12. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error.
13. **Axis moves** to slide out the new tool.
14. **"Tool Changer - Output 4"** goes **HIGH** to move **Tools Tray DOWN,** then the system waits for 6 seconds for the **"Tool Changer - Input 5" (Tools Tray DOWN OK)** signal to go **HIGH**, else gives an error.
15. **"Tool Changer - Output 4"** goes **LOW.**
16. **"Tool Changer - Output 2"** goes **HIGH** to move **Dust Hood DOWN,** then the system waits for 6 seconds for the **"Tool Changer - Input 3" (Dust Hood DOWN OK)** signal to go **HIGH**, else gives an error.
17. **"Tool Changer - Output 2"** goes **LOW.**

INFORMATION: All input & output signals can be easily inverted by selecting the input or output in the list and pressing the space-bar key on the keyboard to invert the signal. These settings are automatically saved.

INFORMATION: Make sure to assign each tool into a tool slot in the **F4 - Tools & Work offset** screen else on a tool change command if the tool is not set in a slot you will get a tool error alarm.

INFORMATION: Tool Changers may be placed outside of soft Limits to protect them from accidental damage however the Auto Tool Zero must remain within soft limits.

Tool Numbering

CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tools have changed and are now Tool 1 to 100.

INFORMATION: Depending on your software version your first user assignable tool will be either Tool 0 or Tool 1

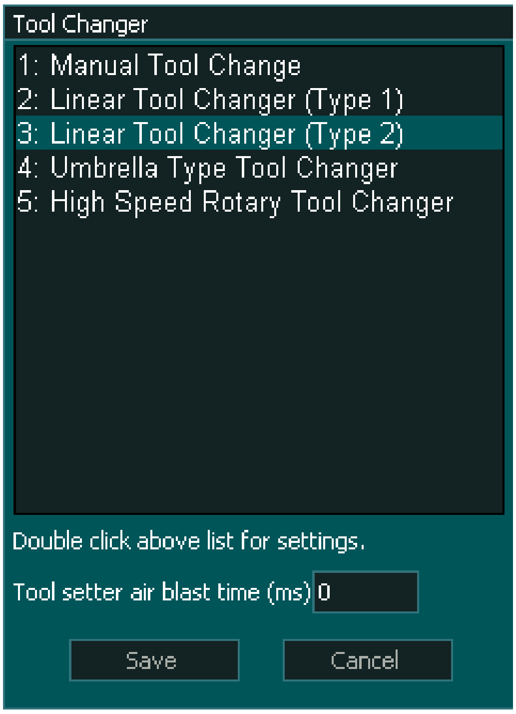
Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.2.3. Linear Tool Changer (Type 2)

Two types of linear tool changers are supported with some different control logic inputs and outputs. Please see both **Type 1** and **Type 2** logic explanations and see the one that fits best to your machine requirements.

Selecting the tool changer

In the **Tool Changer window** select **Linear Tool Changer (Type 2)** and double click for settings.



INFORMATION: The Tool setter air blast is used to clean dust from the tool setter after the tool has been changed and before the tool is measured. It is not used during the tool change process.

Setting up the tool changer logic

INFORMATION: To set up the tool changer logic please see this page: CLICK HERE

Tool Changer Inputs and Outputs

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

> **INFORMATION:** If your machine does not have a sensor for one or more of the inputs below then do not assign an input to that function and the tool change logic will ignore the input and will continue.

INPUTS

- **Tool Changer – Input 1** for **Spindle drawbar Status** (Low for clamped and High for un-clamped)
- **Tool Changer – Input 2** for **Tool in place Status** (Alarm when Low)
- **Tool Changer – Input 3** for **Dust Hood UP OK** signal (High means hood UP)

OUTPUTS

- **Chuck Clamp M10/M11** for **spindle drawbar clamp and un-clamp** (Low to clamp and High to un-clamp)
- **Tool Changer – Output 1** to move **Dust Hood UP/DOWN** (When HIGH the hood will move UP)
- **Tool Changer – Output 2** for **air return** (Will stay high for 6 seconds after tool change)
- **Tool Changer – Output 3** for **spindle clean air blast**

> **INFORMATION:** From MASSO software v3.48, if **"Tool Changer - Output 2"** is not assigned as an output in the **F1-Setup** screen then the 6 second delay is automatically ignored by the logic.

Tool Changer logic

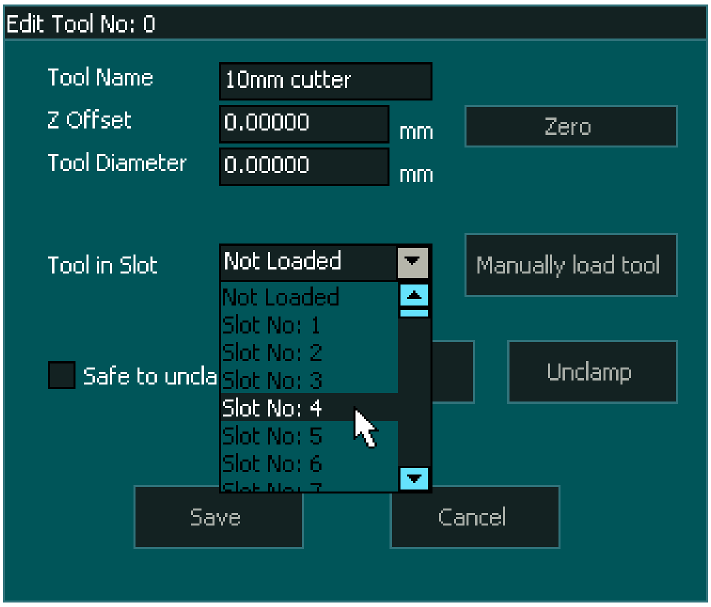
When a tool change command is received, the tool changer logic works in the followings steps:

1. **Spindle is turned OFF** and system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. System checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. System checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Z Axis moves up** to the homing position.
5. **"Tool Changer - Output 1"** goes **HIGH** to move **Dust Hood UP,** then system waits for 6 seconds for the **"Tool Changer - Input 3" (Dust Hood UP OK)** signal to go **HIGH**, else gives an error.
6. **X & Y Axis moves** to tool unload position.
7. **Z Axis moves down** to the tool unload position.
8. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
9. **Tool Changer - Input 2,** (Tool in Place status), to go **LOW**, else gives "**Tool Error**" alarm and

displays "**Tool stuck in spindle detected**"
10. **Tool Changer - Output 3 (spindle clean air blast)** goes **HIGH**
11. **Z Axis moves up** to the tool unload clearance position.
12. **Tool Changer - Output 3 (spindle clean air blast)** goes **Low** when Z axis reaches clearance position,
13. **X & Y Axis moves** to new tool load position.
14. **Z Axis moves down** to the tool load position.
15. **Tool Changer - Output 3 (spindle clean air blast)** goes **HIGH** as the Z axis descends.
16. **Tool Changer - Output 3 (spindle clean air blast)** goes **Low** when Z axis is in position.
17. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error
18. **Tool Changer - input 2,** (Tool in Place status), to go **HIGH**, else gives "**Tool Error**" alarm and displays "**Tool in spindle not detected**"
19. **Axis moves** to slide out the new tool.
20. **Z Axis moves up** to the homing position.
21. **"Tool Changer - Output 1"** goes **LOW** to move **Dust Hood DOWN,** then system waits for 6 seconds for the **"Tool Changer - Input 3" (Dust Hood UP OK)** signal to go **LOW**, else gives an error.
22. **"Tool Changer - Output 2"** goes **HIGH** for 6 seconds (For spindles with air return requirement).

INFORMATION: All input & output signals can be easily inverted by selecting the input or output in the list and pressing the space-bar key on the keyboard to invert the signal. These settings are automatically saved.

INFORMATION: Make sure to assign each tool into a tool slot in the **F4 - Tools & Work offset** screen else on a tool change command if the tool is not set in a slot you will get a tool error alarm.



INFORMATION: Tool Changers may be placed outside of soft Limits to protect them from accidental damage however the Auto Tool Zero must remain within soft limits.

Tool Numbering

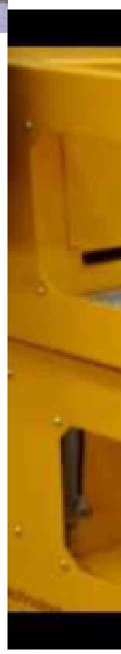
CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tools have changed and are now Tool 1 to 100.

INFORMATION: Depending on your software version your first user assignable tool will be either Tool 0 or Tool 1

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.2.4. Linear Tool changer -Beta version

This tool changer is for MASSO G3 and MASSO Touch and is only available in the current Beta software version



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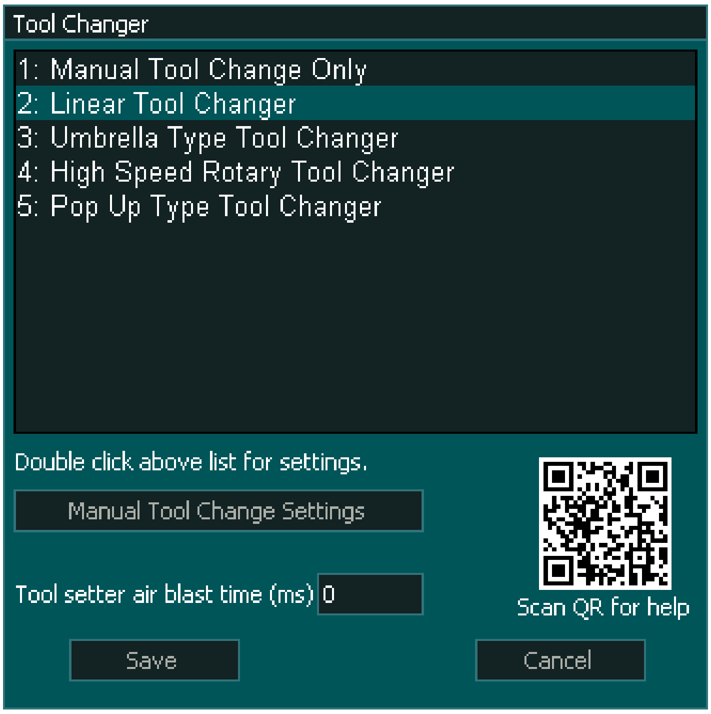
Selecting the tool changer

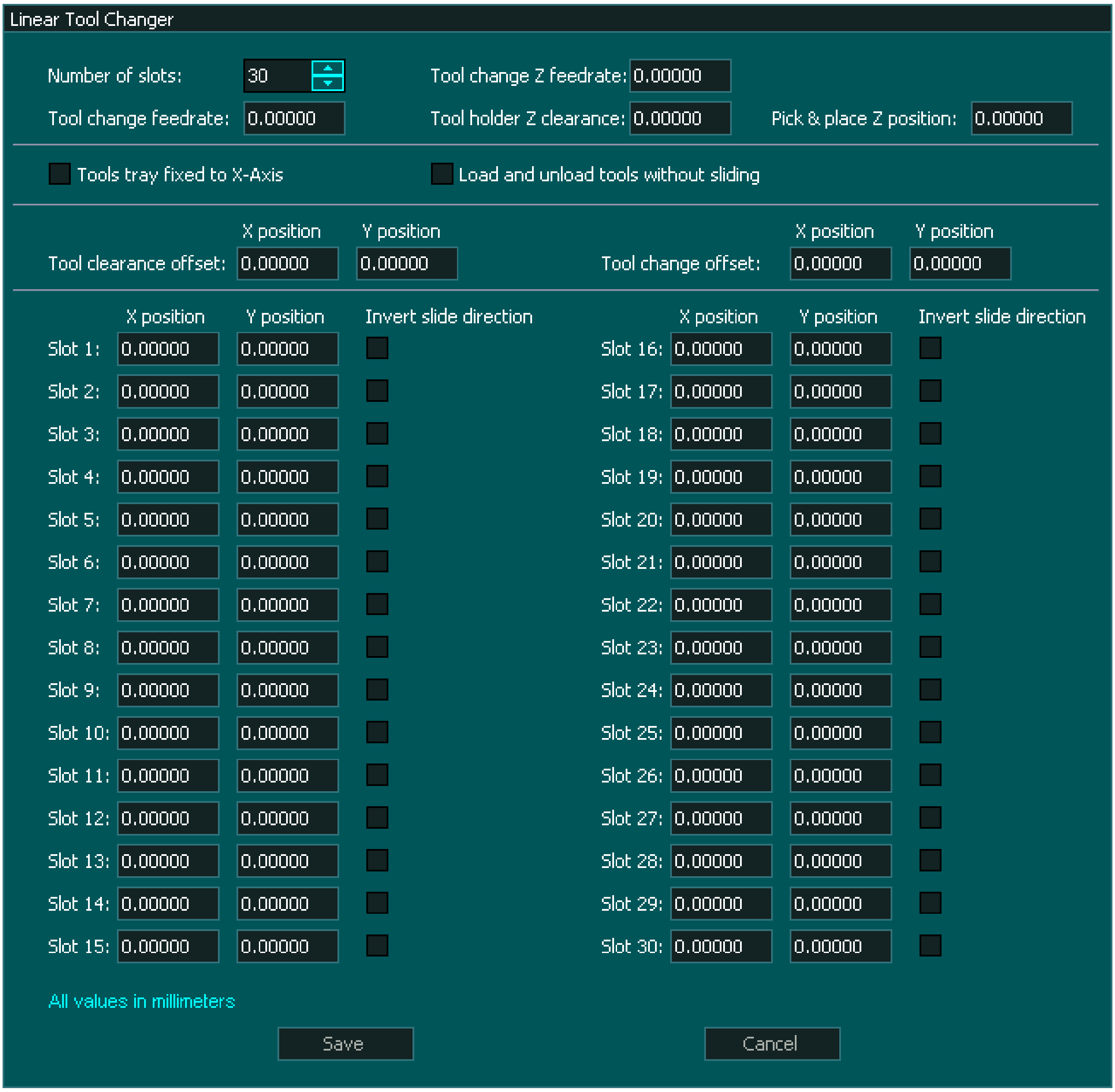
In the **Tool Changer window** select **Linear Tool Changer** and double click for settings.



This timer determines the duration in Milliseconds of the Air blast used to clean the tool setter before the tool is measured after a tool change.

Assign an output for the Tool setter Air Blast 

Linear Tool Changer Settings



MASSO supports 3 types of Linear tool changer.

Type 1 - Slide in (Image 1) The tools can be mounted along either the X or Y axis and the user can use both sides of the chosen axis, choosing to slide in from the left and right by selecting the Invert slide direction option.

Type 2 - Pick and place (Image 2) This can be as simple as a series of holes in a piece of board to hold the tools.

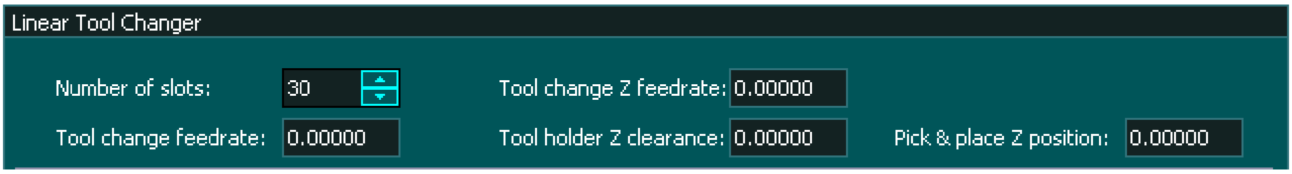
Type 3 - Traveling Linear tool tray (Image 3). The tools are mounted along the X axis and travel with the X axis gantry.

Tool changer Parameters

The tool changer window is broken into 4 sections.

Depending on what type of tool changer you have various options displayed will change.

The following 5 options are common to all tool changers though not all are needed.



Number of Slots: - All Tool changers can can be set from 4 slots up to 30 tool slots.

Tool Change Z feedrate: - This is the feed rate at which Z axis moves when changing tool

Tool Change feedrate: - The is the X & Y axis feed rate that is used when sliding a tool in and out of a tool holder. Not use for Pick and place or the traveling gantry tool tray.

Tool Change Z Clearance - This is the machine coordinate Z safe height that the Z axis retracts to after dropping off the current tool and moves to pick up the next tool.

Pick and Place Z position - This it the machine coordinate Z height that the Z axis move too when placing a tool or picking one up.

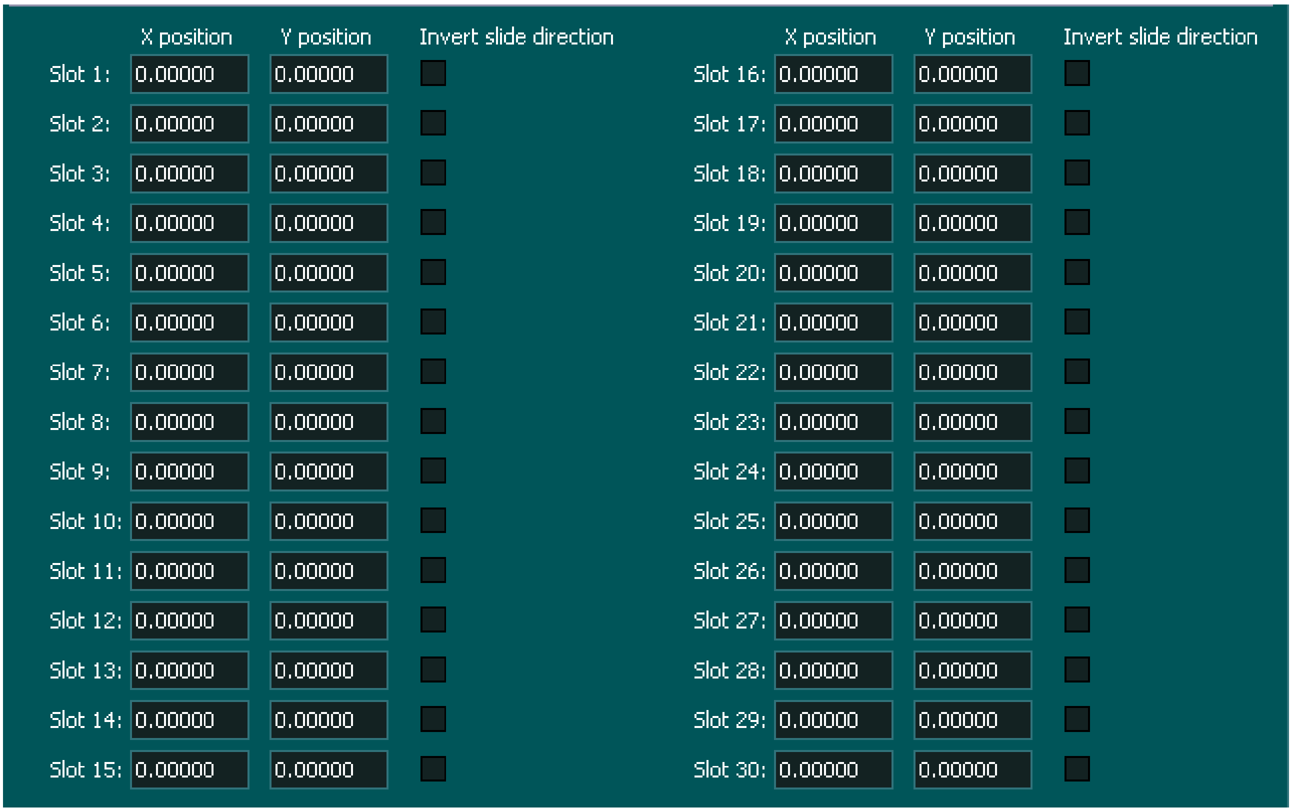
Tool Tray fixed to X-axis: - Select this option if you have a traveling tool tray fixed between the X axis.

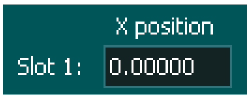
Load and unload tools without sliding: - Select this option is you have a pick and place tool changer.

The following options are only available for the slide in tool changer and will disappear if you select either Tool tray fixed to X-axis or Load and unload tools without sliding.

Tool Clearance Offest: - This parameter defines where the spindle will move to begin the tool change process.

Tool Change offset:- This parameter defines the position where the spindle will begin the slide into or out of the tool slot.





X Position: - Defines the center of the tool in the tool changer. When a Traveling linear tool tray is selected only the X position will be available.

X Position Y Position: - Defines the center of the tool in the tool changer. This option is is only available for the pick and place tool changer when Load and unload tools without sliding is selected

X Position Y Position Invert slide direction: - Defines the center of the tool in the tool changer and allows the user to invert the direction that the tool approaches the tool holder.

This option is only available on the slide in tool changer. The Invert slide direction is selected on a per tool basis so tools can can line both sides of an axis.

For additional information on tool changer configurations please see: >>> Here <<<

Inputs and Outputs

If there are inputs and outputs that your machine does not have or does not use then do not assign them and the MASSO Tool change logic will ignore them and move to the next task in the tool change logic sequence.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Inputs

Tool Changer - Input 1 - Spindle drawbar Status (Low for clamped and High for un-clamped)

Tool Changer - Input 2 - Tool in place Status (LOW signal means no tool in spindle)

T**ool Changer - Input 3** - Spindle in INDEX position

Tool Changer - Input 4 - Tools Tray UP OK signal

Tool Changer - Input 5 - Tools Tray DOWN OK signal (INFORMATION: If only one sensor for UP/DOWN status is used then do not assign this function to any input.)

Outputs

Chuck Clamp M10/M11 - spindle drawbar clamp and un-clamp (Low to clamp and High to un-clamp)

Tool Changer - Output 1 - air return (Will go HIGH for 6 seconds after tool change)

Tool Changer - Output 2 - Spindle clean air blast

Tool Changer - Output 3 - Spindle in INDEX position

Tool Changer - Output 4 - move Tools Tray UP

Tool Changer - Output 5 - move Tools Tray DOWN (INFORMATION: If only one valve is used for tray UP/DOWN then do not assign this function to any output)

INFORMATION: All input & output signals can be easily inverted by selecting the input or output in the list and pressing the space-bar key on the keyboard to invert the signal. These settings are automatically saved.

Tool Tray logic - Type 1

This logic uses a single output to move the Tray up and down or slide in and out.

Tray Up

1. **"Tool Changer - Output 4"** goes **HIGH** to move **Tools Tray UP,** then the system waits for 6 seconds for the **"Tool Changer - Input 4" (Tools Tray UP OK)** signal to go **HIGH**, else gives an error.

Tray Down

1. **"Tool Changer - Output 4"** goes **Low** to move **Tools Tray Down,** then the system waits for 6 seconds for the **"Tool Changer - Input 6" (Tools Tray Down OK)** signal to go **Low**, else gives an error.

Tool Tray logic - Type 2

This logic uses a dual outputs to move the tray up and down or slide in and out.

Tray Up

1. **"Tool Changer - Output 4"** goes **HIGH** to move **Tools Tray UP,** then the system waits for 6 seconds for the **"Tool Changer - Input 4" (Tools Tray UP OK)** signal to go **HIGH**, else gives an error.
2. **"Tool Changer - Output 5"** goes **LOW.**

Tray Down

1. **"Tool Changer - Output 5"** goes **HIGH** to move **Tools Tray DOWN,** then the system waits for 6

seconds for the **"Tool Changer - Input 5" (Tools Tray DOWN OK)** signal to go **HIGH**, else gives an error.
2. **"Tool Changer - Output 5"** goes **LOW.**

Type 1 - Slide in Tool Changer logic

When a tool change command is received, the tool changer logic works in the followings steps:

1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Z-axis moves up** to the homing position.
5. **Tool Tray Up**
6. **X & Y-axis moves** to tool unload start position
7. **Z-axis moves down** to the **Tool Pick & Place Z position**
8. **Z-axis slides into tool holder**
9. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
10. **Z-axis Moves Up** to Tool holder Z clearance height
11. **X & Y-axis moves** to the new tool load position.
12. **Z-axis moves DOWN** to the Tool **Pick & Place Z position.**
13. **Tool Changer - Output 2 (spindle clean air blast)** goes **HIGH** as the Z axis descends.
14. **Tool Changer - Output 2 (spindle clean air blast)** goes **Low** when Z axis is in position.
15. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error.
16. **Tool Changer - input 2,** (Tool in Place status), to go **HIGH**, else gives "**Tool Error**" alarm and displays "**Tool in spindle not detected**"
17. **Z-axis moves** to slide out the new tool.
18. **"Tool Changer - Output 2"** goes **HIGH** for 6 seconds (For spindles with air return requirement).
19. **Tool Tray Down**

Type 2 - Pick and Place Tool Changer logic

When a tool change command is received, the tool changer logic works in the followings steps:

1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.

4. **Z-Axis moves up** to the homing position.
5. **X & Y-Axis moves** to tool position
6. **Z-Axis moves down** to the **Tool Pick & Place Z position**
7. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
8. **Z-axis Moves Up** to Tool holder Z clearance height
9. **X & Y-Axis moves** to the new tool load position.
10. **Z-Axis moves DOWN** to the Tool **Pick & Place Z position.**
11. **Tool Changer - Output 2 (spindle clean air blast)** goes **HIGH** as the Z axis descends.
12. **Tool Changer - Output 2 (spindle clean air blast)** goes **Low** when Z axis is in position.
13. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error.
14. **Tool Changer - input 2,** (Tool in Place status), to go **HIGH**, else gives "**Tool Error**" alarm and displays "**Tool in spindle not detected**"
15. **Z-axis moves** to the Home position.
16. **"Tool Changer - Output 2"** goes **HIGH** for 6 seconds (For spindles with air return requirement).

Type 3 - Travelling Linear Tool Tray Tool Changer logic

When a tool change command is received, the tool changer logic works in the followings steps:

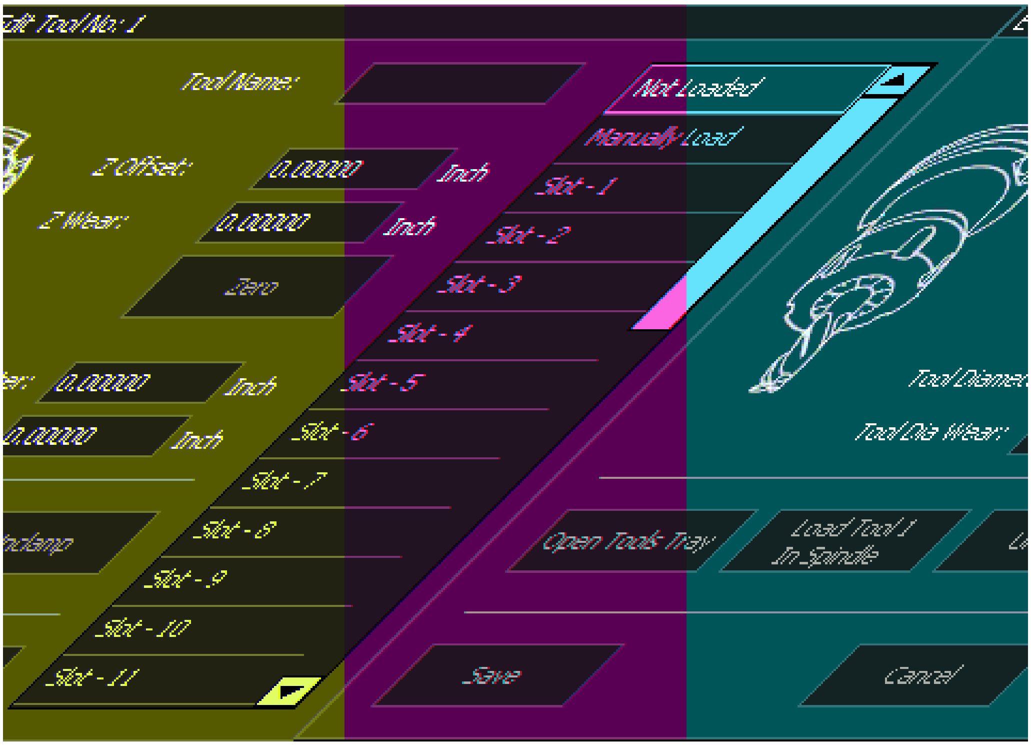
1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Z-Axis moves up** to the homing position.
5. **Tool Tray Up**
6. **X-axis moves** to tool unload start position
7. **Z-axis moves down** to the **Tool Pick & Place Z position**
8. **Tool Tray moves UP**
9. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
10. **Z-axis Moves Up** to Tool holder Z clearance height
11. **Tool Tray Moves Down**
12. **X-axis moves** to the new tool load position.
13. **Z-axis moves DOWN** to the Tool **Pick & Place Z position.**
14. **Tool Tray moves Up**
15. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error.
16. **Tool Changer - input 2,** (Tool in Place status), to go **HIGH**, else gives "**Tool Error**" alarm and displays "**Tool in spindle not detected**"
17. **Tool Tray Moves Down**
18. **Z-axis moves** home position
19. **"Tool Changer - Output 2"** goes **HIGH** for 6 seconds (For spindles with air return requirement).
20. **Tool Tray Down**

Dust Hood

For Dust Hood installation please see >>>Here<<<

Assigning Tool slots

- Each tool can be assigned to a tool slot
- Only one tool can be assigned to the same slot at any time.
- A manually load option is available for each tool and when this option is selected on a tool change the current tool will be returned to its assigned slot and the spindle will move to the manual tool change position where it will wait for the user to manually change the tool and press cycle start to resume machining. See the Manual tool changer setting the tool change position. >>>HERE<<<
- To assign the tool select the slot you wish to use for the tool and Press Save to exit.



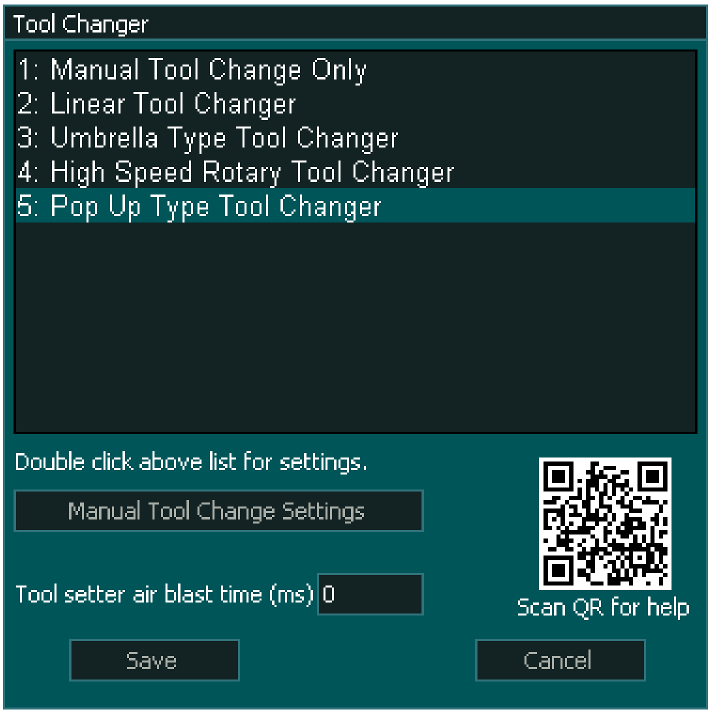
19.2.5. Popup Tool changer- Beta

> This tool changer is for MASSO G3 and MASSO Touch and is only available in the current Beta software version

These tool changer types are common on Multicam machines

Selecting the tool changer

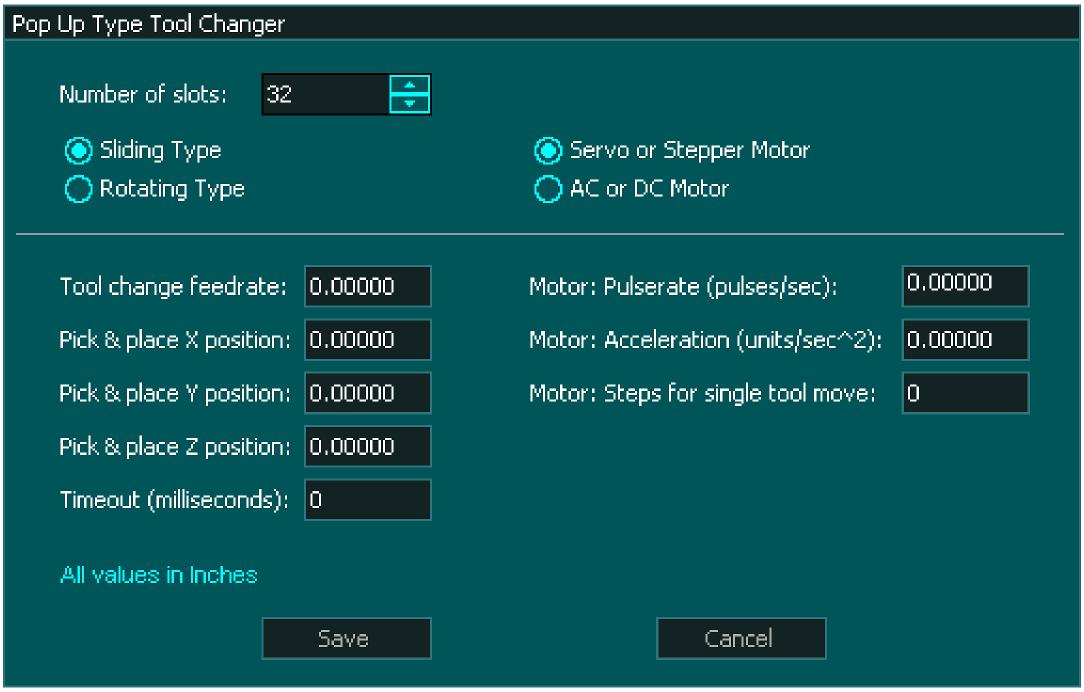
In the **Tool Changer window** select **Pop Up Tool Changer** and double click for settings.



This timer determines the duration in Milliseconds of the Air blast used to clean the tool setter before the tool is measured after a tool change.

Assign an output for the Tool setter Air Blast 

Pop Up Tool Changer Settings



This tool change logic supports rotary popup (image 1 & 2) or sliding popup (image 3) tool changers with up to 32 tools.

The drive motor for the tool changer can be either an AC, DC, stepper or servo motor.

All popup tool changer use a home position sensor.

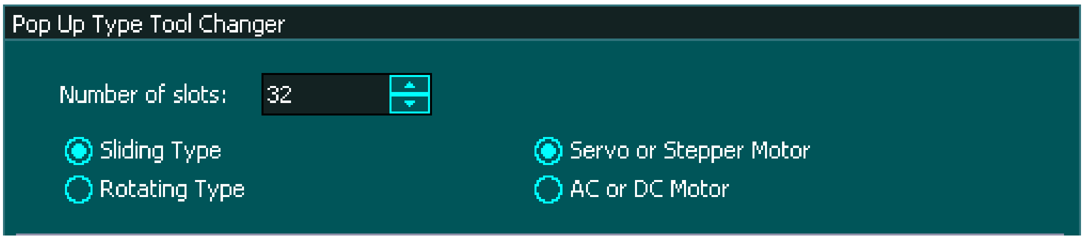
This Tool changer homes when you home your machine.

Tool changer Parameters

The tool changer window is broken into 3 sections.

Depending on what type of tool changer you have various options displayed will change.

The following 5 options are common to all tool changers though not all are needed.



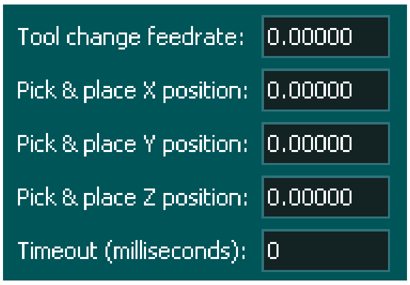
Number of Slots: - All Tool changers can can be set from 4 slots up to 32 tool slots.

Select this option of you have sliding popup tool changer. (image 3)

Select this option of you have rotary popup tool changer. (image 1 & 2)

Select this option if you are using a stepper or servo motor to move the tool cups

Select this option if you are using an AC or DC motor to move the tool cups



This is the speed at which the Tool is picked up or dropped off.

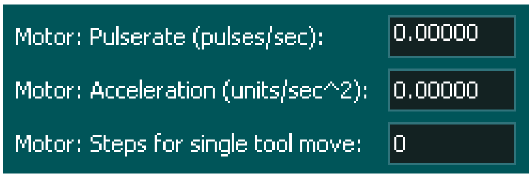
This is the X axis machine coordinate where the tool will popup.

This is the Y axis machine coordinate where the tool will popup.

This is the Z axis machine coordinate that the z axis moves too to drop off and pick up a new tool.

This setting is in milliseconds and defines how long the tool changer has to perform the Homing of the Tool changer before a Homing alarm is displayed.

If this setting is left at 0 it will immediately give a Homing alarm after homing the axis.



The following options are only available when Servo or Stepper motor is selected otherwise it is removed as an option.

Enter the number of pulses per second. This determines the maximum feed rate that the tool cups can move.

Enter your motor acceleration

Enter the number of steps required to move to the next tool.

Inputs and Outputs

If there are inputs and outputs that your machine does not have or does not use then do not assign them and the MASSO Tool change logic will ignore them and move to the next task in the tool change logic sequence.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

INPUTS

Tool Changer - Input 1 - Tool in spindle Status, HIGH means tool in spindle.

Tool Changer - Input 2 - Tool in tool loader cup, HIGH means in cup.

Tool Changer - Input 3 - tool tray home position detect.

Tool Changer - Input 4 - Pulse/Strobe signal for each tool position.

Tool Changer - Input 5 - Tool Door OPEN signal.

Tool Changer - Input 6 - Tool Door CLOSE signal. (INFORMATION: If only one sensor for Tool Door Open/Close status is used then do not assign this function to any input.)

Tool Changer - Input 7 - Tool Loader UP signal.

Tool Changer - Input 8 - Tool Loader DOWN signal. (INFORMATION: If only one sensor for Tool loader UP/DOWN status is used then do not assign this function to any input.)

OUTPUTS

Tool Changer - Output 1 - STEPS for Stepper or CW signal for AC or DC motor.

Tool Changer - Output 2 - DIRECTION for Stepper or CCW signal for AC or DC motor.

Tool Changer - Output 3 - Tool Door OPEN signal.

Tool Changer - Output 4 - Tool Door CLOSE signal. (INFORMATION: If only one valve is used for the Tool Door open/close then do not assign this function to any output)

Tool Changer - Output 5 - Tool Loader UP signal.

Tool Changer - Output 6 - Tool Loader DOWN signal. (INFORMATION: If only one valve is used for Tool Loader UP/DOWN then do not assign this function to any output)

Tool Changer logic

During machine homing:

1. After all the axis of the machine has been homed as per the homing sequence the tool changer logic will home the tool changer.
2. The **tools will be retracted** and the system will wait as per the timeout period set up in the **Tool Changer Settings.**
3. Once retracted the tools will move until the tool tray home position detect is not activated.
4. Then the system will automatically rotate the tool to the last loaded position (empty tool slot).
5. **IMPORTANT:** The home position of the tool changer must be marked as Slot "1".

Tool Door logic - Type 1

This logic uses a single output to move the Tray up and down

Door Open

1. **"Tool Changer - Output 3"** goes **HIGH** to open the Tool door, then the system waits for 6 seconds for the **"Tool Changer - Input 5" (Tools Door Open)** signal to go **HIGH**, else gives an error.

Door Close

1. **"Tool Changer - Output 3"** goes **Low** to close the Tool door**,** then the system waits for 6 seconds for the **"Tool Changer - Input 5" (Tools Door Open)** signal to go **Low**, else gives an error.

Tool Door logic - Type 2

This logic uses a dual outputs to move the tray up and down

Door Open

1. **"Tool Changer - Output 3"** goes **HIGH** to open the Tool door, then the system waits for 6 seconds for the **"Tool Changer - Input 5" (Tools Door Open)** signal to go **HIGH**, else gives an error.
2. **"Tool Changer - Output 3"** goes **LOW.**

Door Close

1. **"Tool Changer - Output 4"** goes **High** to close the Tool door**,** then the system waits for 6 seconds for the **"Tool Changer - Input 6" (Tools Door Closed)** signal to go **High**, else gives an error.
2. **"Tool Changer - Output 4"** goes **LOW.**

Tool Change

When a tool change command is received, the tool changer logic works in the followings steps:

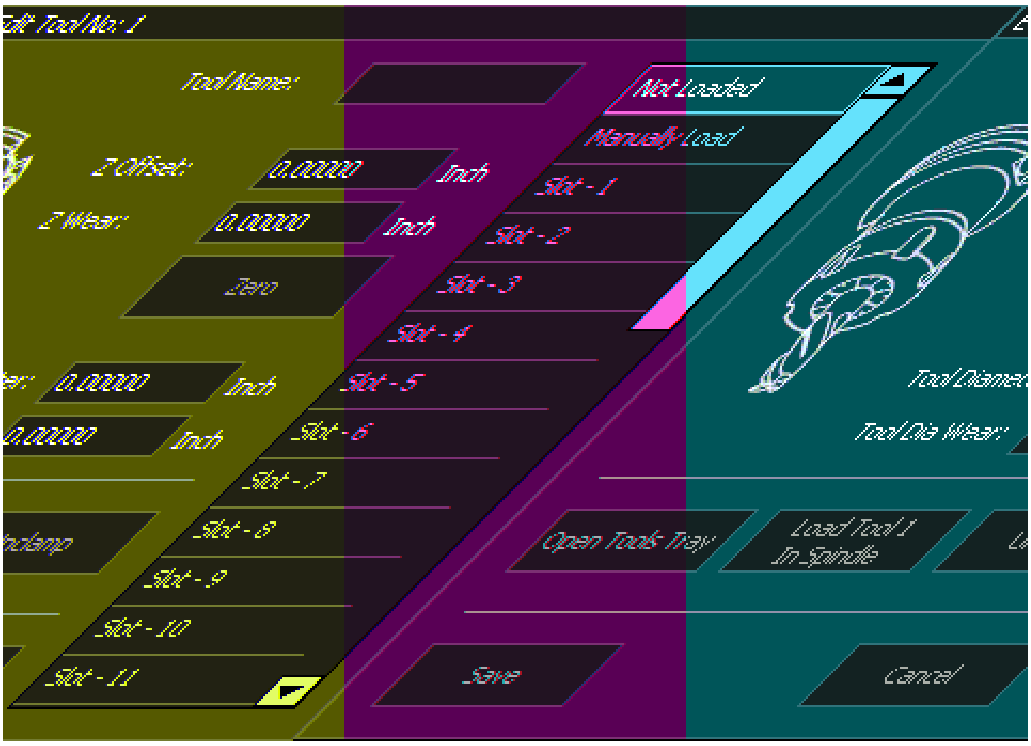
1. **Spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Z-axis moves up** to the homing position.
5. **X & Y-axis** moves to **"Pick and Place Position"**
6. The **Tool Door Opens**
7. **Tool Changer - Output 5 -** goes **High** to move the Tool cup up and waits for **"Tool Changer input - 7"** to go **High (**Tool Loader UP signal) else gives an error
8. **Z-axis moves down** to the **Tool Pick & Place Z position**
9. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **HIGH**, else gives an error.
10. **"Tool Changer - Input 2" -** goes H**IGH** to indicate tool in cup else gives an error
11. **Z-axis Moves Up** to Tool holder Z clearance height
12. **"Tool Changer Outputs 1& 2"** are used to move the tools to the next tool position using **Tool Changer Input-2** to count the position pulses
13. Once the desired tool is in position the **"Tool Changer - Output 1 &2 "** stop tool tray rotation.
14. **Z-axis moves DOWN** to the Tool **Pick & Place Z position.**
15. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool**,** then the system waits for 6 seconds for the **"Tool Changer - Input 1" (Spindle draw bar Status)** signal to go **LOW**, else gives an error.
16. **Tool Changer - input 1,** (Tool in Place status), to go **HIGH**, else gives "**Tool Error**" alarm and displays "**Tool in spindle not detected**"
17. **Z-axis moves** Home Position
18. **"Tool Changer - Output 6"** goes **Low** to retract the tool loader cup
19. The **Tool door closes**

Dust Hood

For Dust Hood installation please see >>>Here<<<

Assigning Tool slots

- Each tool can be assigned to a tool slot
- Only one tool can be assigned to the same slot at any time.
- A manually load option is available for each tool and when this option is selected on a tool change the current tool will be returned to its assigned slot and the spindle will move to the manual tool change position where it will wait for the user to manually change the tool and press cycle start to resume machining. See the Manual tool changer setting the tool change position. >>>HERE<<<
- To assign the tool select the slot you wish to use for the tool and Press Save to exit.



19.2.6. Linear Tool Changer configuration

INFORMATION: This tool changer logic is only available on **MASSO G3** controllers running software version **5.0** and above.

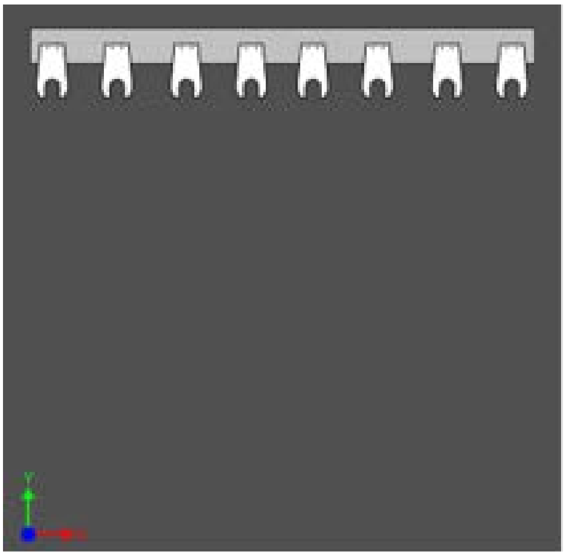
WARNING: Please exercise great care when setting the tool changer parameters as incorrect settings may produce strange results and cause damage to your tool changer. If you are at all unsure about your settings you may find it useful to use feed rate override to slow the machine down while you are setting it up. Feed override

INFORMATION: Tool Changers may be placed outside of soft Limits to protect them from accidental damage however the Auto Tool Zero must remain within soft limits.

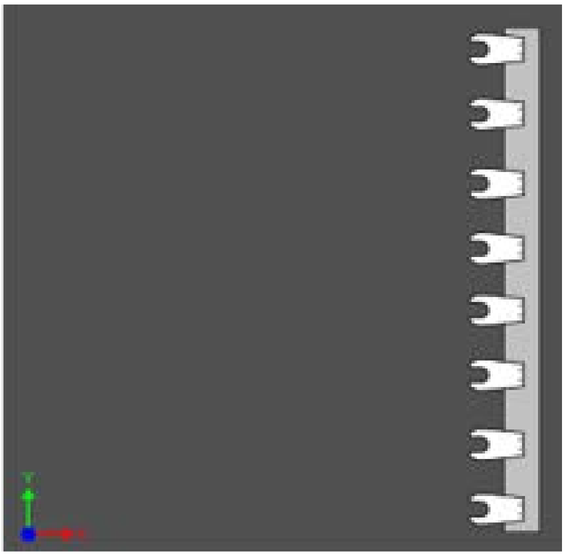
Introduction

The linear tool changer logic allows multiple types of linear tool changer setups to be easily configured. Each tool can be positioned independently giving the user the option to have tools in single or multiple rows.

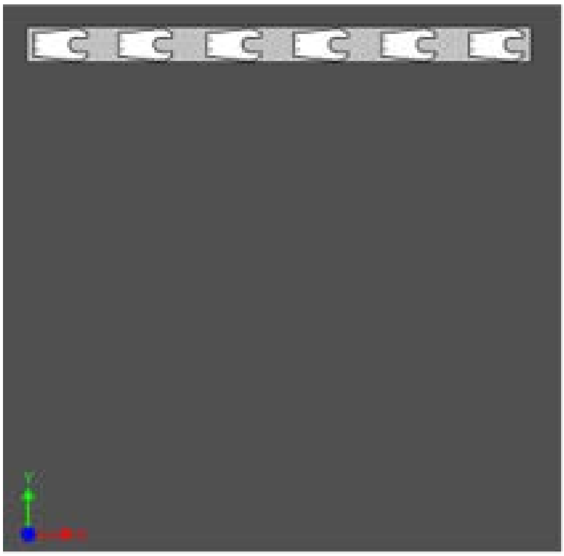
Below are some common examples:



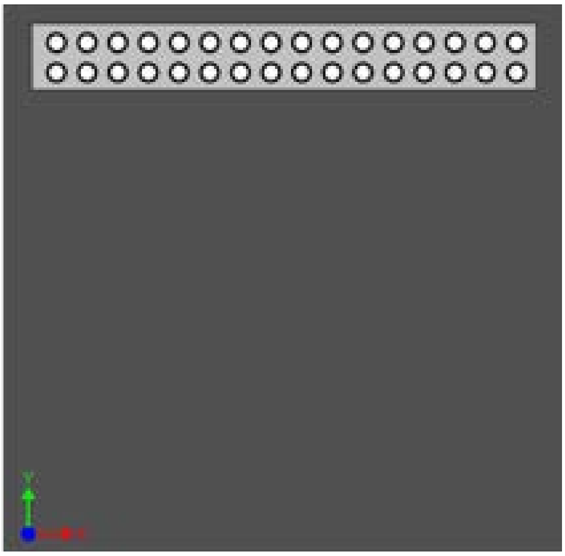
Tool holders mounted along the X - Axis



Tool holders mounted along the Y - Axis



Tool holders mounted along the X - Axis with sliders turned 90 deg



Tool holders with multiple rows

Setup process

The below window shows all the parameters that are required to set up the tool changer logic.

Assigning the number of slots

- The Linear tool changer allows for up to 30 tool slots to be assigned. When you first open the Linear Tool Changer page you will see 4 slots displayed.
- To increase or decrease the number of slots displayed for your tool changer use the up and down arrows beside the **Number of slots:** box to change the value.

Tool Change Feedrate

- This parameter defines the feed rate that is used to slide a tool into and out of a tool holder.
- The feed rate is defined in the native unit of measurement, either metric or imperial that you have set under general settings in the F1 Screen.
- The Distance that a tool slides in and out is defined by the **Tool Change offset**.
- All other movements are performed at rapid speeds.

Tool holder Z clearance

- This parameter defines the position that the Z axis will move to when it has dropped the old tool into its slot and is traveling to the new slot to pick up the new tool.
- The Z clearance height is a machine coordinate.
- Travel between tools will be at rapid speed.
- Travel will take the most direct route to the next tool to be picked up and may travel across the top of other tool holders.

Pick & place Z Position

- This parameter defines the height of the Z axis as a tool slides into or out of a tool holder.
- This parameter defines the height the Z axis descends to when picking up or dropping off a tool in a pick and place tool changer.
- The Z position height is defined as a machine coordinate.
- The Z-axis moves at rapid speed when rising up from or dropping onto a tool.

Tool Clearance Offset

- This parameter defines where the spindle will move to begin the tool change process.
- The position is defined by X & Y coordinates and these are relative coordinate values that will be added to the slot position coordinate value.
- You can use positive or negative values to determine which side of the tool holder you approach from.
- The values are defined in the native unit of measurement, either metric or imperial that you have set under general settings in the F1 Screen.
- Once the spindle has moved to the Tool clearance offset position it will rapid toward the **Tool change offset** position
- The Tool clearance offset is only used at the start of the tool change process before dropping off the old tool.

Tool change offset

- This parameter defines the position where the spindle will begin the slide into or out of the tool slot.
- The feed rate used for the slide in the process is defined by the **Tool Change feed rate** parameter
- On a sliding tool change usually only one of the position values will be used and the other is left at 0. If both X & Y positions have defined values the tool will enter the slot at an angle.
- On a Pick and place tool changer this parameter must be set to X0, Y0.
- The position is defined by X & Y coordinates and these are relative coordinate values that will be

added to the slot position coordinate value.
- You can use positive or negative values to determine which side of the tool holder you approach from.
- The values are defined in the native unit of measurement, either metric or imperial that you have set under general settings in the F1 Screen.

Defining the Tool Position

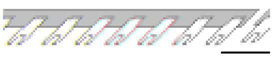
- The Center of each slot is defined by the Slot #: X, Y position parameter box.
- These coordinates are used to define the tool position and are Machine coordinates.
- The values are defined in the native unit of measurement, either metric or imperial that you have set under general settings in the F1 Screen.
- Because each tool holder's position is defined by both an X & Y coordinate you can place the tools anywhere on the table.
- When using a Pick and place tool holder you can define multiple rows of tools.

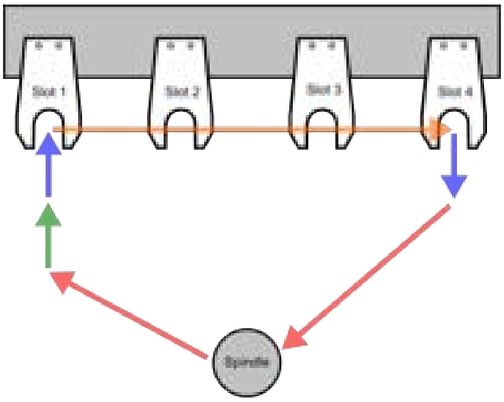
> **INFORMATION:** Tool slot coordinates can be located outside of the machine's soft limits.

Coordinate Calculations

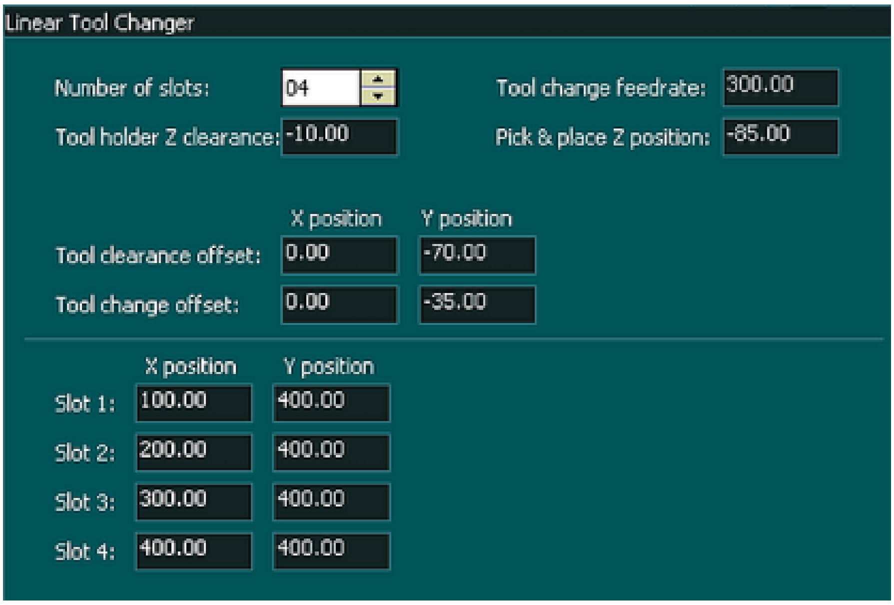
Calculate coordinate positions as follows:

- **Tool clearance offset coordinate X, Y =** Slot position X **+** Tool clearance offset position X**,** Slot position Y **+** Tool clearance offset position Y
- **Tool change offset coordinate X, Y =** Slot position X **+** Tool change offset position X**,** Slot position Y **+** Tool change offset position Y

Example: 1 

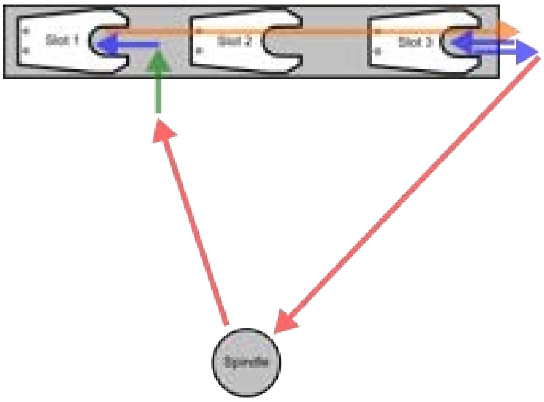


- Rapid move to and from spindle.
- Rapid move from tool clearance.
- Move at tool change feedrate at pick and place height.
- Rapid move to next tool at tool holder Z clearance height.



- In the following example Tool 1 is in Slot1 and Tool 2 is in Slot 4
- Current tool loaded Tool 1
- Gcode T2 M06
- Spindle rapids to Machine coordinate X100 Y330 (Tool clearance offset coordinate)
- Rapid move to Machine coordinate X100 Y365 (Tool Change offset coordinate)
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X100 Y400 (Slot 1 Coordinate)
- Chuck clamp released and Z rises to Machine coordinate Z-10
- Rapid move to X400 Y400 (Slot 4 Coordinate)
- Z descends to Z-85 and chuck clamp locks
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X400 Y365 (Tool Change offset coordinate)
- Z-axis ascends maximum height and rapids to original spindle position
- Machining resumes.

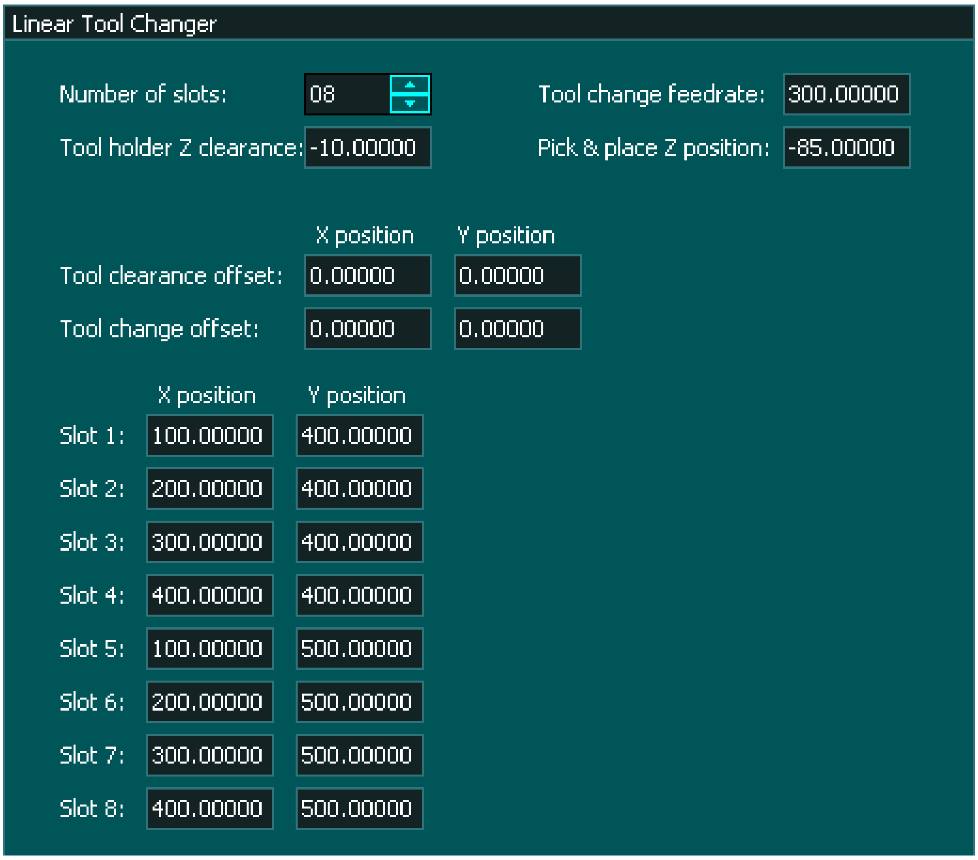
Example: 2



Rapid move to and from spindle.
Rapid move from tool clearance.
Move at tool change feedrate at pick and place height.
Rapid move to next tool at tool holder Z clearance height.

- In the following example Tool 1 is in Slot 1 and Tool 2 is in Slot 3
- Current tool loaded Tool 1
- Gcode T2 M06
- Spindle rapids to Machine coordinate X135 Y325 (Tool clearance offset coordinate)
- Rapid move to Machine coordinate X135 Y400 (Tool Change offset coordinate)
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X100 Y400 (Slot 1 Coordinate)
- Chuck clamp released and Z rises to Machine coordinate Z-10
- Rapid move to X300 Y400 (Slot 3 Coordinate)
- Z descends to Z-85 and chuck clamp locks
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X335 Y400 (Tool Change offset coordinate)
- Z-axis ascends maximum height and rapids to original spindle position
- Machining resumes.

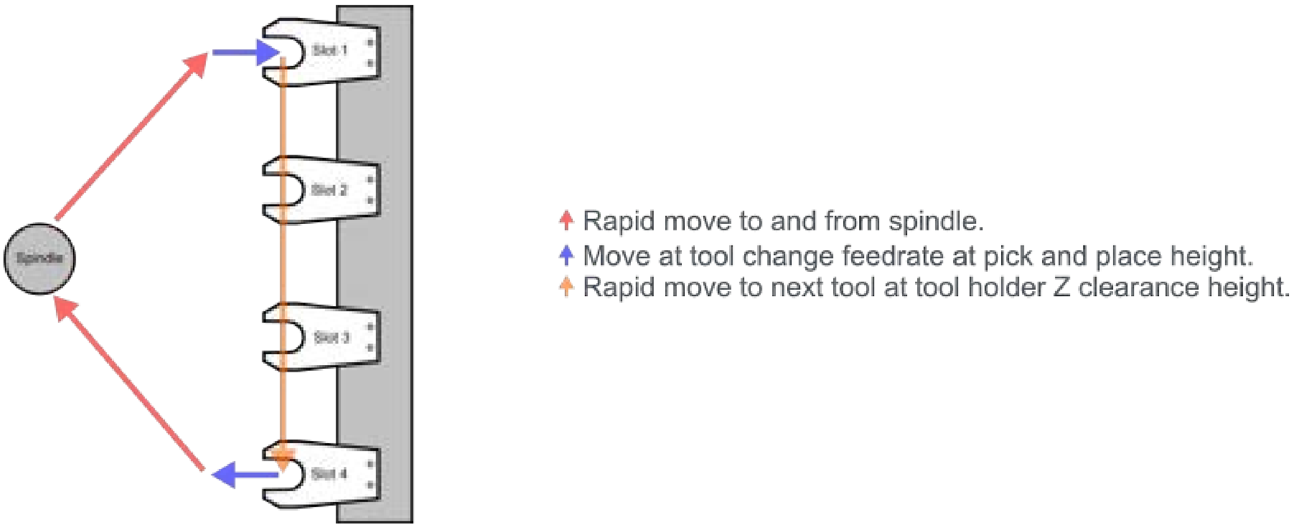
Example: 3



- In the following example Tool 1 is in Slot 1 and Tool 2 is in Slot 7
- Current tool loaded Tool 1
- Gcode T2 M06
- Spindle rapids to Machine coordinate X100 Y400 at Z maximum Z height (Tool slot1)
- Tool moves down to Z-85 and Chuck clamp releases tool (Pick & place Z position)
- Chuck clamp released and Z rises to Machine coordinate Z-10 (Tool Holder Z clearance)
- Rapid move to X300 Y500 (Slot 7 Coordinate)
- Z descends to Z-85 and chuck clamp locks tool in the spindle
- Z-axis ascends maximum height and rapids to original spindle position

- Machining resumes.

Example: 4



- In the following example Tool 1 is in Slot 1 and Tool 2 is in Slot 4
- Current tool loaded Tool 1
- Gcode T2 M06
- Spindle rapids to Machine coordinate X365 Y400 (Tool clearance / Tool change offset coordinate)

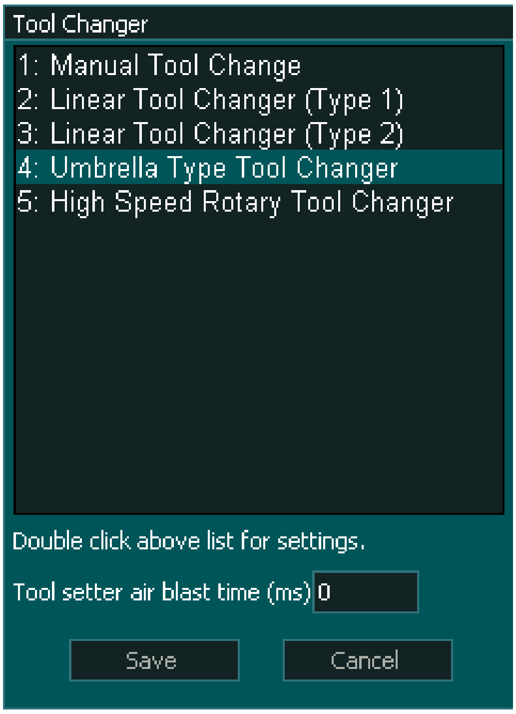
- Because the Tool clearance offset and the Tool change offset are in the same position the next move is the Tool change
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X400 Y400 (Slot 1 Coordinate)
- Chuck clamp released and Z rises to Machine coordinate Z-10
- Rapid move to X400 Y200 (Slot 4 Coordinate)
- Z descends to Z-85 and chuck clamp locks
- Move at feed rate 300mm/m at a Machine coordinate Z height of Z-85 to X365 Y200 (Tool Change offset coordinate)
- Z-axis ascends maximum height and rapids to original spindle position
- Machining resumes.

19.2.7. Umbrella Tool Changer

WARNING: The below instructions are for MASSO G3 controllers running software v5.0 and above. For any other software version, the below instructions **CAN NOT** be used, please contact support if you have any other software version with umbrella tool changer.

Selecting the tool changer

In the Tool Changer window select the tool changer and double click for settings.

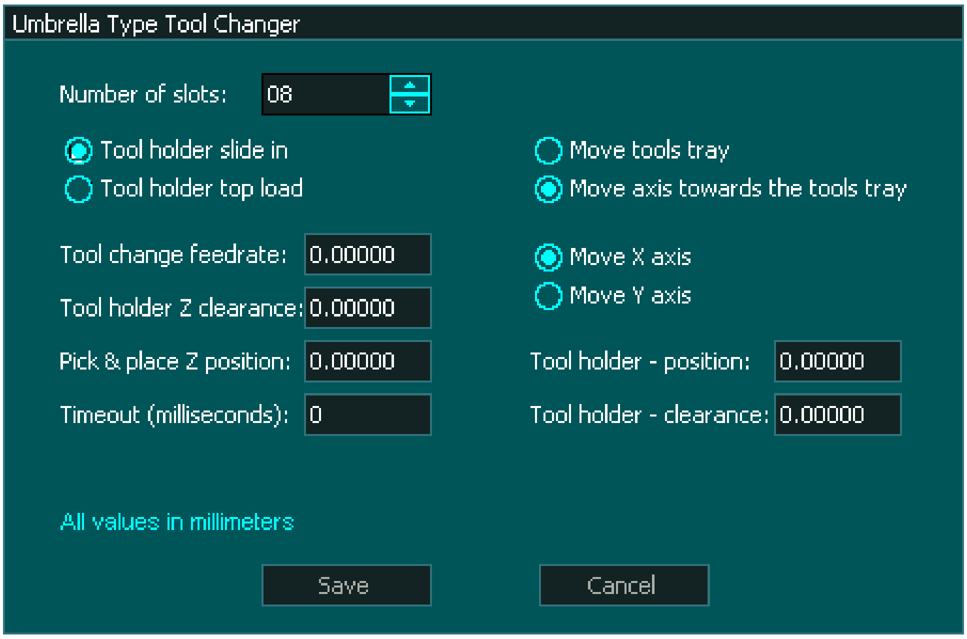


INFORMATION: The Tool setter air blast is used to clean dust from the tool setter after the tool has been changed and before the tool is measured. It is not used during the tool change process.

Setting up the tool changer as per your machine

There are different types of umbrella tool changer setups depending on the tool changer design. In most cases, an external arm moves the tools into position for tool unloading and loading, but in some designs, the machine's axis is used to position the spindle above the tool change position.

MASSO umbrella tool changer logic provides options to easily set up tool changer logic as per your machine requirements.



Double Click on Umbrella Type Tool changer to see the Settings

Settings 1 - Tool holder sliding or top-loading type

- If the machine requires the tool holder to slide in/out from the side, then select the **"Tool holder slide in"** option.
- If the machine requires the tool holder to be loaded from the top, then select the **"Tool holder top load"** option.

Settings 2 - Tool holder moving under spindle or spindle moved using axis

- If the machine requires the tools to be moved under the spindle using an external arm, then select the **"Move tool holder"** option.
- If the machine requires the X or Y axis to move the spindle to the tool change position, then select the **"Move axis"** option.

"Move axis" option

If the **"Move Axis"** option is used then the following settings are required:

- Select the machine axis X or Y that will be used to position the spindle for tool change.
- **Tool holder - position:** The X or Y axis machine coordinates to position the tool holder in the center of the spindle.
- **Tool holder - clearance:** The X or Y axis machine coordinates to position the tool holder away from the tool holder clamp.

Timeout (milliseconds)

This setting is in milliseconds and defines how long the tool changer has to perform the Homing of the Tool changer before a Homing alarm is displayed.

If this setting is left at 0 it will immediately give a Homing alarm after homing the axis.

Tool Changer Inputs and Outputs

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

WARNING: The below input and output pins are for MASSO G3 controllers running software v4.02 and above. For any other software version, the below instructions **CAN NOT** be used, please contact support if you have any other software version with umbrella tool changer.

INFORMATION: If your machine does not have a sensor for one or more of the inputs below then do not assign an input to that function and the tool change logic will ignore the input and will continue.

INPUTS

- **Tool Changer – Input 1** for **Homing Sensor** *(to be used to find Slot-1 position when the machine is homed)*
- **Tool Changer – Input 2** for **Pulse Counter Sensor** *(this pulse signal is required as each tool passes the sensor)*
- **Tool Changer – Input 3** for **Dust Hood UP OK** signal (High means hood UP)
- **Tool Changer – Input 4** for **Tools Retract OK** *(signal from sensor or switch telling the system that the tools are retracted away from the spindle)*
- **Tool Changer – Input 5** for **Tools In Position OK** *(signal from a sensor or switch telling the system that the tools fully extended and at loading position)*
- **Tool Changer – Input 6** for **Spindle in INDEX position** *(signal from VFD, telling the system that the spindle is Indexed and locked in position)*
- **Tool Changer – Input 7** for **Drawbar Locked** *(signal from sensor or switch telling the system that drawbar is in the locked position)*
- **Tool Changer – Input 8** for **Drawbar Unlocked** *(signal from sensor or switch telling the system that drawbar is in unlocked position)*

OUTPUTS

- **Chuck Clamp M10/M11** for spindle **drawbar clamp and un-clamp** *(Low to clamp and High to un-clamp)*
- **Tool Changer – Output 1** to move **Dust Hood UP/DOWN** (When HIGH the hood will move UP)
- **Tool Changer – Output 2** to **Rotate Tools Tray**
- **Tool Changer – Output 3** when **LOW** will **Retract Tools (away from spindle)** and when **HIGH** will **Bring Tools In Position (for tool change)**
- **Tool Changer – Output 4** when **HIGH** will give a signal to VFD to **Start JOGGING the spindle at very low RPM.**
- **Tool Changer – Output 5** when **HIGH** will give a signal to VFD to **Automatically stop and lock in INDEX position.**
- **Tool Changer – Output 6** for **spindle clean air blast**

Tool Changer logic

During machine homing:

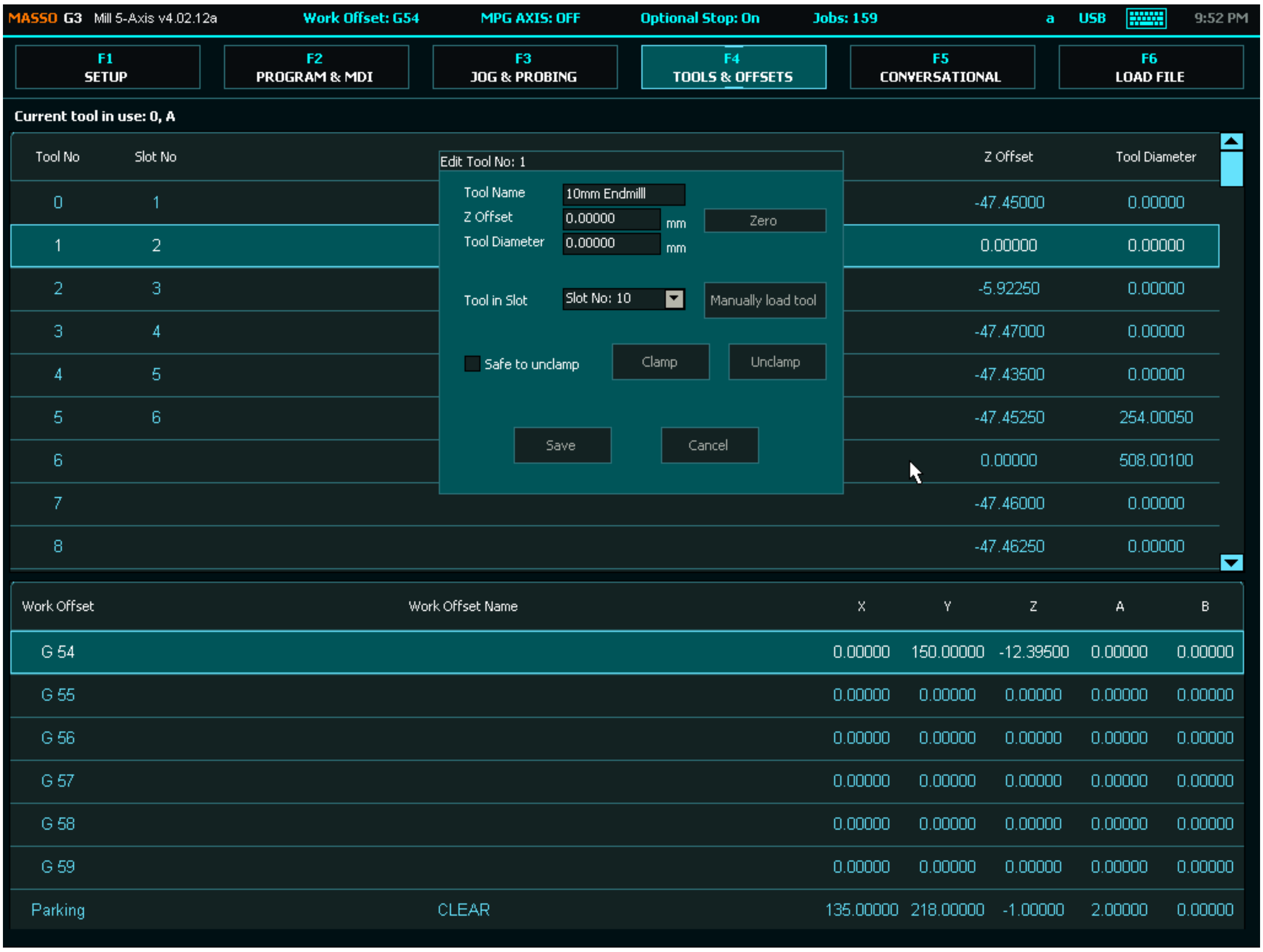
1. After all the axis of the machine has been homed as per the homing sequence the tool changer logic will home the tool changer.
2. The **tools will be retracted** and the system will wait as per the timeout period set up in the **Umbrella Tool Changer Settings.**
3. Once retracted the tools will rotate until the homing sensor on the tools is not activated.
4. Then the system will automatically rotate the tool to the last loaded position (empty tool slot).
5. **IMPORTANT:** The home position of the tool changer must be marked as Slot "1".

When a tool change command is received, the tool changer logic works in the followings steps:

1. **The spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is set up in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is set up in a slot is the **F4-Tools** screen, else gives an error.
4. **Z-Axis moves UP** to the Tool **Pick & Place Z position.**
5. If spindle indexing is required and "**Tool Changer - Input 6 (Spindle in INDEX position)"** is assigned to one of the MASSO inputs then:
6. **Tool Changer - Output 4** goes **HIGH** for VFD to **Start JOGGING the spindle at a very low RPM.**
7. **Tool Changer - Output 5** goes **HIGH** for VFD to **Automatically stop and lock in INDEX position.**
8. The system waits for the **"Tool Changer - Input 6 (Spindle in INDEX position)"** to go **HIGH.**
9. **"Tool Changer - Output 3"** goes **HIGH** to move **Tools In Position** to unload the current tool. The system waits for time setup in **Timeout** settings for the **"Tool Changer - Input 5" (Tools In Position)** signal to go **HIGH**, else gives an error.
10. "**Chuck Clamp M10/M11"** goes **HIGH** to unclamp the tool**.**
11. If spindle "**Drawbar Locked & Unlocked"** signals are assigned to any of the MASSO inputs then:
12. The system waits for the **"Tool Changer - Input 7 (Drawbar Locked)"** to go **LOW.**
13. And waits for the **"Tool Changer - Input 8 (Drawbar unlocked)"** to go **HIGH.**
14. **Z-Axis moves up** to the **Tool holder Z clearance** position.
15. **"Tool Changer - Output 2"** goes **HIGH** to **Rotate Tools** and counts pulses from **"Tool Changer - Input 2"**.
16. Once the desired tool is in position the **"Tool Changer - Output 2"** goes **LOW** to stop tool tray rotation.
17. **Z-Axis moves DOWN** to the Tool **Pick & Place Z position.**
18. **Tool Changer - Output 6 (spindle clean air blast)** goes **HIGH** as the Z axis descends.
19. **Tool Changer - Output 6 (spindle clean air blast)** goes **Low** when Z axis is in position.
20. "**Chuck Clamp M10/M11"** goes **LOW** to clamp the tool.
21. If spindle "**Drawbar Locked & Unlocked"** signals are assigned to any of the MASSO inputs then:
22. The system waits for the **"Tool Changer - Input 7 (Drawbar Locked)"** to go **HIGH.**
23. And waits for the **"Tool Changer - Input 8 (Drawbar unlocked)"** to go **LOW.**
24. **"Tool Changer - Output 3"** goes **LOW** to **Retract the tools** away from the spindle. The system waits for time setup in **Timeout** settings for the **"Tool Changer - Input 4" (Tools In Position)** signal to go **HIGH**, else gives an error.

INFORMATION: All input & output signals can be easily inverted by selecting the input or output in the list and pressing the space-bar key on the keyboard to invert the signal. These settings are automatically saved.

INFORMATION: Make sure to assign each tool into a tool slot in the **F4 - Tools & Work offset** screen else on a tool change command if the tool is not set in a slot you will get a tool error alarm.



Tool Numbering

CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tools have changed and are now Tool 1 to 100.

INFORMATION: Depending on your software version your first user assignable tool will be either Tool 0 or Tool 1

INFORMATION: Tool Changers may be placed outside of soft Limits to protect them from accidental damage however the Auto Tool Zero must remain within soft limits.

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.2.8. High Speed Rotary Tool Changer

> ⚠ This feature currently undergoing Alpha testing and will be available for MASSO G3 & MASSO Touch in an upcoming Beta software release.

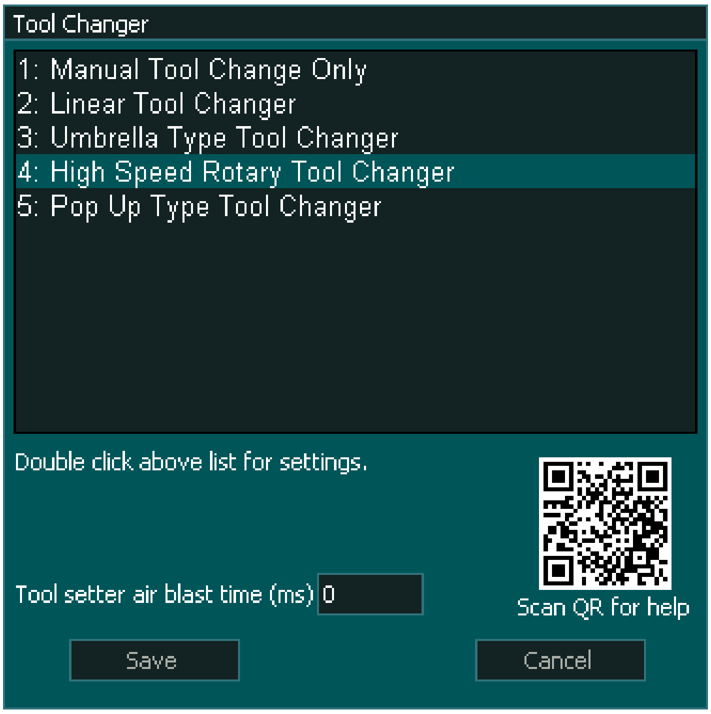
This tool changer has been tested in the following model tool changers and may be suitable for other similar models.

Please let MASSO Support know if your tool changer model works and we will add it to the list.

- Brother TC-211

Selecting the tool changer

In the **Tool Changer window** select **High Speed Rotary Tool Changer** and double-click for settings.



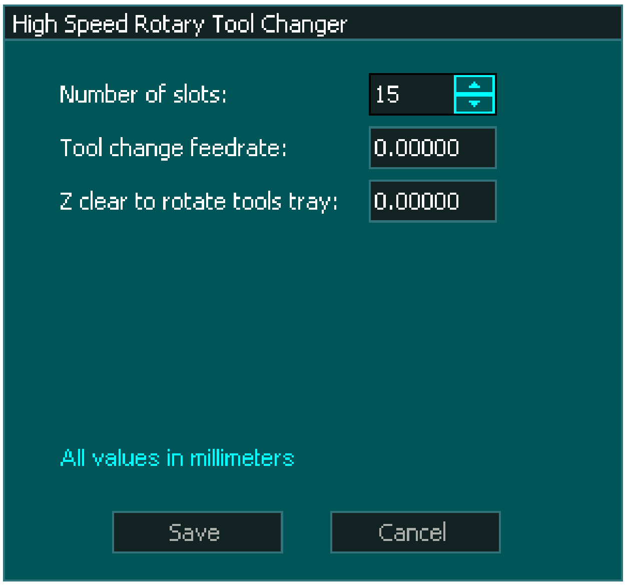
INFORMATION: The Tool setter air blast is used to clean dust from the tool setter after the tool has been changed and before the tool is measured. It is not used during the tool change process.

Settings

Number of Slots: Up to 15 tool slots can be assigned.

Tool Change Feedrate: Defines how fast the Z axis moves up and down during the tool change.

Z Clear to Rotate tools tray: This is the machine coordinate that the spindle moves up before the tool tray rotates.



Tool Changer Inputs and Outputs

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

INFORMATION: If your machine does not have a sensor for one or more of the inputs below then do not assign an input to that function and the tool change logic will ignore the input and will continue.

INPUTS

1. **Tool Changer - Input 1** for **Spindle in INDEX position**
2. **Tool Changer - Input 2** for **Clear to rotate tools tray signal**
3. **Tool Changer - Input 3** for **Tool position bit 1 signal from the tool changer**
4. **Tool Changer - Input 4** for **Tool position bit 2 signal from the tool changer**
5. **Tool Changer - Input 5** for **Tool position bit 3 signal from the tool changer**
6. **Tool Changer - Input 6** for **Tool position bit 4 signal from the tool changer**
7. **Tool Changer - Input 7** for **Tool changer deceleration range**

OUTPUTS

1. **Tool Changer - Output 1** for **Spindle INDEX start**
2. **Tool Changer - Output 2** for **Spindle clean air blast**
3. **Tool Changer - Output 3** to **rotate Tools Tray CW**
4. **Tool Changer - Output 4** to **rotate Tools Tray CCW**

Tool Changer logic

When a tool change command is received, the tool changer logic works in the followings steps:

1. **The spindle is turned OFF** and the system waits for the spindle to stop as per the spindle **"Spin down delay"** value in the spindle settings.
2. The system checks if the **current tool in the spindle** is setup in a slot is the **F4-Tools** screen, else gives an error.
3. The system checks if the **tool to load** is setup in a slot is the **F4-Tools** screen, else gives an error.
4. **Tool Changer - Output 1** for Spindle in INDEX position goes **High** to start index process
5. The system waits for the "**Tool Changer - Input 1** (Spindle in INDEX position)" to go **HIGH** to signal spindle is indexed, otherwise it gives an error.
6. Z-Axis moves UP past the homing switch until **Tool Changer Input 2** (Clear to Rotate Tools) goes **HIGH**. The homing switch is pressed the entire time it is in tool change.
7. "**Tool Changer - Output 3 or 4**" goes **HIGH** to Rotate the Tools tray depending on the direction of rotation required.
8. The system reads 4 digital inputs from the positioning sensor:
9. **Tool Changer - Input 3**: (bit 1)
10. **Tool Changer - Input 4**: (bit 2)
11. **Tool Changer - Input 5**: (bit 3)
12. **Tool Changer - Input 6**: (bit 4)
13. Then the system waits for **Tool Changer - Input 7** signal to check if the new tool is in the correct position.
14. Once the desired tool is in position the "**Tool Changer - Output 2**" goes **LOW** to stop tools rotation.
15. **Tool Changer - Output 6** (spindle clean air blast) goes **HIGH**
16. **Z-Axis** moves **DOWN**
17. **Tool Changer - Output 6** (spindle clean air blast) goes **Low** when Z axis is back below homing switch.
18. **Tool Changer - Output 1** goes **LOW** to allow normal spindle control.
19. Tool change compete.

INFORMATION: All input & output signals can be easily inverted by selecting the input or output in the list and pressing the space-bar key on the keyboard to invert the signal. These settings are automatically saved.

INFORMATION: Make sure to assign each tool into a tool slot in the **F4 - Tools & Work offset** screen else on a tool change command if the tool is not set in a slot you will get a tool error alarm.

INFORMATION: Tool Changers may be placed outside of soft Limits to protect them from accidental damage however the Auto Tool Zero must remain within soft limits.

19.2.9. Dust Hood - Beta Version

This Dust Hood logic is for MASSO G3 and MASSO Touch and is only available in the current Beta software version

Dust Hood

The Dust hood logic has been removed from tool changer logic and is now a stand alone.

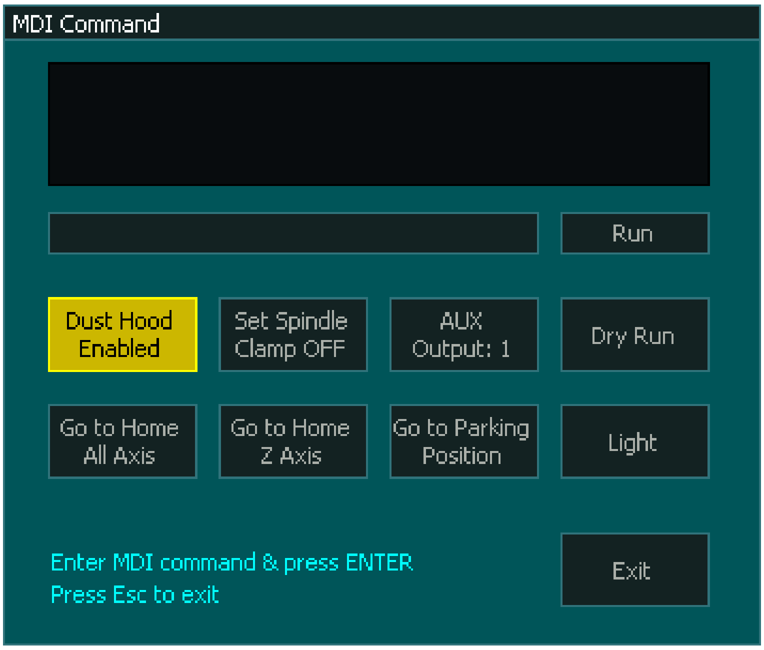
There are 2 types of Dust Hood logic available depending on the type of Dust Hood you have on your machine.

A manual override has been added and is available from the MDI screen to disable the Dust hood from operating and can be accessed and operated while the machine is running.

This allows all tool changers including manual tool change to have a dust hood if required.

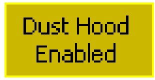
The Dust hood is controlled by the Spindle and is automatic.

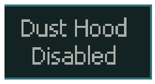
- When the spindle turns on the Dust hood moves down
- When the spindle turns off the Dust hood moves up



This is useful if the tool being used is too large for the dust hood or if the user just wants to see the cut as it occurs.

The MDI screen can be accessed while the machine is running and the Dust Hood disabled and enabled as required while machining.

The default state for the Dust hood when you power MASSO on is for Dust hood enable 

and it can be disabled by opening the MDI screen and pressing the button to change it to disabled 

Dust Hood logic Type 1

Outputs

- **Dust Hood-1** - Move Dust Hood Up and Down

Inputs

- **Dust Hood-1** - Dust Hood Down (optional)

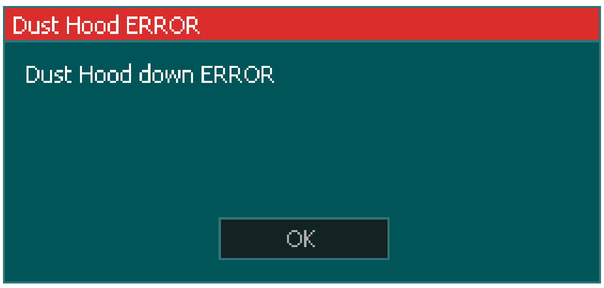
- Assign a Dust Hood-1 output 

- Assign a Dust Hood-1 input 

, This input changes to High when the Dust Hood is down and is Low when the Dust Hood is up.
- The Dust Hood-1 input is optional and if not assigned MASSO will ignore the input and continue.

Dust Hood Down

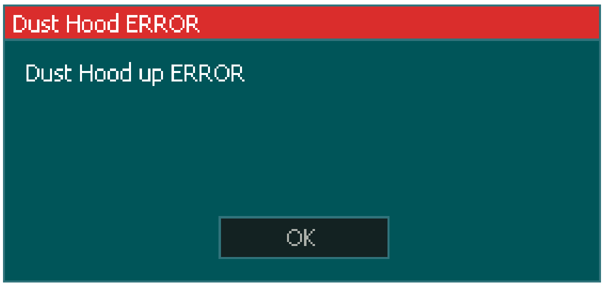
- **M3**
- MASSO checks Dust Hood Enable setting in MDI and if it is enabled the **Dust Hood-1 output** changes to High
- MASSO Waits 5 sec for **Dust Hood-1 input** to change to High to indicate that the Dust Hood is down and if the input does not change, a Dust Hood Down Error will be Displayed



Dust Hood Up

- **M5**

- **Dust Hood-1 output** changes to Low
- MASSO Waits 5 sec for **Dust Hood-1 input** to change to Low to indicate that the Dust Hood is up and if the input does not change, a Dust Hood Up Error will be Displayed



Wiring Diagram

Dust Hood Logic Type 2

Outputs

- **Dust Hood-1** - Move Dust Hood Down
- **Dust Hood-1** - Move Dust Hood Up

Inputs

- **Dust Hood-1** - Dust Hood is Down (Not Optional)
- **Dust Hood-1** - Dust Hood is Up (Not Optional)

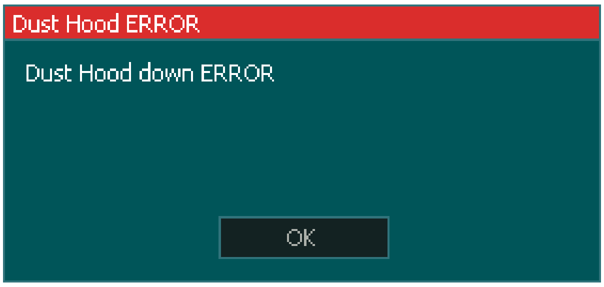
- Assign 2 outputs Dust Hood-1for Dust hood Down and Dust hood-2 for Dust hood up 

- Assign 2 Inputs Dust Hood-1for Dust Hood Down and Dust hood-2 for Dust Hood up 

- The Dust Hood inputs are not optional in this logic and must be installed

Dust Hood Down

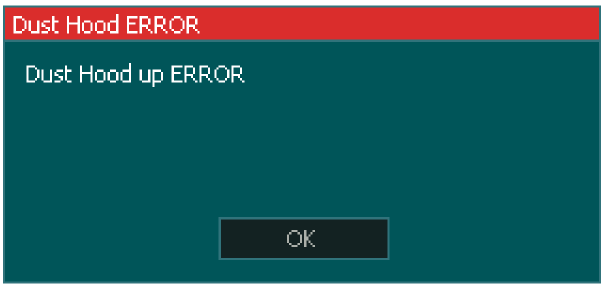
- **M3**
- MASSO checks Dust Hood Enable setting in MDI and if it is enabled the **Dust Hood-1 output** changes to High
- MASSO Waits 5 sec for **Dust Hood-1 input** to change to High to indicate that the Dust Hood is down and if the input does not change, a Dust Hood Down Error will be Displayed and **Dust Hood-1 Output** changes to Low



- On receipt of the **Dust Hood-1 input** signal the **Dust Hood-2 Output** changes to Low

Dust Hood Up

- **M5**
- **Dust Hood-1 output** changes to Low
- MASSO Waits 5 sec for **Dust Hood-2 input** to change to High to indicate that the Dust Hood is up and if the input does not change, a Dust Hood Up Error will be Displayed and **Dust Hood-2 Output** will change to Low



- On receipt of the **Dust Hood-2 input** signal the **Dust Hood-2 Output** changes to Low

Wiring diagram

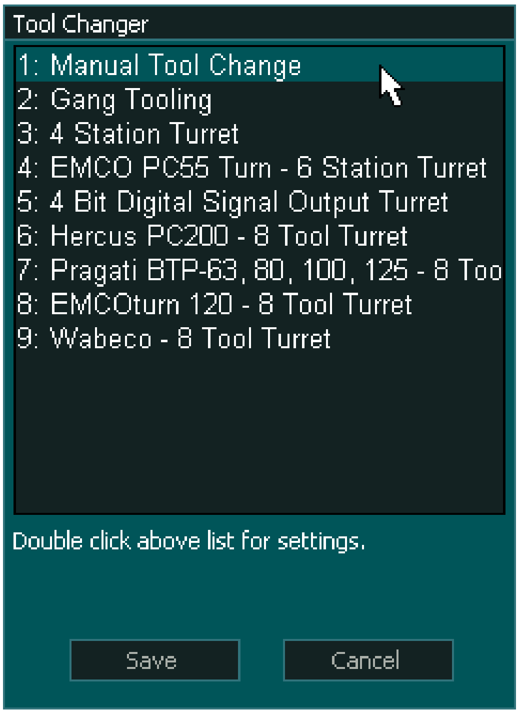
19.3. Lathe Tool Changers

Read other subtopics below:

19.3.1. Manual Tool Change

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Manual Tool Change** from the list.



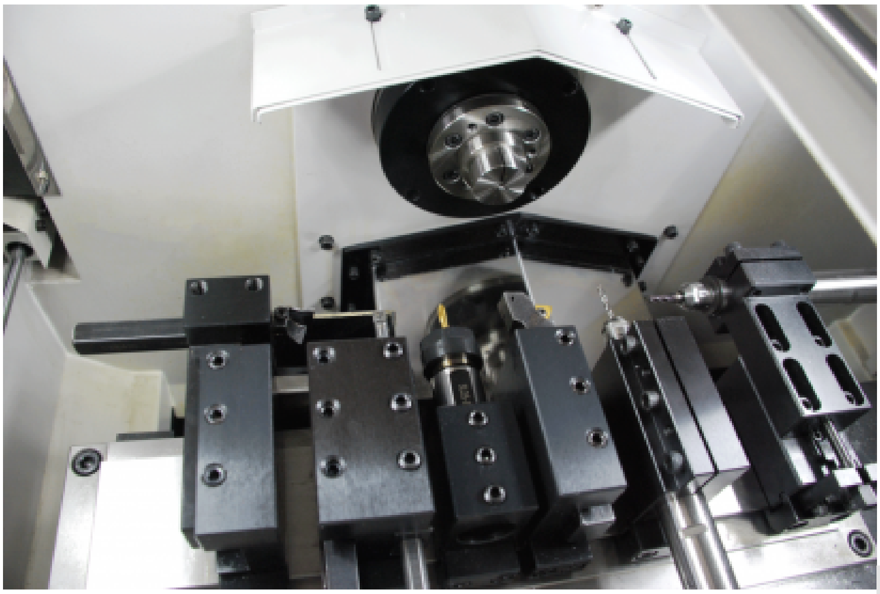
Tool Numbering

CAUTION: Please be aware that from MASSO G3 software versions 5.0 and higher, user assignable tools have changed and are now Tool 1 to 100.

INFORMATION: Depending on your software version you first user assignable tool will be either Tool 0 or Tool 1

[Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.]

19.3.2. Linear - Gang Type Setup

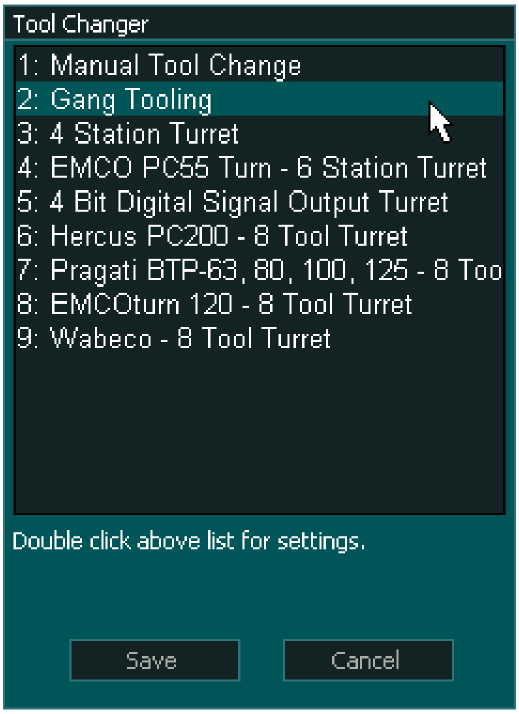


This logic supports 2 types of Tool changers

1. The tools are mounted on the X axis. They can be either Fixed or moved into position by a pneumatic cylinder.
2. The tools are mounted on the Z axis and the tools move into position by a pneumatic cylinder.

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Gang Tooling** from the list.



Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Output Signals

- **Tool Changer - Output 1** goes high when Tool 1 is selected
- **Tool Changer - Output 2** goes high when Tool 2 is selected
- **Tool Changer - Output 3** goes high when Tool 3 is selected
- **Tool Changer - Output 4** goes high when Tool 4 is selected
- **Tool Changer - Output 5** goes high when Tool 5 is selected
- **Tool Changer - Output 6** goes high when Tool 6 is selected

These outputs can be used in either tool changer configuration.

If a tool needs to be moved into position assign the **Tool changer - output** that matches the tool number and it will automatically change to High when that tool is selected

If the tool does not require to be moved into position, do not assign a **Tool Changer - Output**.

There is no limit to the number of tools this tool changer can support but only Tools 1 to 6 have associated

Outputs.

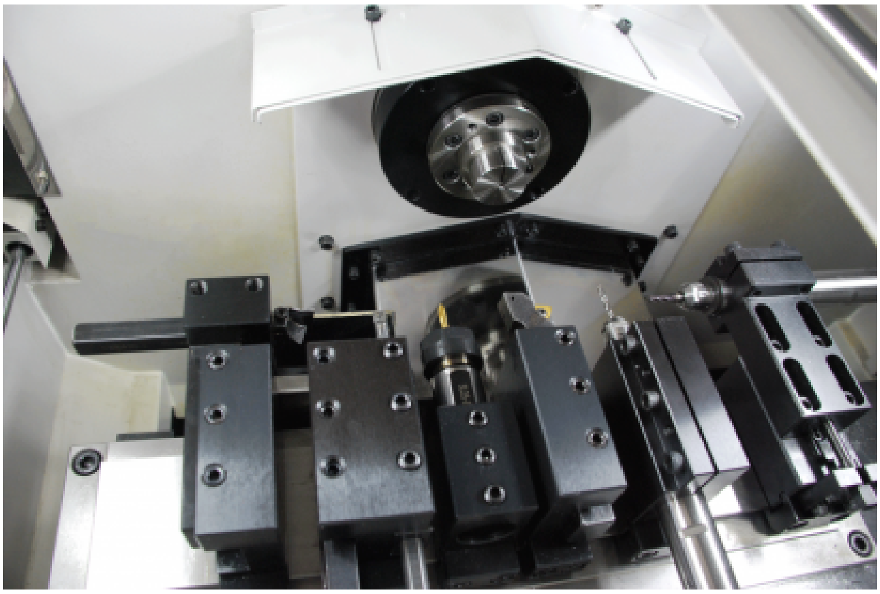
Logic

When Tools 1 to 6 are selected the associated Tool Changer output changer from Low to High.

Tools mounted on the X axis

This type of tool changer has the tools set in a fixed position on the X axis though one or more tools could also be moved into position using a pneumatic cylinder

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Gang Tooling** from the list.
- Assign **Tool Changer - Outputs 1 - 6** if required.



Chucker Lathe

Tools mounted on the Z axis

This type of setup is most likely to be used on a Wood lathe though could be used on a Metal lathe.

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Gang Tooling** from the

list.
- Assign **Tool Changer - Outputs 1 - 6** as required

Wood Lathe

Tool Numbering

> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

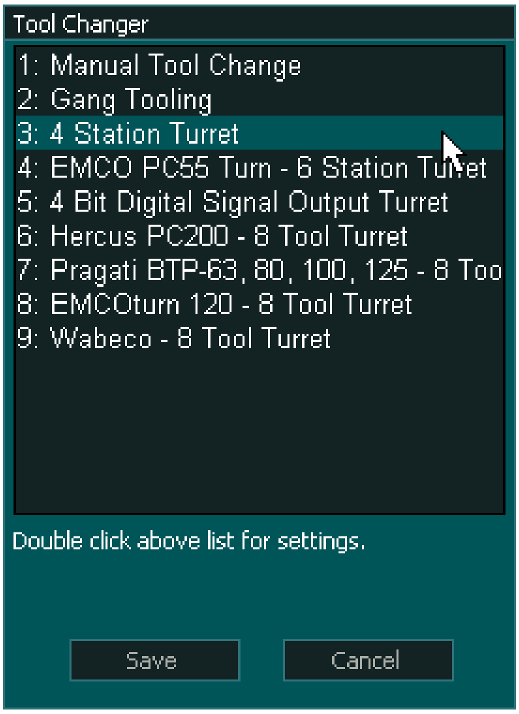
Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.3.3. 4 Station Turret

The 4 station type turret outputs the turret tool position to corresponding 4 signals going high representing the tool in position.

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **4 Station Turret** from the list.



Tool changer logic

On a tool change request, MASSO will make the **Tool Changer - Output 1 HIGH** to turn the tool changer head clockwise till the desired tool has been loaded in position. Once the tool is in position t**he Tool Changer - Output 1** becomes **LOW** and **Tool Changer - Output 2** goes **HIGH** to turn the tool changer head counterclockwise for 400ms to lock the tool in position.

Syntax used in this document for Tool Changer inputs and outputs

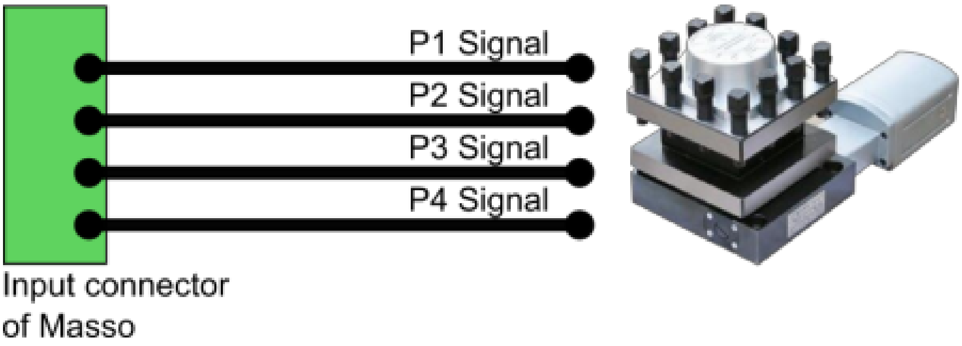
"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

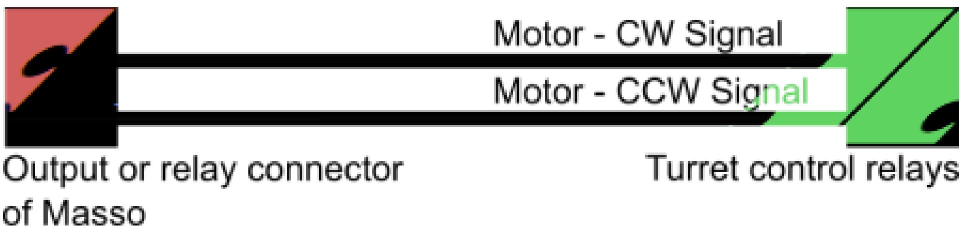
Input Signals

Wire the **P1, P2, P3 & P4** signals to any free inputs on MASSO and in the **INPUTS** list assign them to **Tool Changer - Input 1** to **Tool Changer - Input 4.**



Output Signals

Wire the turrets control electronics **CW** and **CCW** signals on any free outputs on MASSO and in the **OUTPUTS** list assign them to the **CW** signal to **Tool Changer - Output 1** and **CCW** signal to **Tool Changer - Output 2.**



Tool Numbering

> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool on your tool changer will be Tool 1
- Users of MASSO G2, the first tool on your tool changer will be Tool 0

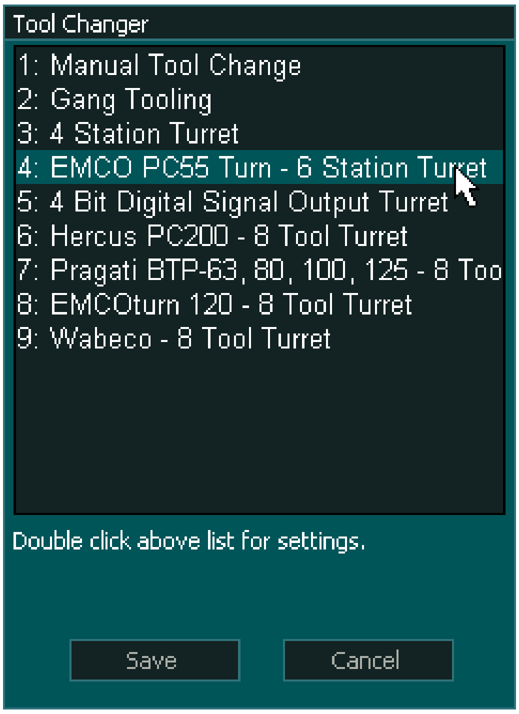
Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.3.4. EMCO PC55 Turn

This 6 station turret outputs two control signals. The first signal is the home position signal which tells the system that the first tool is in position. The second signal is the pulse signal, this signal pluses once on each tool change and is used to count tool number position as the turret turns.

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **EMCO PC55 Turn - 6 Station Turret** from the list.



Tool changer logic

On a tool change request, MASSO will make the **Tool Changer - Output 1 HIGH** to turn the tool changer head clockwise till the desired tool has been loaded in position. Once the tool is in position t**he Tool Changer - Output 1** becomes **LOW**.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Input Signals

Wire the sensor inputs and assign to MASSO as below:

- **Tool Changer - Input 1** for **Turret home signal.**
- **Tool Changer - Input 2** for **Tool change pulse signal.**

Output Signals

Wire the turrets control electronics **CW** signals on any free output on MASSO and in the **OUTPUTS** list assign it to **Tool Changer - Output 1.**

Tool Numbering

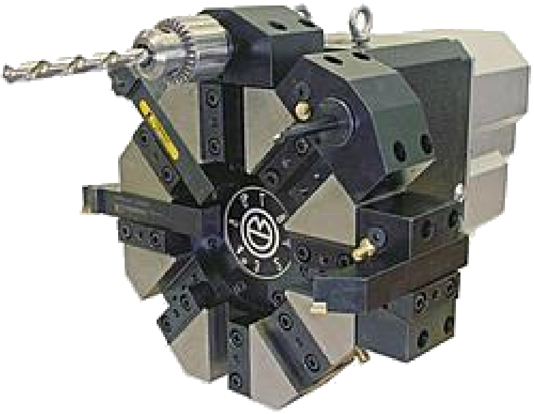
> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1

- Users of MASSO G2, the first tool in your tool changer will be Tool 0

[Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.]

19.3.5. 4 Bit Digital Signal Output Turret



The 4 bit output type turret outputs the turret tool position in a 4 bit binary output as below:

The tool represented by the binary code will depend on which software version you are using.

See the section on Tool numbering at the bottom of this page for more information.

Users of MASSO G3 & MASSO Touch running software version 5.01 or higher

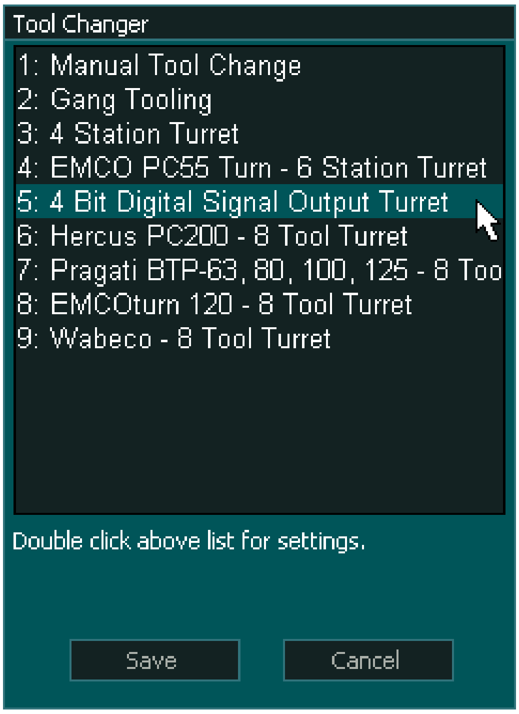
- Tool 1 signal - Binary 0001
- Tool 2 signal - Binary 0010
- Tool 3 signal - Binary 0011
- Tool 4 signal - Binary 0100
- and so on...

Users of MASSO G2 and software version lower than 5.01

- Tool 0 signal - Binary 0001
- Tool 1 signal - Binary 0010
- Tool 2 signal - Binary 0011
- Tool 3 signal - Binary 0100
- and so on...

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the **4 Bit digital Signal Output Turret** from the list.



Tool changer logic

On a tool change request, MASSO will make the **Tool Changer - Output 1 HIGH** to turn the tool changer head clockwise till the desired tool has been loaded in position. Once the tool is in position the **Tool Changer - Output 1** becomes **LOW** and **Tool Changer - Output 2** goes **HIGH** to turn the tool changer head counterclockwise for 400ms to lock the tool in position.

This tool change supports 2 to 14 tools

Syntax used in this document for Tool Changer inputs and outputs

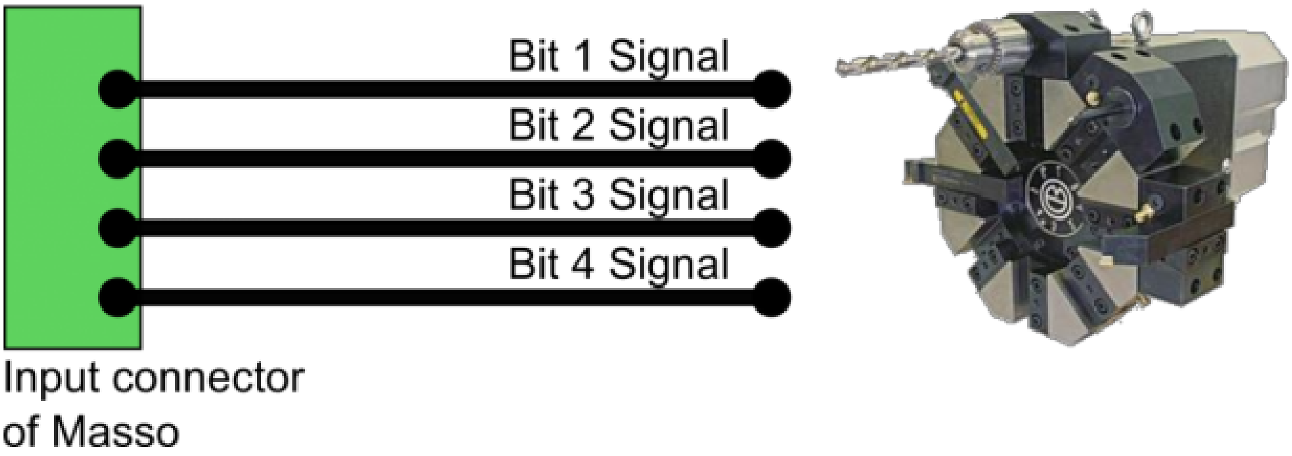
"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

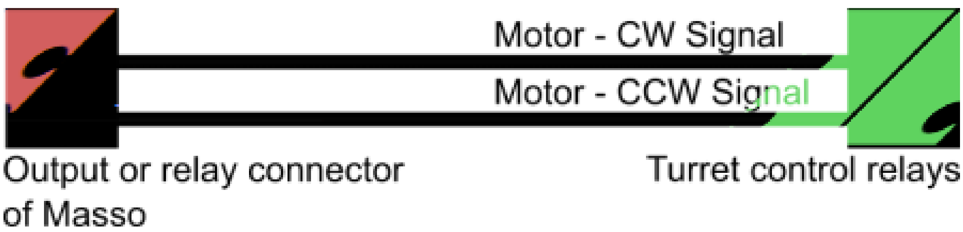
Input Signals

Wire the **Bit 1, Bit 2, Bit 3 & Bit 4** signals to any free inputs on MASSO and in the **INPUTS** list assign them to **Tool Changer - Input 1** to **Tool Changer - Input 4.**



Output Signals

Wire the turrets control electronics **CW** and **CCW** signals on any free outputs on MASSO and in the **OUTPUTS** list assign them to the **CW** signal to **Tool Changer - Output 1** and **CCW** signal to **Tool Changer - Output 2.**



Tool Numbering

> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

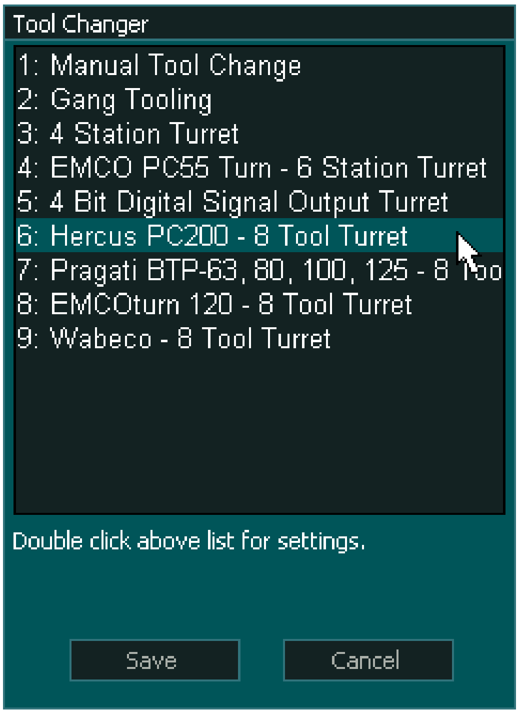
- Users of MASSO G3 & MASSO Touch running software version 5.01 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.3.6. Hercus PC200 - 8 Tool Turret

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Hercus PC200 - 8 Tool Turret** from the list.



Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Input Signals

Wire the sensor inputs and assign to MASSO as below:

- **Tool Changer - Input 1** for Tool 0 signal input (used to home the turret during machine homing).
- **Tool Changer - Input 2** for Tool counter signal input.
- **Tool Changer - Input 3** for Locking pin signal input.

Output Signals

Wire the control outputs and assign to MASSO as below:

1. **Tool Changer - Output 1** to rotate turret for tool change rotation.
2. **Tool Changer - Output 2** to rotate turret in tool lock direction.

Tool Numbering

> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

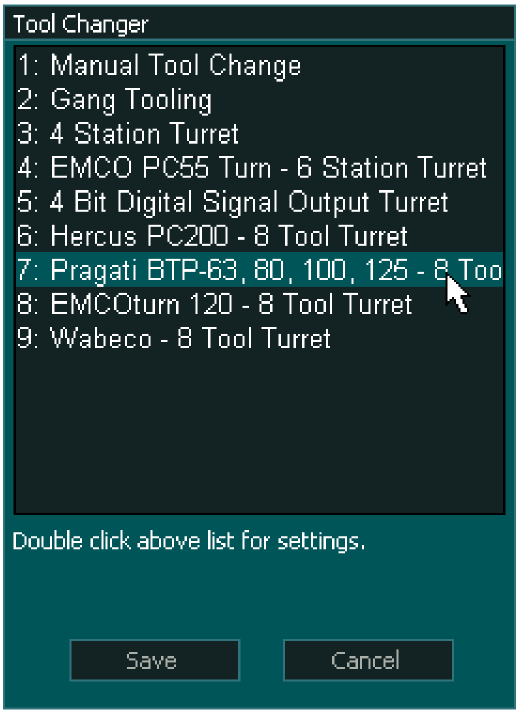
Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.3.7. Pragati BTP-63, BTP-80, BTP-100, BTP-125

INFORMATION: This tool changer logic is designed as per Pragati tool turret requirements which is also used in other brands of tool turrets, please see the PDF document for details.

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the the **Pragati BTP-63, 80, 100,125 - 8 Tool Turret** from the list.



Tool changer logic

After all the axis of the machine have been homed as per the homing sequence the tool changer logic will read the encoder data from Turret to get the current tool in position.

If a valid tool number is received then the current tool number is updated on the controller else an ERROR message is displayed on the screen telling the user that the signals from Turret were not correct.

CAUTION: In MASSO G2, tool numbers start from Tool No. 0. When a command is given to load Tool No. 0, on the Pragati Turret Tool No. 1 is loaded. When tool load command is given for Tool No. 7, on the Pragati Turret Tool No. 8 is loaded. This has changed for Software version 4.02.77b and Higher. Please see the section on Tool numbering at the bottom of the page.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Input Signals

Wire the sensor inputs and assign to MASSO as below:

- **Tool Changer - Input 1** for **BIT-1**
- **Tool Changer - Input 2** for **BIT-2**
- **Tool Changer - Input 3** for **BIT-3**
- **Tool Changer - Input 4** for **BIT-4**
- **Tool Changer - Input 5** for **PARITY**
- **Tool Changer - Input 6** for **STROBE**
- **Tool Changer - Input 7** for **CLAMP**
- **Tool Changer - Input 8** for **THERMAL ALARM**

Output Signals

- **Tool Changer - Output 1** for **CW rotate**
- **Tool Changer - Output 2** for **CCW rotate**

Tool Numbering

> **CAUTION:** Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

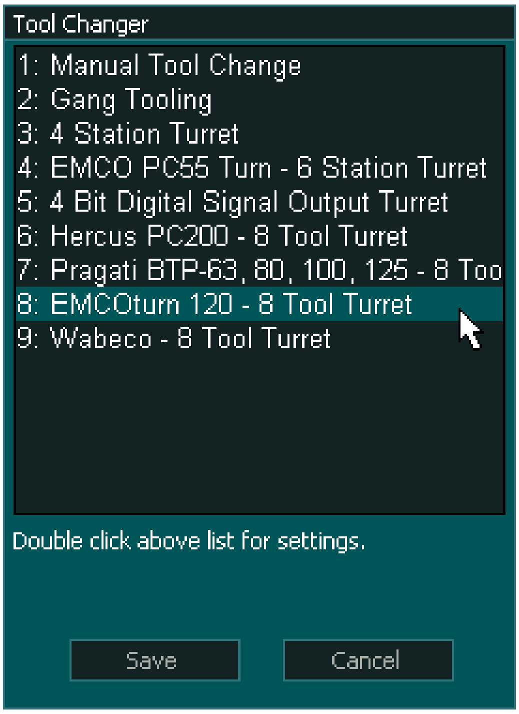
- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.3.8. EMCOturn 120

Setting up the tool changer

- Go to **F1-Setup** screen and open **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the **EMCOturn 120** from the list.
- There are no settings for this tool changer.



Tool changer logic

After all the axis of the machine has been homed as per the homing sequence the tool changer logic will read the encoder data from Turret to get the current tool in position.

If a valid tool number is received then the current tool number is updated on the controller else an ERROR message is displayed on the screen telling the user that the signals from Turret were not correct.

On a tool change request, MASSO will make the **Tool Changer - Output 1 HIGH** to turn the tool changer head clockwise till the desired tool has been loaded in position. Once the tool is in position **the Tool Changer - Output 1** becomes **LOW** and **Tool Changer - Output 2** goes **HIGH** to turn the tool changer head counterclockwise for 1000ms to lock the tool in position.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Output Signals

- **Tool Changer - Output 1 -** Motor clockwise
- **Tool Changer - Output 2** - Motor Counter clockwise

Input Signals

Wire the sensor inputs and assign to MASSO as below:

- **Tool Changer - Input 1** for **Turret signal-1**
- **Tool Changer - Input 2** for **Turret signal-2**
- **Tool Changer - Input 3** for **Turret signal-3**
- **Tool Changer - Input 4** for **Turret signal-4**

Input Signal Sequence Chart

The below chart shows the signal sequence as per EMCO documentation. Check that your tool turret provides the signals as shown below to work properly with MASSO.

INFORMATION: Depending on what software version you are using in your machine will determine the tool numbering on your tool changer. Please see the section on Tool Numbering at the bottom of this page for more information.

MASSO G3 & MASSO Touch

Tool Number	Tool Changer Input 1	Tool Changer Input 2	Tool Changer Input 3	Tool Changer Input 4
1	**HIGH**	**HIGH**	**HIGH**	LOW
2	**HIGH**	**HIGH**	LOW	LOW
3	**HIGH**	**HIGH**	LOW	**HIGH**
4	**HIGH**	LOW	LOW	**HIGH**
5	**HIGH**	LOW	**HIGH**	**HIGH**
6	LOW	LOW	**HIGH**	**HIGH**
7	LOW	**HIGH**	**HIGH**	**HIGH**
8	LOW	**HIGH**	**HIGH**	LOW

MASSO G2

Tool Number	Tool Changer Input 1	Tool Changer Input 2	Tool Changer Input 3	Tool Changer Input 4
0	**HIGH**	**HIGH**	**HIGH**	LOW
1	**HIGH**	**HIGH**	LOW	LOW
2	**HIGH**	**HIGH**	LOW	**HIGH**
3	**HIGH**	LOW	LOW	**HIGH**
4	**HIGH**	LOW	**HIGH**	**HIGH**
5	LOW	LOW	**HIGH**	**HIGH**
6	LOW	**HIGH**	**HIGH**	**HIGH**
7	LOW	**HIGH**	**HIGH**	LOW

Output Signals

Wire the turrets control electronics **CW** and **CCW** signals on any free outputs on MASSO and in the **OUTPUTS** list assign them to the **CW** signal to **Tool Changer - Output 1** and **CCW** signal to **Tool Changer - Output 2.**

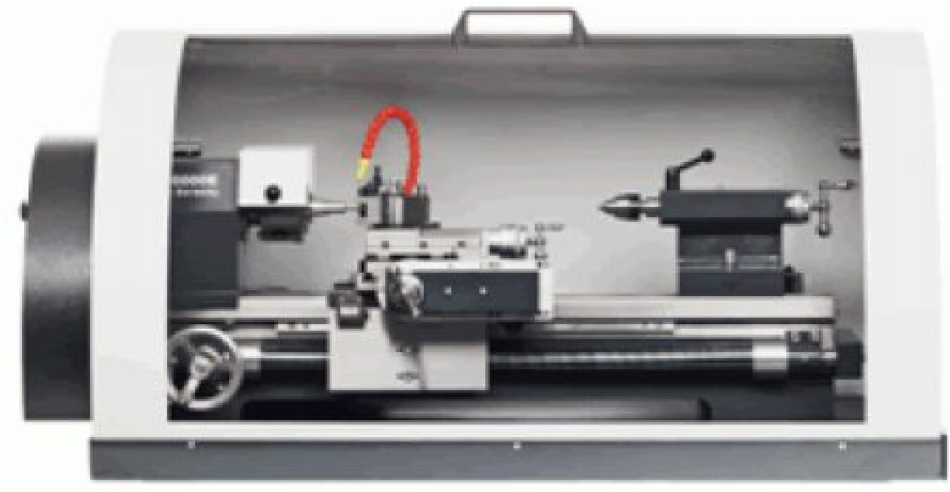
Tool Numbering

CAUTION: Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

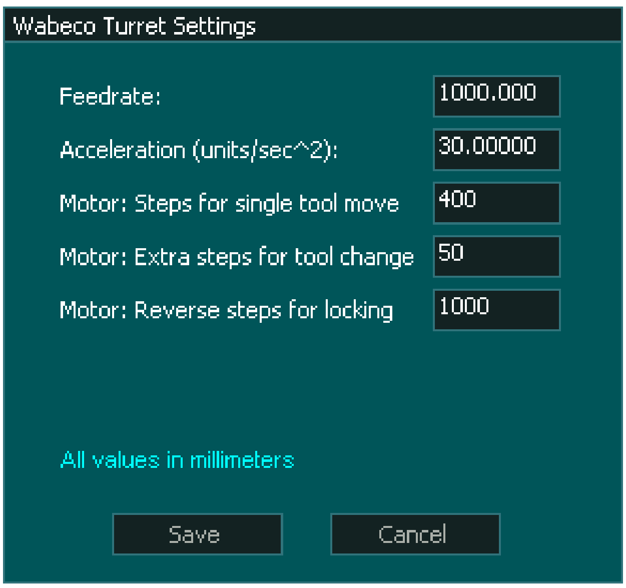
19.3.9. WABECO 8 Tool Turret



INFORMATION: This tool changer is only available on MASSO-G3 software v4.0 and above.

Setting up the tool changer

- Go to **F1-Setup** screen and open the **Tool Changer** window.
- From the list select Press enter to open **Tool Changer** list and select the **WABECO 8 Tool Turret** from the list and double click it to open the below settings window.



Feedrate:

The Feed rate is in tools per minute.

To work out how long it will take for the tool changer to do one full revolution use the following formula

60 seconds in a minute / Feedrate: tools per minute x 8 tools in the tool changer = Time in seconds for one full revolution

Acceleration:

Acceleration rate of the stepper motor in tools per sec ^2

Motor: Steps for single tool tool move

The number of steps required to move between tool position

Motor: Extra steps for tool change

Once the required tool position has been reached this is the number steps are required to move pass the tool lock position to ensure that when the tool changer reverses it will lock into position.

Motor: Reverse steps for locking

This is the number of steps required to reverse and lock the tool into position

Tool changer logic

After all the axis of the machine have been homed as per the homing sequence, the tool changer logic will start rotating the stepper motor for the turret till a home (Tool 0) signal is received.

If a valid tool home signal is not received in one full revolution, the controller will display an alarm on the screen.

On a tool change request, MASSO will start rotating the turret stepper motor till the desired tool has been loaded into position.

Syntax used in this document for Tool Changer inputs and outputs

"Tool Changer - Output 1" means Tool Change - 1 and it is an output

"Tool Changer - Input 1" means Tool Changer -1 and it is an Input

Note: Any tool changer input or output can be assigned to any Input or Output on MASSO. The tool changer number does not refer to an actual input or output port.

Input Signals

Wire the homing sensor input and assign it to MASSO as below:

- **Tool Changer - Input 1** for **Turret home position sensor.**

Output Signals

The turret stepper motor's STEP and DIRECTION signals should be wired to the MASSO Y-axis STEP and DIRECTION connector.

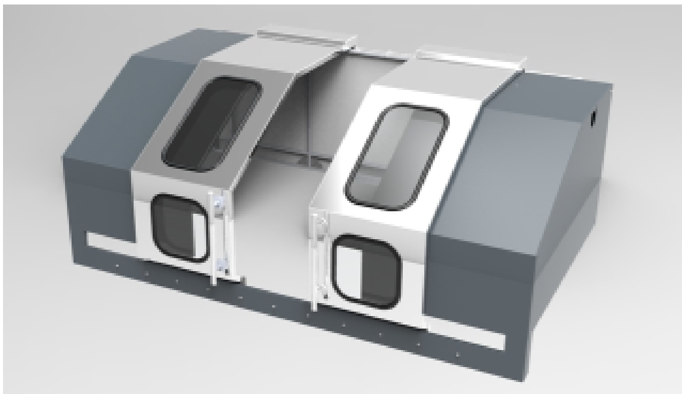
Tool Numbering

CAUTION: Please be aware that for software versions 5.0 and higher, user assignable tool have changed.

- Users of MASSO G3 & MASSO Touch running software version 5.0 or higher, the first tool in your tool changer will be Tool 1
- Users of MASSO G2, the first tool in your tool changer will be Tool 0

Follow this link to find out more about MASSO Tool numbering and how it will apply to your machine.

19.4. Automatic Doors



During a manual tool change sequence the door will automatically open to allow the user to change the tool.

The doors do not open during an automatic tool change.

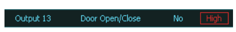
A sounder is output is provided to alert the user that the door is about to open or close.

The doors can also be opened and closed using an external button or by using Gcode.

A door sensor input to monitor the status of the door which will put the machine into Feed Hold if the doors are opened while machining is in progress.

Inputs and Outputs

Outputs

- Door Open / Close output on MASSO and sets the output **HIGH** to open the door. 

- Sounder output provides a warning of the door opening. 

- The output will change to **HIGH** for 1 second before the door starts to move then pulses between **HIGH** and **LOW** every 0.5 seconds for the next 5 seconds as the door opens.
- Depending on the sounder you are using you can either drive it through a TTL MASSO relay or if the sounder is TTL compatible it can be directly driven.
- MASSO TTL Outputs provide logic level signals only 5volts @ 5ma

Inputs

- An external button to open and close of the door can be provided by configuring the Door Open Close input. 

- This allows the door to be opened manually as needed and acts as a toggle. A Momentary press of the button it will either open or close the door depending on it's current state.
- This input is active when it changes to **HIGH**

- This Input monitors if the door is open or closed. 

- When this input goes HIGH MASSO will put the machine into Feed Hold.
- If you tick **Enable Cycle Start in door close** in the F1 screen under General settings the machine will automatically restart when the door closes. 

- It you do not enable this then the machine can be restarted by pressing Cycle Start.
- For more information on the Door input please see https://docs.masso.com.au/wiring-and-setup/setup-and-calibration/door-input

Manual Tool change Door Logic

- During a manual tool change the spindle will move to the tool change position.
- Sounder output provides a 1 second continuous tone to warn the door is about to open.
- The Door Open / Close output changes to **HIGH** to open the door.
- Sounder output provides a beeping to warn the door is opening.
- The user manually changes the tool.
- The user presses Cycle Start.
- Sounder output provides a 1 second continuous tone to warn the door is about to close.
- The Door Open / Close output changes to **LOW** to close the door.
- Sounder output provides a beeping to warn the door is closing.
- When the door is closed the Tool setter Air Blast cleans the tool setter.
- The spindle moves to the Tool setter touch off to measure the tool if required.
- The Spindle returns to the position it was before the tool change was called and machining continues.

Gcode

- The **M85** Gcode works with the Door Open / Close output on MASSO and sets the output HIGH to open the door.
- The **M86** Gcode works with the Door Open / Close output on MASSO and sets the output LOW to close the door.

19.5. Adding New Tool Changers

If your tool changer is not currently compatible with the MASSO controller, you can request to have its logic integrated into the MASSO system.

If the tool changer is a widely-used model, integration may be completed at no additional cost. However, if the tool changer employs a unique or uncommon logic, it will be subject to review to determine whether integration is feasible. Additional charges may apply for the implementation of specialized logic.

To initiate the process of adding your machine's tool changer logic, please email the following information to MASSO Support:

1. Name and model of the machine
2. Photos and video links showcasing the machine's tool-changing process
3. A PDF document that includes:
4. A list of all input signals
5. A list of all output signals
6. A flow diagram detailing the tool changer logic, clearly indicating input signals, output signals, and workflow.

INFORMATION: All documents sent must the in PDF format else the emails will not be processed.

20. Plasma - Torch Height Control

Read other subtopics below:

20.1. Installing MASSO Plasma and DTHC

About MASSO DTHC

The MASSO DTHC (Digital Torch Height Control) module is designed to provide digital arc voltage information from a plasma source. The module is designed to be mounted at the plasma source end then connect between the MASSO G3 controller and the plasma source. The Plasma source needs to provide a divider output.

It is important to mount the DTHC next to the Plasma source rather than the controller. The DTHC is optically isolated and mounting it at the source reduces the chance of noise entering MASSO.

The digital arc voltage data is used by MASSO to monitor arc voltage levels and to adjust the torch height while cutting parts.

Having full digital information about arc voltages, the user can easily set and adjust cutting voltages for jobs using gcode commands or on screen.

This makes it very flexible and easy for the user to set all the cutting parameters of a job in a gcode file as there is no requirement to set cutting voltages manually on an external THC.

Everything is automatically loaded in when the gcode file is loaded.

INFORMATION: The DTHC module is only supported with the MASSO G3 controllers as the old G2 model does not have the required interface electronics.

Linking your DTHC to your Controller

When you purchase your MASSO DTHC it is important that you link your DTHC module to your MASSO controller.

The DTHC serial number will appear in your MY WORKSHOP portal and you will be able to choose which controller you want to link it to if you have more than one.

Once linked you can download the new software with the DTHC included and load it onto your MASSO

Linking your DTHC to your controller in MY WORKSHOP

Specifications

- **Requires 24v power -** The unit can be powered using the MASSO Power supply or a separate 24v power supply**.**
- **Optically isolated interface -** The unit provides optically isolated digital signals to MASSO for noise immunity and protection against high voltages from the plasma source.
- **Supports multiple arc voltage ratios -** The unit can be used with a plasma source with the following voltage ratios: 50:1, 30:1, 20:1 or 16:1

Arc voltage rotary switch setting

- Rotary switch position **0 - 50:1**
- Rotary switch position **1 - 30:1**
- Rotary switch position **2 - 20:1**
- Rotary switch position **3 - 16:1**

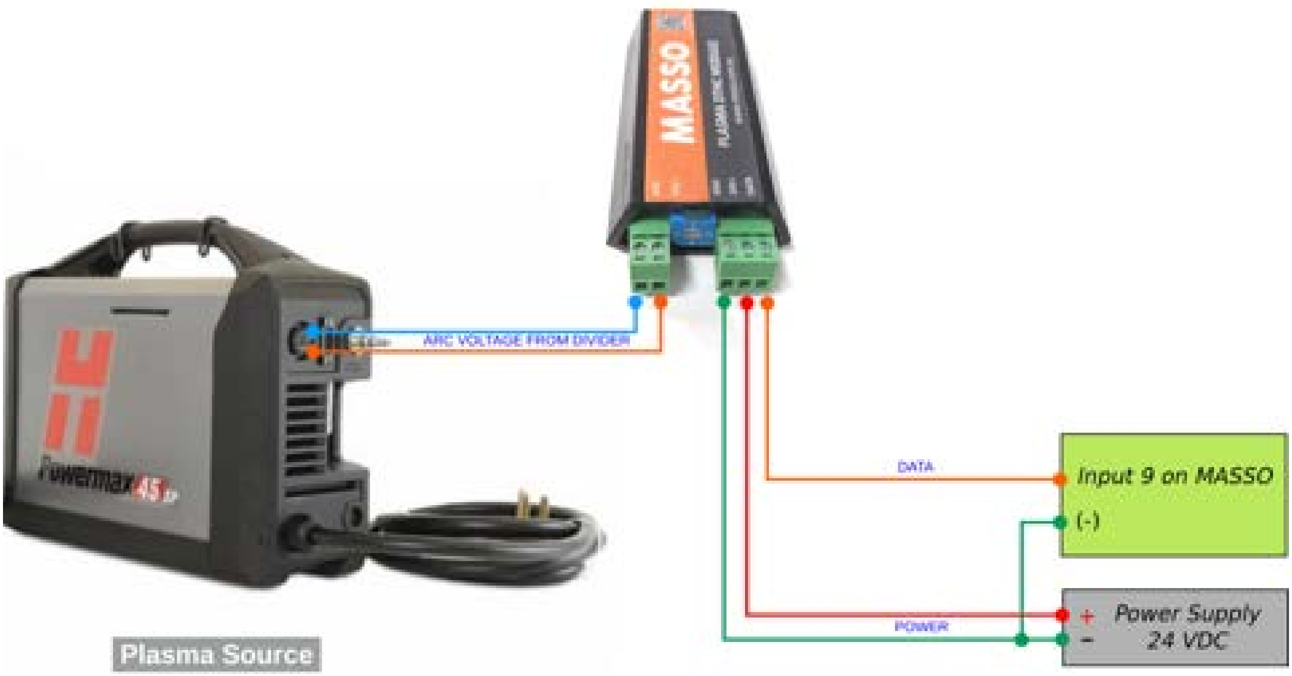
LED status indication

The MASSO DTHC module has a Green LED which can tell you the status of your DTHC module.

Green LED Status	Meaning
Solid	DTHC powered up No voltage from the Plasma divider
Flashing fast	Arc Voltage received from Plasma divider
Flashing slow	The DTHC requires a power reset. Unplug power from DTHC module and plug back in to reset.

Wiring

CAUTION: Mount the DTHC as close to the PLASMA as practical and run cable to MASSO. Mounting the DTHC next to MASSO will cause noise related issues



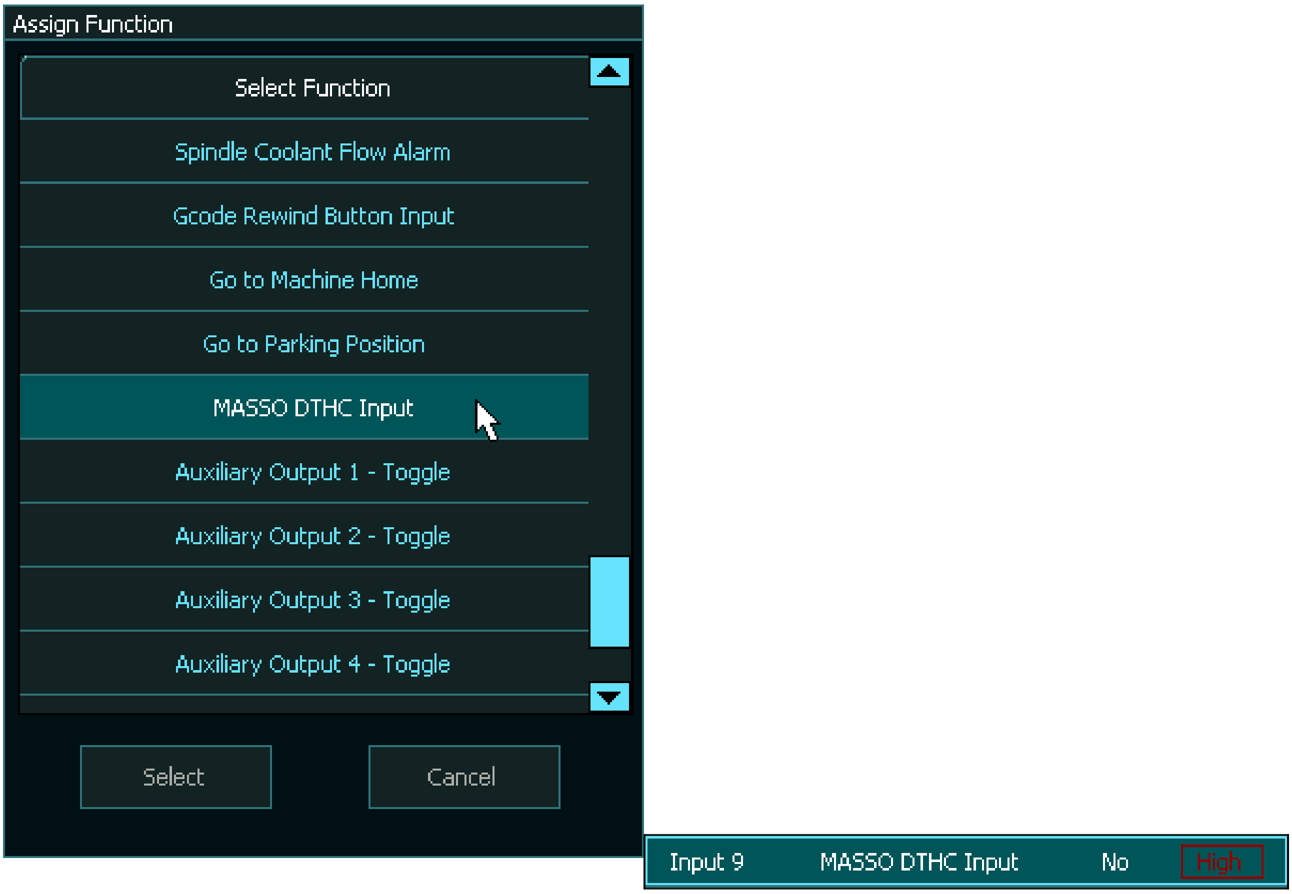
INFORMATION: You can use the MASSO power supply or a separate one. If you use a separate power supply please ensure you connect the -ve of each power supply together or the DTHC will not work.

Setting up in MASSO

INFORMATION: To use Plasma you must select tool 112 or the plasma screen will not show and the plasma features will not work. To manually change to Plasma in MDI enter the Gcode command T112 M6 and this will change you into the Plasma screen.

Configure MASSO DTHC

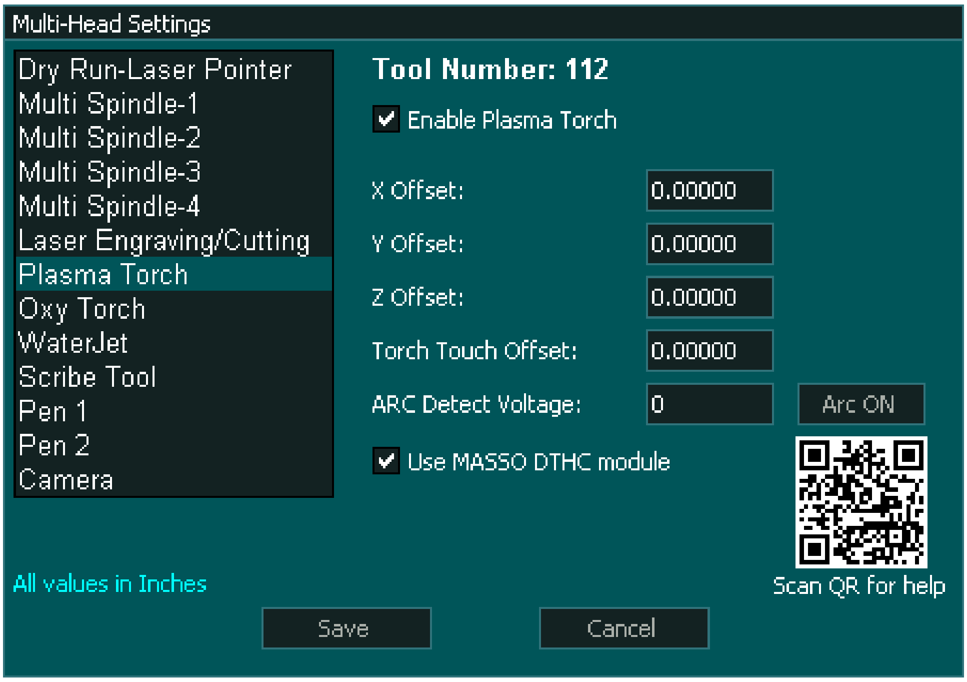
- Once the system has been wired, go to the F1-Setup screen and set **Input 9,** and assign it the function **MASSO DTHC Input**.
- Do not invert the input, ensure the invert column is set to **No**
- The **MASSO DTHC** module data signal must be wired to MASSO **Input 9** and assigned the function **MASSO DTHC Input,** or else the DTHC module will not work.
- It is normal for Input 9 to continuously change between High & Low when the THC is connected, even when not being used. If the input is not flashing you have lost connectivity.



Enable plasma

- Go to the **Multi-Head Settings** and select the **Plasma Torch** option as shown below by putting a tick in the **Enable Plasma Torch** box
- Enter the plasma torch offset values in reference to the spindle location. If your machine is a plasma only machine the X Y & Z offsets will be left as 0
- If the plasma head is one of several heads on your machine you will need to choose one head as the main head from which all other heads are offsets. On a combined Mill / Plasma combination machine the Main Spindle would normally be considered the main head. MASSO does not need to know which head is the main, it is up to the user to remember when configuring their machine.
- Tick the **Use MASSO DTHC module** option to enable MASSO DTHC logic. You will not be able to put a tick in the **Use MASSO DTHC module box** if you have not purchased a MASSO DTHC. When you receive your DTHC you will need to link your DTHC module to your MASSO in MY WORKSHOP then download and update your software to enable the feature.

Linking your DTHC to your controller in MY WORKSHOP



Probing inputs

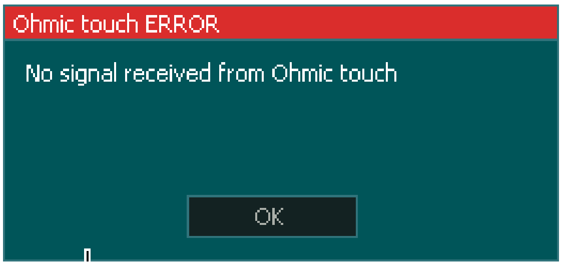
- MASSO has 2 sets of probing inputs Touch and Ohmic.
- The Input logic can be inverted as required to suit your sensor. Both input logic should be LOW when not triggered and change to HIGH when triggered.
- To invert the input logic, select the required input and press the spacebar to toggle.
- You can choose which you want to use for your probing and switch between them as required by using the O parameter in the Gcode G200.or by using the on screen Ohmic button 

- Note that the Ohmic selection will be overridden by G200 O parameter so if you want to use full manual selection between Ohmic and Touch then remove the O parameter from G200 and it will not override your selection.

Ohmic Sensor

- Wiring of the ohmic input will depend on the Ohmic unit used.
- There is no Torch Touch Offset when using the Ohmic sensor
- Assign an input as the Plasma Ohmic and invert as required to show logic Low when the sensor is not active. 

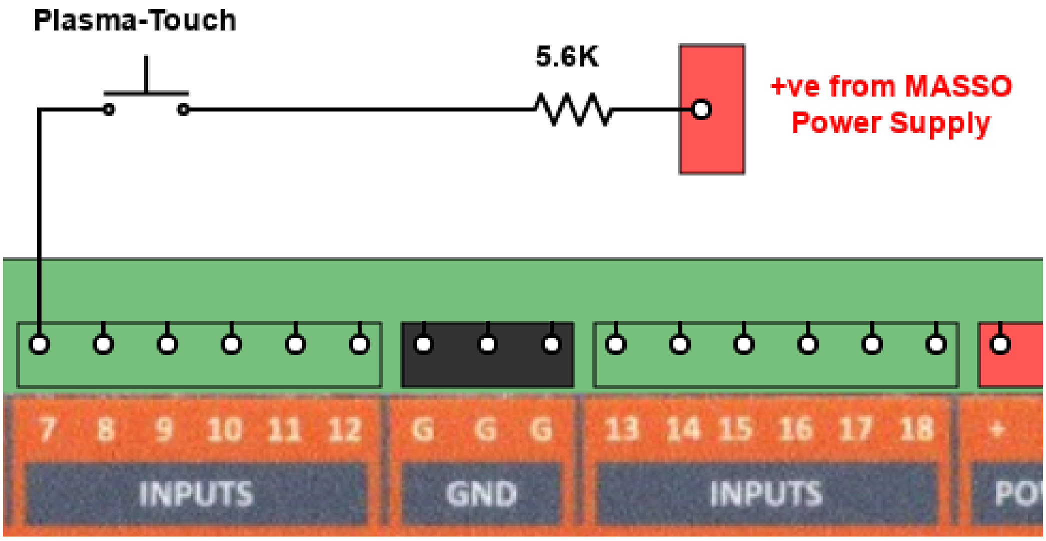
- To invert the input logic, select the Plasma-Ohmic input and press the spacebar to toggle.
- If using you select Ohmic and the sensor does not trigger before the touch sensor you will receive an alarm. It is therefore advised that a touch sensor be installed on your system as a backup in case the Ohmic sensor fails.



Touch Sensor (Floating Head)

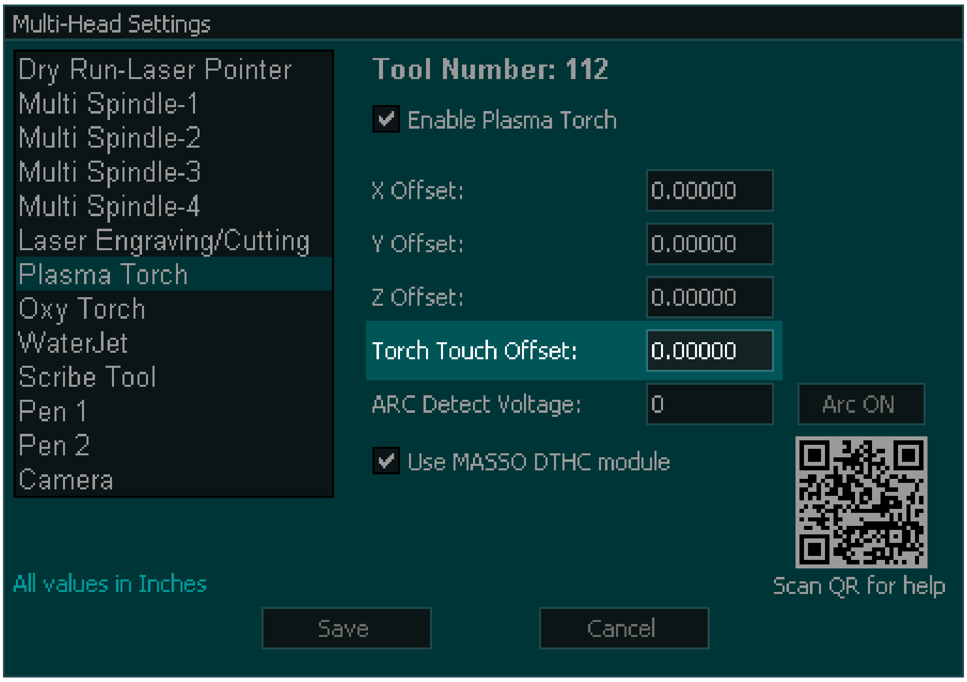
- The extent of Z axis travel while probing is determined by the Z axis soft limit setting.
- Ensure that your Z axis soft limits are set so that the touch sensor can reach the material surface with additional travel to operate the touch switch or a probing alarm will result.
- Assign an input as Plasma-Touch and invert as required to show logic Low when the sensor is not active. 

- To invert the input logic, select the Plasma-Touch input and press the spacebar to toggle.
- In the wiring example below the Resistor is located at the MASSO end and is used to limit current in case of accidental contact with Gnd



Wiring Example

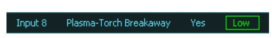
- Set the Torch Touch offset in the Plasma Multi-Head Settings page to offset the height difference between the torch touching the material and the point that the switch in the torch touch detects the touch. This value is used to automatically adjust the zero point of the material.



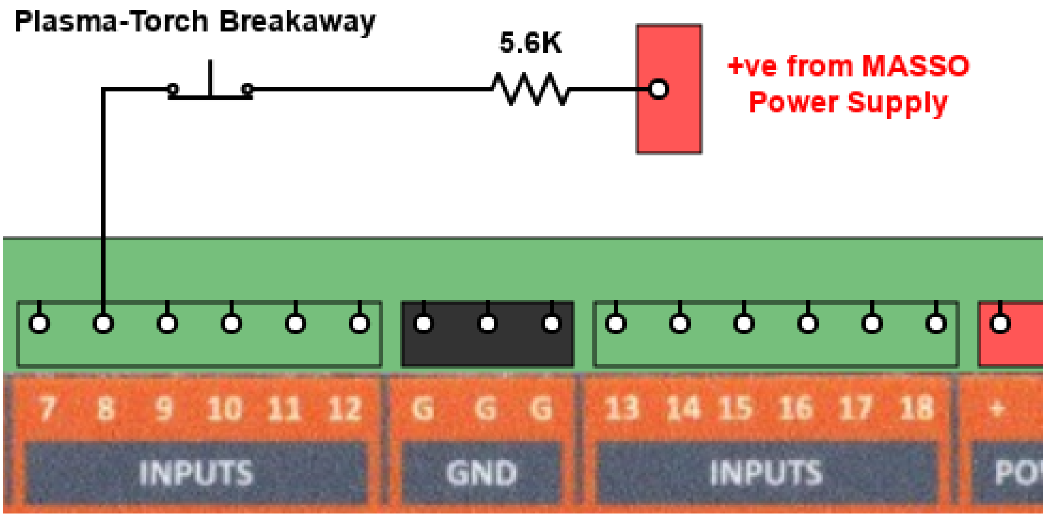
Setting the Torch Touch Offset.

- Ensure you use a thick piece of material for setting the torch offset such that is does not bend, flex or move or your measured distance will be incorrect.
- Jog the Z axis down until the torch just touches the material surface.
- Set the Z axis DRO to 0
- Jog down in single step increments until the Plasma Touch input just changes to high when using the smallest step increment setting for greater accuracy.
- Enter the Z axis DRO reading into the Torch Touch Offset box and ignore the -ve sign in the DRO reading.
- The Touch Touch offset and will always be a positive number.

Torch Breakaway

- A breakaway switch is configure a MASSO input as Plasma-Torch Breakaway. 

- The input logic should be LOW when not triggered and change to HIGH when triggered.
- To invert the input logic, select the Plasma-Torch Breakaway input and press the spacebar to toggle.
- In the wiring example below the Resistor is located at the MASSO end and is used to limit current in case of accidental contact with Gnd



Wiring Example

Combined Torch Touch and breakaway

- When using a torch holder that combines the touch-off and torch breakaway such as the torch holder below it requires that the breakaway is disabled while the torch is probing.
- In this setup the **Plasma - Torch Breakaway** input is not assigned and the **Plasma - Touch** input is used as both the breakaway and the touch signal.
- Simply assign **Plasma - Touch** to an input and if you have multiple sensors you can either just use 1 or multiplex their outputs as needed.
- The Input logic can be inverted as required to suit your sensor. The input logic should be LOW when not triggered and change to HIGH when triggered.
- To invert the input logic, select the required input and press the spacebar to toggle.
- Wiring will depend on the sensor types you have on your torch holder.

ARC Ok

MASSO Plasma has two methods of ARC detection for the user to choose from.

You can use the Arc ok output built into your Plasma unit or MASSO can derive an Arc ok by detecting the Arc voltage.

Only one method of Arc detect can be used and configuring a Plasma-Arc OK input on MASSO will disable the DTHC internal Arc detect.

Using the external Arc input is the recommended method of detection if you have one built into your Plasma.

External ARC input

The user can wire up the ARC ok, (ARC Transfer), to an external input on MASSO and this will override the built-in ARC ok in the MASSO DTHC.

This has the advantage that the Plasma machine is able to monitor the ARC status internally and provide the best feedback to MASSO as to the Arc Status.

This requires your plasma machine to have an ARC status output built n

Configure an external input on MASSO as Plasma - ARC Ok

Configuring a Plasma - ARC Ok input on MASSO Automatically disables the internal ARC Detect from the DTHC module and Calibration of the ARC Detect Voltage is not required.

Connect the ARC Ok / ARC Transfer output of your plasma to the MASSO input in accordance with your plasma manual.

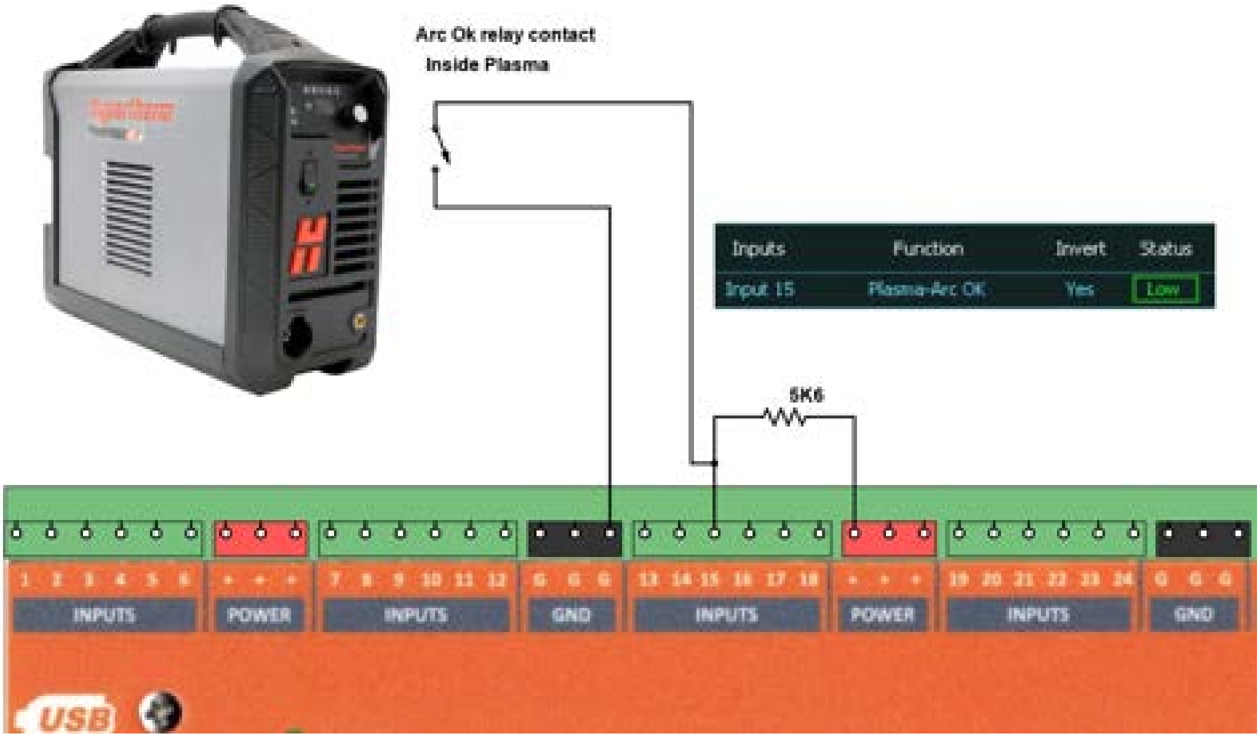
Ensure that the MASSO input shows Low when the plasma is idle and changes to High when the plasma ARC is in operation.

To invert the input logic, select the Plasma-Arc OK input and press the spacebar to toggle.

If your plasma has a built in Arc Ok output, with a dry contact that is normally open when the plasma is idle, you can connect as shown below.

This method of connection will give the greatest noise immunity.

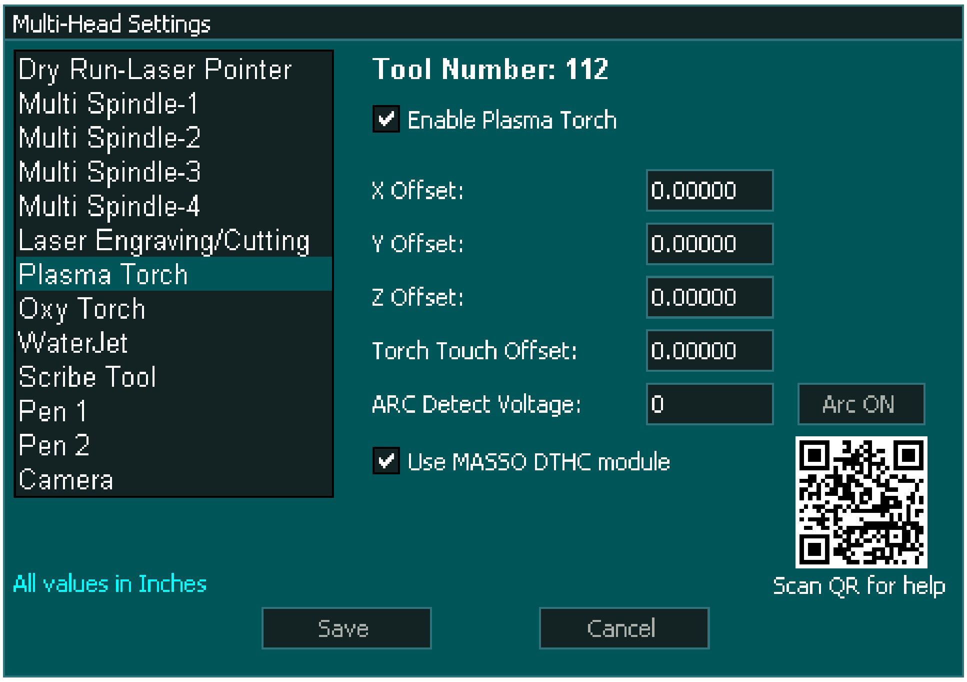
Note that the input is inverted to make the input Low when the plasma Arc is off.



MASSO DTHC ARC detect

- The MASSO can use the information from the DTHC to determine the ARC status.
- Note that if you have assigned a Plasma-Arc OK input on MASSO the MASSO DTHC Arc detect feature is disabled

- On the Multi-Head Setting page for Plasma, there is the ARC Detect Voltage which must be set up before the Arc Detect will work.
- There is an Arc ON button that is used to calibrate the ARC Detect voltage.



Arc Detect Voltage Calibration Process

> **WARNING:** Ensure the torch is set above the table surface where it will not burn a hole in anything, as the Plasma will start during the setup process.

This test is performed with the torch in mid air to detect the highest possible voltage from the Plasma. See the warming above.

To set the ARC Detect Voltage simply press the Arc ON Button and the Plasma arc will start.

Press the Arc ON button again, the torch will turn off and the ARC Detect Voltage box will fill in the ARC Detect voltage for you.

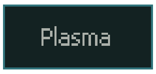
Press Save and you will be ready to go.

- The voltage in the box will auto-fill with the voltage that MASSO will use as its Arc ok voltage.

- MASSO will also create a log Auto Detect voltage test data and save it to the Flash drive.
- This log file can be sent to MASSO for troubleshooting purposes.
- The log file is located in the **MASSO\Machine Setting** folder and is called **Plasma_Arc_Log-001.csv**
- Each time the Arc Detect rest is run a new Log file is created with an increasing number.
- Arc detect should only need to be run once.

Plasma On/Off

- The Plasma On/Off output is assigned to allow MASSO to remotely turn the plasma on and off.

- The plasma can be turned on by use of the **M3** command or using the Plasma button on the F2 screen 

Plasma Up/Down

The Plasma up/Down is used to move the plasma torch into position when used in a Multi-head configuration. eg combined Plasma and Spindle.

This output would not normally be used on a Plasma only machine.

The Touch would be mounted on a linear rail on a Common Z axis along with all the other heads such as spindle, scribe, laser.

The chosen Multi-Head is moved into position by a pneumatic cylinder or similar when tool 112 is selected and it moves up when another tool is selected.

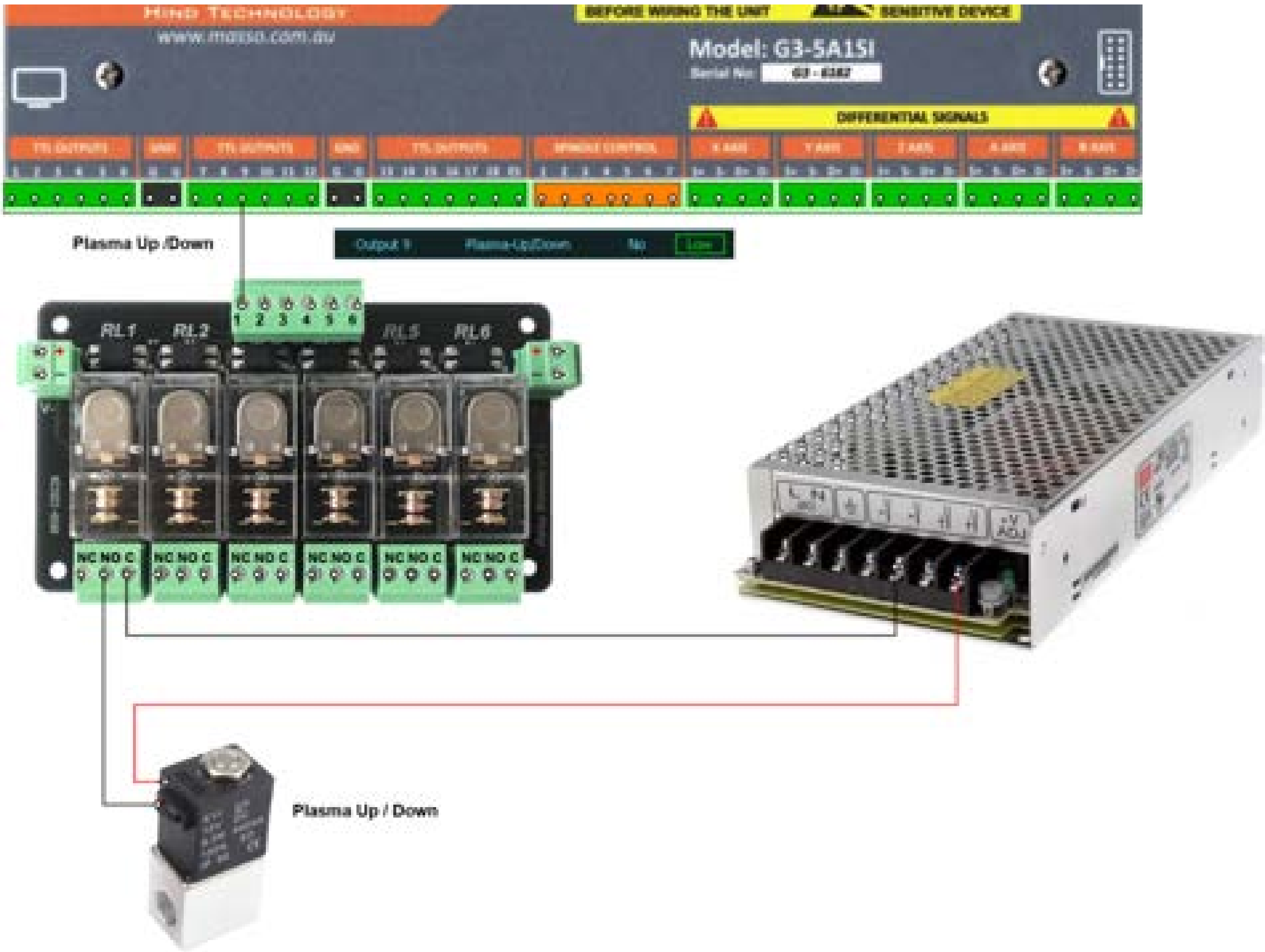
The output is normally Low and changes to High when selected.

To invert the output logic, select the required output and press the spacebar to toggle.

The output can be used for other purposes as decided by the user.

An example of how the Plasma Up/Down could be wired to operate a Pneumatic cylinder.

Plasma Up/Down Output



Example Plasma Up/Down Wiring

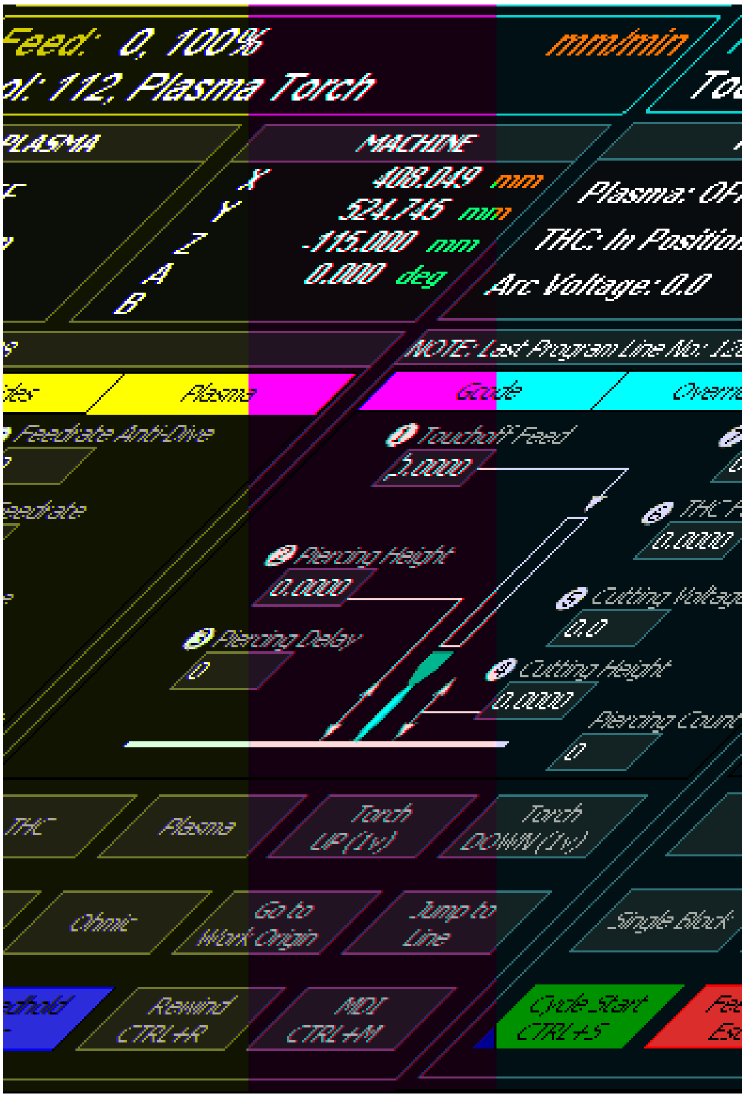
Plasma Tab

If you do not see the Plasma tab in the F2 screen please ensure that you have selected Tool 112

Ensure you have enabled Plasma in the Multi-head Plasma screen

In MDI type T112 M6 to change to the Plasma tool.

You will see 3 Tabs in the Gcode section of the screen.



F2 Screen

- 7 Parameters are provided on the F2 Plasma tab to allow easy adjustment of the Plasma torch while it is cutting.
- Each parameter box can be clicked on and a new value entered into the box.
- Touch off and Piercing is automated in MASSO Plasma and will occur on each M3 command before moving to the cutting height and these are controlled by parameters 1 to 4
- The THC voltage can be set directly on MASSO and changed either by entering a new value or using the Torch Up / Down buttons on screen which will change the voltage by 1 volt.
- The THC feed rate can be adjusted as needed and this adjusts the speed of the Z axis when under THC control.
- Feed rate Anti dive is a percentage of the X Y axis feed rate and should it fall below this value the Z axis will lock when under THC control to prevent the torch falling and touching the material.
- Parameters 1,2,3,4,5 & 7 can be set as part of the Gcode file. Gcode command G200
- Parameter 6 is set using Gcode command M667

1. Touch off Feedrate
2. Piercing Height

3. Piercing Delay
4. Cutting Height
5. Cutting Voltage
6. THC Feedrate
7. Feedrate Antidive **(Under development)**

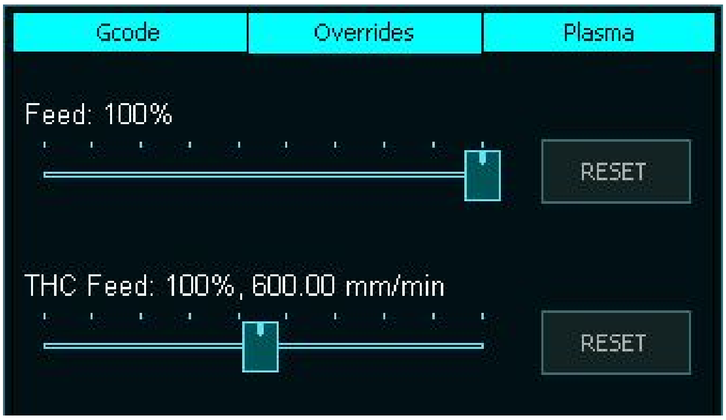
Overrides Tab

For easy adjustment while cutting is in progress the overrides tab has two sliders that the user can use to adjust machining speed in real time.

The Feed slider will adjust the X & Y axis feed rate speed from 10 to 100%

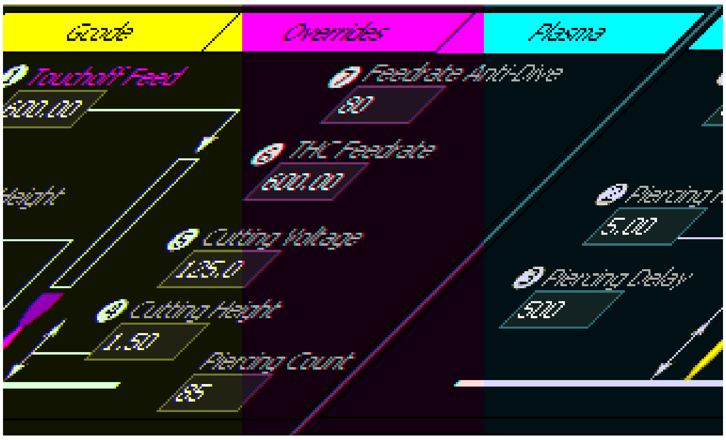
The THC Feed slide allows you to adjust the Z axis feed rate between 20 & 200% in real time to allow you to fine tune the Z axis movement when the THC is runing

If you find that your Z axis is hunting up and down uncontrollably seeking the correct z height under DTHC control this will allow you to slow it down until it becomes stable and follows the material correctly. Take a note of the feed rate on screen and you can use it in future Gcode files.



Overrides Tab

How Plasma works



- Gcode command issued eg. **T112 M6**. (This set MASSO to the Plasma tool.)
- The Plasma-Up/Down output goes high to move the Torch in to position. This is usually done on a multi-head machine with pneumatic cylinder and not needed is the Plasma torch is the primary head or does not need to move into position.
- When the Gcode file is loaded and run it will populate the cutting parameters into the Plasma tab using the information in the G200 Command.
- The **M3** command will start the Plasma torch will automatically touch off on the material
- It will then move to the piercing height
- Start the Arc and wait for an Arc Ok
- On the receipt of an Arc ok it will wait the time specified in the Piercing Delay
- At the end of the delay it will move to the specified cutting height.
- Piercing count is incremented to allow the user to track the wear on the consumable.
- MASSO will then proceed with the Gcode file.
- If there is a MASSO DTHC installed, when the THC is turned on using **M667 F???** the DTHC will assume control of the Z axis height and it will use the Cutting Voltage specified to keep a constant height above the material.
- If the X,Y Feed rate falls below the amount specified in the Anti-Dive value the Z axis will lock to prevent the Z axis crashing into the material and will resume once the feed rate returns to a valid speed. **(under development)**
- **M666** will turn off the THC
- Parameters 1-7 can be adjusted in the Plasma Tab by selecting the box and typing in a new value. This can be done while machining is in progress to fine tune the cutting.
- Torch up and down buttons are provided on the F2 screen to allow fine tuning to the torch height. This will adjust the cutting voltage by + or - 1 volt.
- M5 will turn off the Plasma Arc.
- Changing to a different tool will cancel Plasma mode.
- The Plasma-Up/Down output goes Low to move the Torch in to the up position when a different tool is selected.
-

Gcode

With the introduction of the MASSO DTHC and Multi-Head a new Gcode has been introduced. G200

This Gcode is used to address parameters on the DTHC module as well as automate some of the plasma processes such as Probing, Piercing and setting cutting height.

Use of G200 is required for DTHC use.

For more information on G200 please click >>Here<<

Post Processors

Post processors have been developed to works with the new MASSO Version 5 software.

These post processors are suitable for all Plasma THC units or for Plasmas with not THC.

Please read the information provided in the G200 Gcode command to understand for it works.

Sheetcam Post processor

Fusion 360

WARNING: Please do not used the Post processor supplied with Fusion 360 as it will not work with MASSO. Please use the one from the link above.

Make your own post processor

Troubleshooting

ARC ok not working.

- If using external **Plasma-ARC ok** input from the Plasma ensure that the input changes from LOW to HIGH when the ARC Starts. Please see the section on External Arc Input for more information on connecting.
- If using DTHC for the ARC ok signal ensure that you do not assign a **Plasma-ARC ok** input assigned as this will override the DTHC arc detect preventing it from working.
- If using DTHC for the ARC ok signal you must run the **Arc Detect Voltage calibration Process** noted above or the Plasma will start and then stop after 5 seconds.

- If you are not connecting the ARK ok signal from your Plasma to MASSO do not assign a **Plasma-ARC ok** input.

THC UP / Down not working correctly

- When using the MASSO DTHC make sure that you do not have have a **THC-Up** or a **THC-Down** input configured as these will override the DTHC and prevent it from working.
- Ensure that **Use MASSO DTHC module** is ticked in the Multi-Head Settings / Plasma Torch Page
- THC moves too fast or too slow - check your Gcode for a feed rate in the M667 Gcode command as this defines the THC Z axis speed. eg M667 F500
- THC moves too fast or too slow - check the THC Feed rate slider on the Overrides page. Normally this is set to 100%. You can use this slider to fine tune the THC feed rate.
- THC is uncontrollable and bounces up and down - Check your THC Feed Rate as having this set too high. Slow it down by specifying a lower feed rate in your Gcode file or use the THC Feedrate slider to adjust in real time while cutting.

Probing

- Probing happens twice - You are using the wrong Gcode for the MASSO DTHC. Links to SheetCam and Fusion360 Post processors have been posted above
- Torch height too High or too low after probing - Check the **Torch Height Offset** in the Multi-Head Settings / Plasma Torch Page as this is used to compensate for the difference between the trigger point of the Touch switch and the Torch
- A probing alarm occurs immediately when probing starts. This indicates that the probing input is set to High and may indicate incorrect settings or a probe fault.
- A probing alarm occurs as the probe heads towards the material surface for no apparent reason. The most likely cause is that the soft limits have been reached before before the touch switch was triggered. Check your Z axis soft limits.

Alarms and messages

- **Clean Material surface and press cycle start** - This message is displayed when you have G200 S1 set to stop after piercing. This is used when piercing thicker material and allows the user to clean the surface before the cut continues. Setting G200 S0 will disable this feature.
- **No signal Received from Ohmic touch**. - The Plasma-Torch input detected the material before the Ohmic sensor.
- **Alarm Probe Error** - The Z axis has reached the extent of travel before the material is detected by the touch probe.
- **Alarm Torch Hit** - The Z axis has detected a breakaway event. If a **Plasma-Torch Breakaway** input is not assigned the **Plasma Touch** input acts as a Breakaway signal

20.2. Proma Compact THC 150

> **INFORMATION:** If you are using a G3 controller for Plasma and are wishing to purchase a torch height controller unit you may wish to consider the MASSO DTHC which is specially designed to integrate into the MASSO Controller.

MASSO supports THC control signals to easily connect different types of THC's. THC's that are designed to control Z-axis directly using STEP and DIRECTION signals are not supported.

> **INFORMATION:** Before the Z-axis can be automatically controlled by THC, THC control must be enabled via gcode commands and a proper sequence of commands must be executed. Please see the section on testing THC signals for the correct THC test Procedure

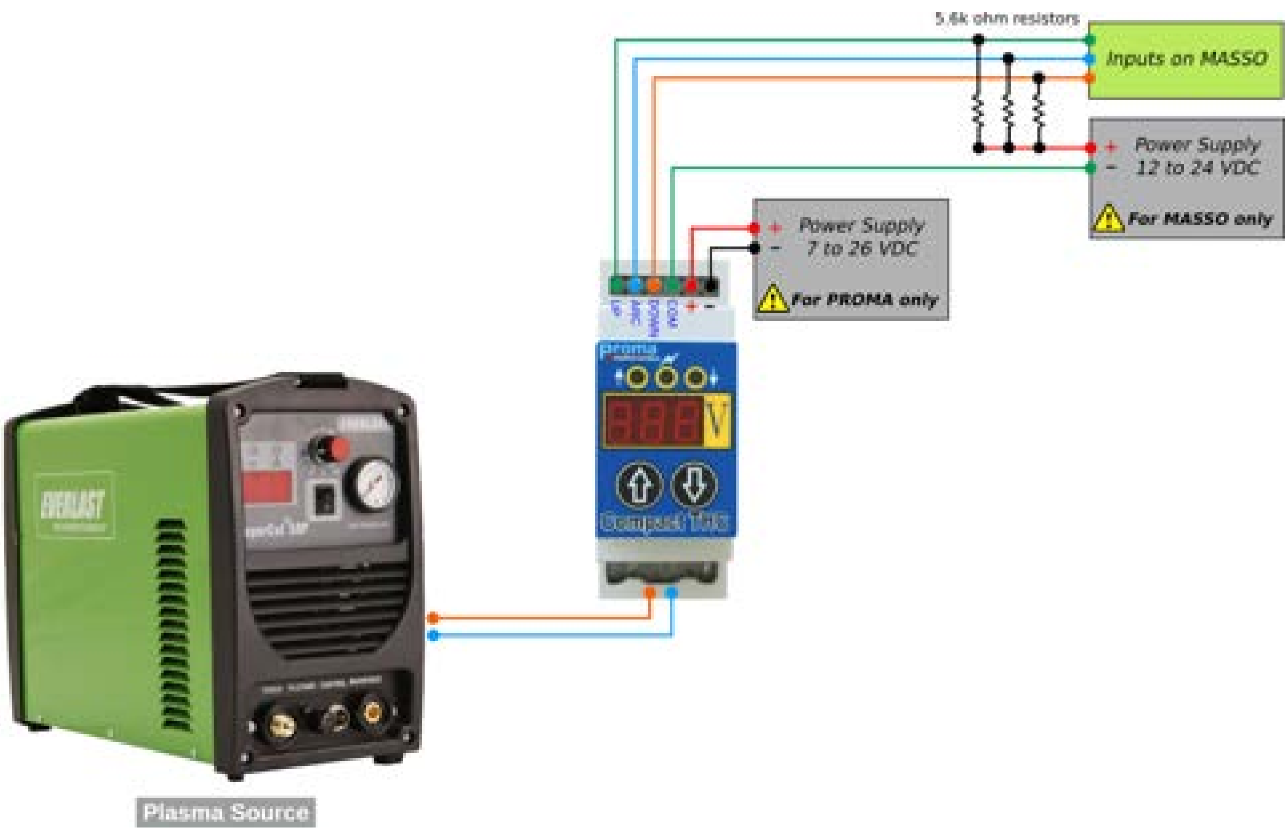
Control signals

- **Plasma Arc OK Signal -** This signal is required to tell MASSO that the arc has been successful. This signal should go HIGH by the THC on successful arc start. Wire this to one of the inputs on MASSO and assign the input as **Plasma Arc OK Signal.**
- **Z Up Signal -** When this signal goes HIGH the Z-axis is moved up. Wire this to one of the inputs on MASSO and assign the input as **THC-1**
- **Z Down Signal -** When this signal goes HIGH the Z-axis is moved down. Wire this to one of the inputs on MASSO and assign the input as **THC-2**

PROMA 150 wiring example

WARNING: Use a separate power supply to power your THC unit as shown in the example below. Failure to do so can result in noise-related issues and in case of THC failure damage to MASSO as using the same power supply bypasses input optical isolation.

INFORMATION: The below wiring example is how its recommended by PROMA 150 manufacturers. As plasma sources induce high voltages and electrical noise, it's very important to do the proper wiring and used shielded wires.



Setting up MASSO G3 and MASSO Touch Version 5.0 to use with Proma Compact THC 150

Under Multi-head enable plasma torch box and leave the MASSO DTHC software module required box unticked or it will not work.

You can leave X,Y & Z offset at 0 if you are a standalone Plasma machine.

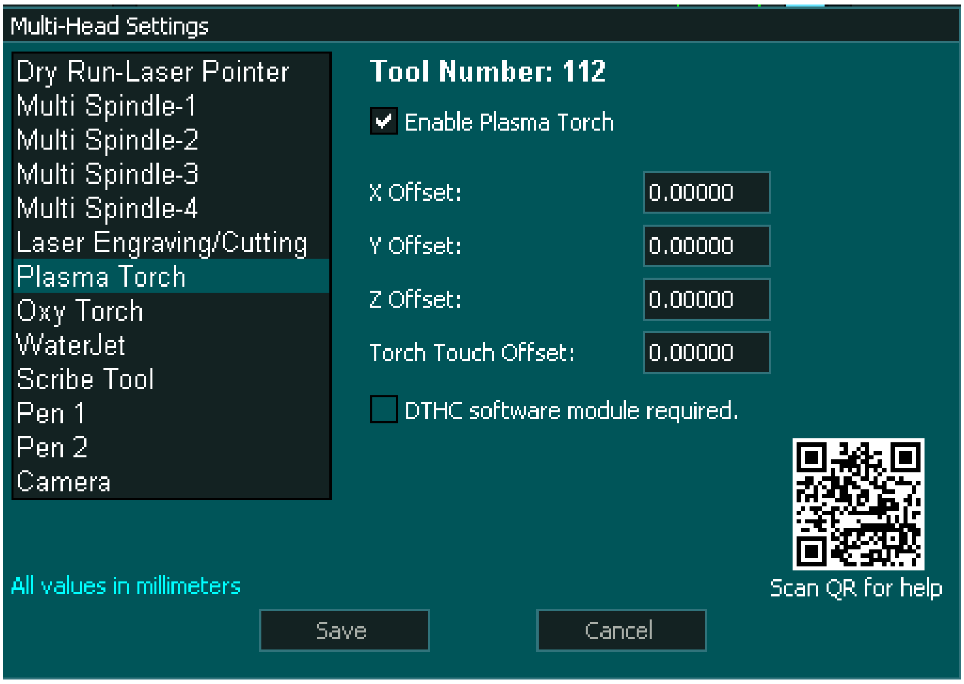
Torch Touch Offset value is used compensate for the difference in torch height with respect to the touch off switch. This value is not used for Ohmic touch.

Wire the THC to MASSO as shown above

Remember to invert inputs as needed to show Low when they are not active. eg Plasma-Arc OK, THC-Up & THC-Down

Inputs are inverted by selecting the input and pressing the spacebar.

All inputs and outputs change to HIGH when active.



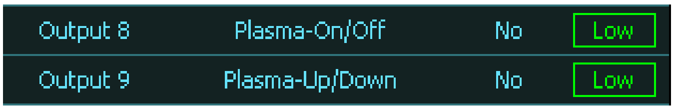
Enable Plasma and leave DTHC software module disabled

Input 10	Plasma-Arc OK	Yes	Low
Input 11	THC-Up	Yes	Low
Input 12	THC-Down	Yes	Low

Assigning THC Inputs

Input 6	Plasma-Ohmic	No	Low
Input 7	Plasma-Touch	No	Low
Input 8	Plasma-Torch Breakaway	No	Low

Assign other Inputs



Assigning Plasma Outputs as needed

INFORMATION: The G200 Gcode command is the standard for G3 Plasma use from version 5 software Please read this page for more details on the G200 Gcode as it is important to understand this command structure and how to use it.

G200

G200 defines how your plasma will operate.

A G200 with no parameters after it will turn off the G200 operation and the plasma will work in legacy mode where all operations need to be done manually using Gcode.

For information on using G200 Click Here

Regardless of whether you use a MASSO DTHC or a Proma 150 you should use the latest post processor for MASSO Version 5 software which makes use of the G200 Gcode and only disable it if you are using an old Gcode file and do not want to repost it to the newer format.

Post Processors for Version 5 software

Post processors have been developed to works with the new MASSO Version 5 software.

These post processors are suitable for all Plasma THC units or for Plasmas with not THC.

Please read the information provided in the G200 Gcode command to understand for it works.

Sheetcam Post processor

Fusion 360

Make your own post processor

Setting up MASSO G2 and all software versions below 5.0

Under THC Control select option3: Proma Compact THC Controller 150

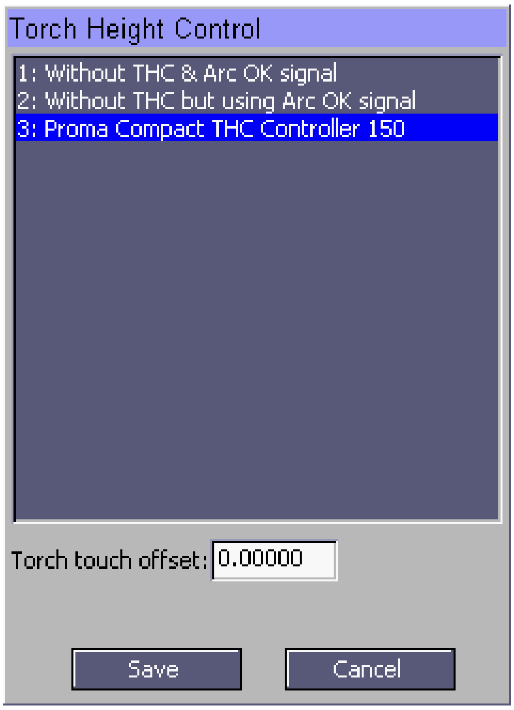
Torch Touch Offset value is used compensate for the difference in torch height with respect to the touch off switch. Set to 0 if using Ohmic.

This software version does not support both Touch and Ohmic probing.

Wire the THC to MASSO as shown above

Remember to invert inputs as needed to show Low when they are not active. eg Plasma-Arc OK, THC-Up & THC-Down

Inputs are inverted by selecting the input and pressing the spacebar



Select Proma Compact THC Controller 150

Assign output to turn Plasma on and off

Input 5	THC - Input 1	Yes	Low
Input 6	THC - Input 2	Yes	Low
Input 7	Plasma Arc OK Signal	Yes	Low
Input 8	Torch Breakaway Signal	No	Low
Input 9	Torch Touch Signal Input	No	Low

Assign THC and other Inputs

INFORMATION: This software does not use the G200 Gcode and all processes such as probing, piercing, piercing delay and setting cutting height must be done using individual Gcode instructions.

20.3. Hypertherm 45, 65 & 85

Plasma ON/OFF wiring example

INFORMATION: Once a relay driver has been wired to one of the outputs on MASSO, assign this output as **Plasma On/Off Signal** in the OUTPUTS list.

20.4. Torch Touch (floating head) Signal

The torch touch signal is used to find the top of the workpiece before starting a cut. Generally a switch or sensor is mounted on Z axis floating head, this input is then used internally by MASSO to automatically offset the Z axis gap from the switch / sensor. This input is used with G38.2 command.

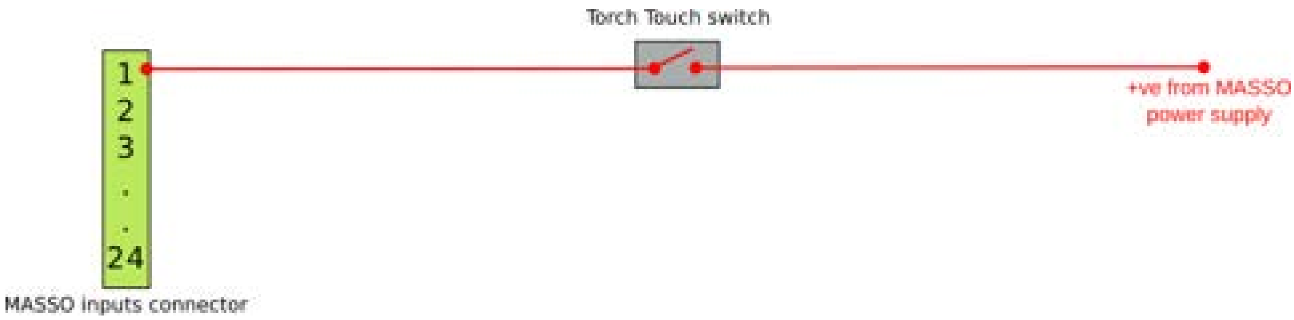
Floating head gap calibration

As each machine floating head gap between the switch / sensor to the torch tip is different, you can enter the distance in the **F1-Setup** screen under **Torch Height Control** settings.

By setting this value MASSO will internally offset this to automatically position the torch touch position, this also saves time and avoids confusion setting the offset values in CAM software.

Wiring example

Below is a simple wiring example showing how to wire a switch. A 5 to 24 VDC signal can be used.


Torch Touch switch
1
2
3
.
.
24
MASSO inputs connector
+ve from MASSO
power supply

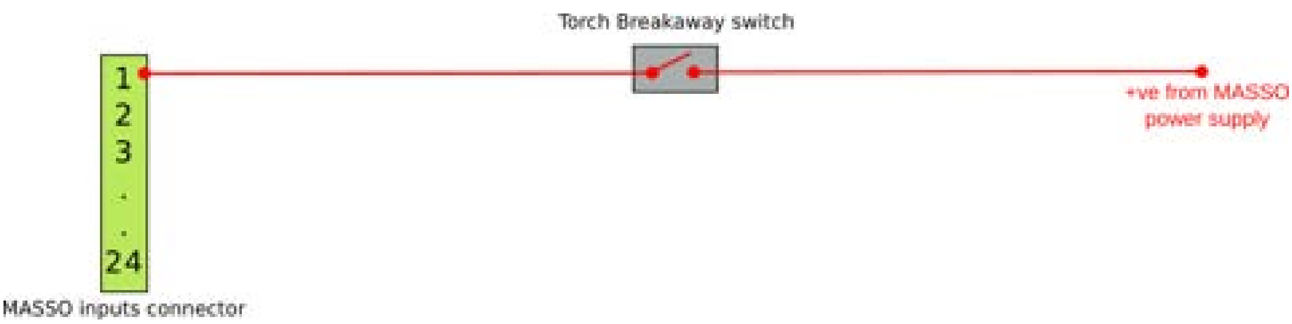
20.5. Torch Breakaway Signal

The torch breakaway signal is used to stop plasma and machine axis movements if the plasma torch is hit during a cut.

For this setup, generally the torch is mounted on magnetic holders and when the torch hits something such as a cut metal piece then the torch comes off the magnetic holders triggering a switch or sensor.

Wiring example

Below is a simple wiring example showing how to wire a torch breakaway switch. A 5 to 24 VDC signal can be used.



20.6. How MASSO G3 Plasma works

This documents how MASSO G3 & MASSO Touch works in conjunction with the G200 Gcode command in Version 5.0 software and above.

Please ensure that you read and understand this relationship.

INFORMATION: For detailed setup information of Plasma on a MASSO G3 please follow see >>HERE<<

To use Plasma you must select Tool 112.

You can do this in Gcode with the command T112 M6 or by typing it into MDI

MASSO will remain in this tool until it is changed to another.

MASSO remembers which tool was in use when it is powered off and will boot up on the same tool when powered on.

Gcode

The G200 Gcode command in Version 5.0 software and above.

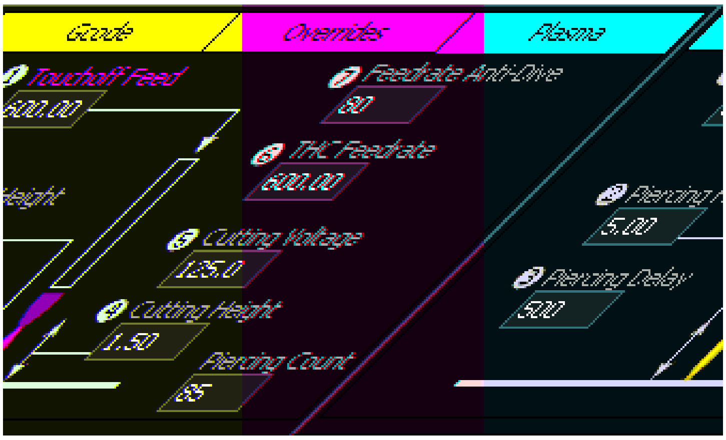
This Gcode is used to address parameters on the DTHC module as well as automate some of the plasma processes such as Probing, Piercing and setting cutting height.

Use of G200 is required for DTHC use.

Please ensure that you read and understand this relationship.

For more information on G200 please click >>Here<<

How Plasma works



- Gcode command issued eg. **T112 M6**. (This set MASSO to the Plasma tool.)
- The Plasma-Up/Down output goes high to move the Torch in to position. This is usually done on a multi-head machine with pneumatic cylinder and not needed is the Plasma torch is the primary head or does not need to move into position.
- When the Gcode file is loaded and run it will populate the cutting parameters into the Plasma tab using the information in the [G200](G200) Command.
- The **M3** command will start the Plasma torch will automatically touch off on the material
- It will then move to the piercing height
- Start the Arc and wait for an Arc Ok
- On the receipt of an Arc ok it will wait the time specified in the Piercing Delay
- At the end of the delay it will move to the specified cutting height.
- Piercing count is incremented to allow the user to track the wear on the consumable.
- MASSO will then proceed with the Gcode file.
- If there is a MASSO DTHC installed, when the THC is turned on using **M667 F???** the DTHC will assume control of the Z axis height and it will use the Cutting Voltage specified to keep a constant height above the material.
- If the X,Y Feed rate falls below the amount specified in the Anti-Dive value the Z axis will lock to prevent the Z axis crashing into the material and will resume once the feed rate returns to a valid speed. **(under development)**
- **M666** will turn off the THC
- Parameters 1-7 can be adjusted in the Plasma Tab by selecting the box and typing in a new value. This can be done while machining is in progress to fine tune the cutting.
- Torch up and down buttons are provided on the F2 screen to allow fine tuning to the torch height. This will adjust the cutting voltage by + or - 1 volt.
- M5 will turn off the Plasma Arc.
- Changing to a different tool will cancel Plasma mode.
- The Plasma-Up/Down output goes Low to move the Torch in to the up position when a different tool is selected.
- The manner of Plasma operation is the same for a machine using a legacy THC unit with the exception that the voltage setting is done manually on the THC unit and the V parameter is ignored.

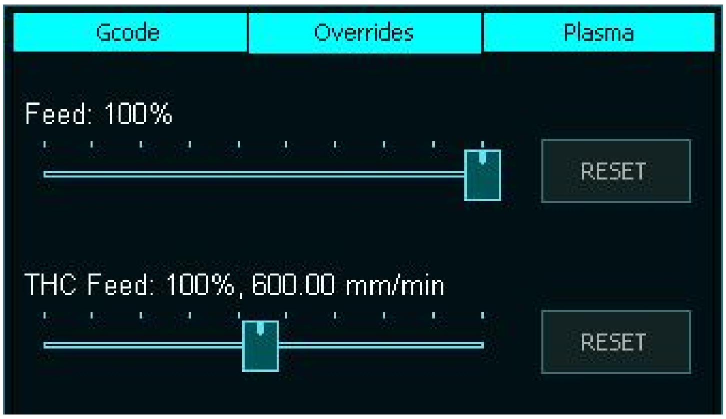
Overrides Tab

For easy adjustment while cutting is in progress the overrides tab has two sliders that the user can use to adjust machining speed in real time.

The Feed slider will adjust the X & Y axis feed rate speed from 10 to 100%

The THC Feed slide allows you to adjust the Z axis feed rate between 20 & 200% in real time to allow you to fine tune the Z axis movement when the THC is runing

If you find that your Z axis is hunting up and down uncontrollably seeking the correct z height under DTHC control this will allow you to slow it down until it becomes stable and follows the material correctly. Take a note of the feed rate on screen and you can use it in future Gcode files.



Overrides Tab

21. OEM Logo & Details

Details such as OEM logo, machine model and contact details can be added to the MASSO startup and F1-Setup screen.

Horizontal screen layout

MASSO power up screen with OEM logo

MASSO F1-Setup screen with OEM details

Vertical Screen layout

MASSO power up screen with OEM logo


MASSO G3 5-Axis v5.0
Work Offset: G54
MPG AXIS: OFF
Optional Stop: On
Jobs: 940
Wi-Fi
3:05 PM
F1 SETUP
F2 PROGRAM & MDI
F3 JOG & PROBING
F4 TOOLS & OFFSETS
F5 CONVERSATIONAL
F6 LOAD FILE
READY
MACHINE READY
DOOR
DOOR CLOSED
E-STOP
RELEASE BUTTON
X ZERO 0.000 mm
Y ZERO 0.000 mm
Z ZERO 0.000 mm
A ZERO 0.000 mm
Feed: 0, 100% mm/min
Tool: 1,
MAIN SPINDLE
RPM: 0
Req: 0, 100%
Direction: STOP
MACHINE
X 0.000 mm
Y 0.000 mm
Z 0.000 mm
A 0.000 mm
B
STEP MODE
CONTINUOUS MODE
1.0000
0.5000
0.1000
0.0100
Feed: 100%
COMPANY
Your Logo Here
Y+
Z+
X-
Home
X+
Y-
Z-
A-
A+
G01 Linear
G17 XY Plane
G90 Absolute
G94 Units/Min

MASSO F1-Setup screen with OEM details

How to integrate your details to MASSO

Please contact us via support@masso.com.au email for integration costs and provide the following details:

1. High quality logo file with transparent background in *PNG format.*
2. Company Name *(Maximum of 31 characters).*
3. Machine Model *(Maximum of 31 characters).*
4. Website Address *(Maximum of 31 characters).*
5. Email ID *(Maximum of 31 characters).*
6. Support Phone Number *(Maximum of 31 characters).*

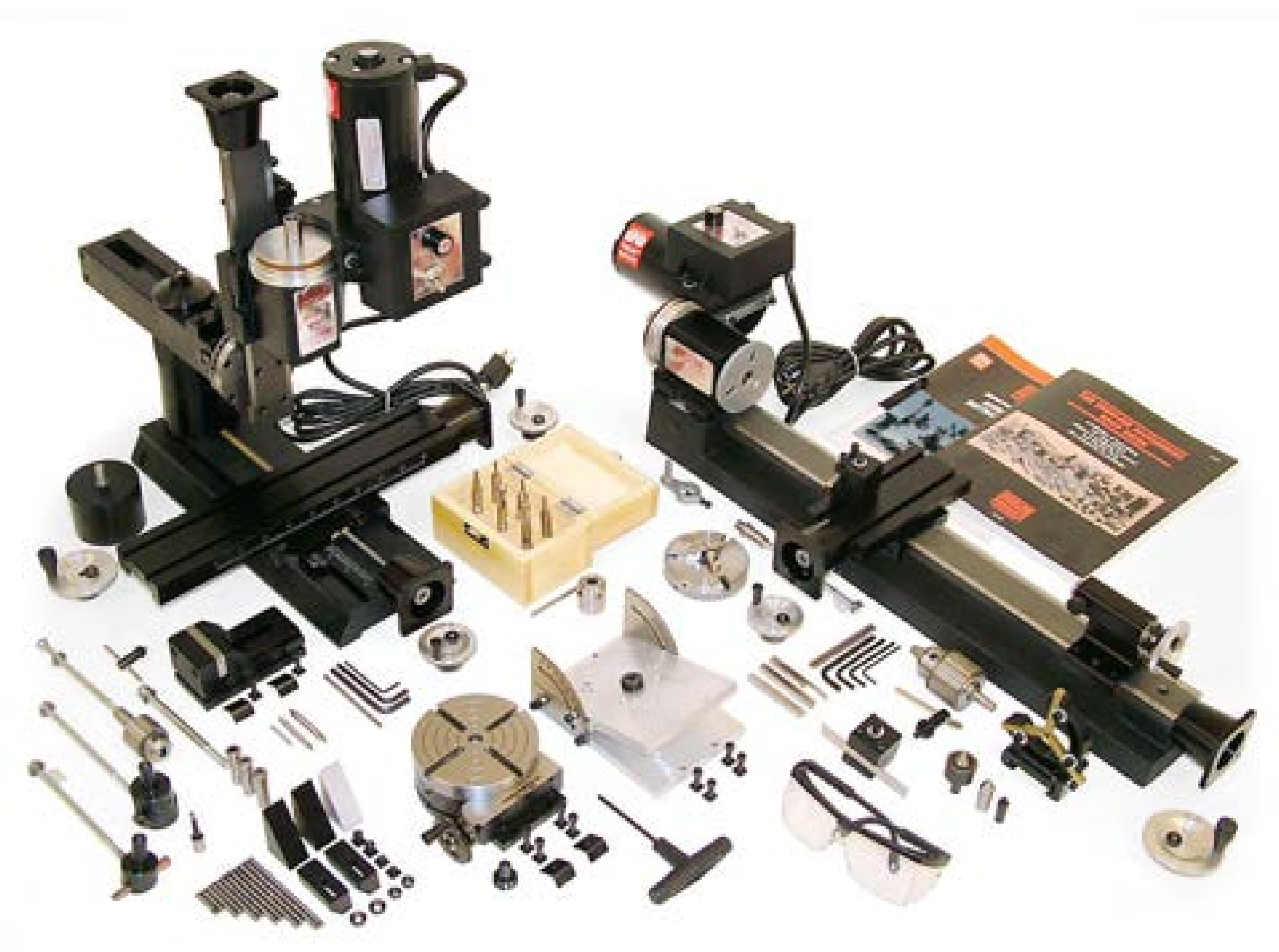
22. Sherline Mills and Lathes

SHERLINE products are manufacturers of high precision CNC mill and lathes. SHERLINE manufactures all its machines in California, USA.

SHERLINE CNC machines are used in medical, space and many more high precision industries.

To provide high reliblity and ease of machining, SHERLINE provides machine with MASSO controllers integrated with their machines.

Visit SHERLINE website www.sherline.com



Read other subtopics below:

22.1) Wiring & Setup

22.1. Wiring & Setup

WARNING: Power off the machine and electronics when wiring, unplugging or connecting any connectors or connections.

WARNING: Double check your connections on the **DB9 male** and **DB9 female** connectors as these can be easily mistaken and if connected at the wrong connector can damage the entire controller.

DB9 (MALE) Connector on the control box

Pin No.	Description
1	**P3** of the DC spindle motor drive (+ve of Spindle Drive).
2	**P2** of the DC spindle motor drive (RPM of Spindle Drive).
3	**P1** of the DC spindle motor drive (-ve of Spindle Drive).
4	24v - Only to be used for very low current loads (Type: output).
5	Spindle Encoder A Signal (Type: input).
6	Spindle Encoder B Signal (Type: input).
7	Spindle Encoder Z Signal (Type: input).
8	Spindle CW signal for relay coil (Type: output).
9	24v - For relay coil (Type: output).

DB9 (FEMALE) Connector on the control box

Pin No.	Description
1	**X-axis** Homing Sensor (Type: input, 5 to 24VDC).
2	**Y-axis** Homing Sensor (Type: input, 5 to 24VDC).
3	**Z-axis** Homing Sensor (Type: input, 5 to 24VDC).
4	**A-axis** Homing Sensor (Type: input, 5 to 24VDC).
5	**B-axis** Homing Sensor (Type: input, 5 to 24VDC).
6	Tool Setter Input (for auto tool zero). Has an internal pull-up resistor, ground this input for touch signal. (Type: input).
7	Touch Plate / Probe Input (for probing). Has an internal pull-up resistor, ground this input for touch signal. (Type: input)
8	Optional output for controlling a relay coil (Type: output).
9	24v - For relay coil & homing switch inputs (Type: output).

23. 3DTEK Routers

3DTEK manufactures high-quality CNC routers in Australia and United Kingdom.

With high precision linear rails and high-quality aluminum build, the machines provide great cut quality and reliability.

To provide high reliability and ease of machining, 3DTEK provides machines with MASSO controllers integrated with their machines.

Visit 3DTEK website www.3dtek.xyz

24. CANCAM Routers

CanCam manufacture high-quality CNC routers in Canada.

With high precision linear rails and heavy gantry, the machines provide great cut quality and reliability for different industries.

To provide high reliability and ease of machining, CanCam provides desktop CNC routers with MASSO controllers integrated with their machines.

Visit CanCam website www.cancam.ca

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25. REVO CNC

REVO

REVO manufactures high-quality CNC routers in Turkey.

The machines are built on a rigid platform and with high-quality parts that give exceptional cut quality and speed.

Visit REVO's website www.revo.com.tr

26. Forums & Email Support

Forums

Building and operating a CNC machine requires having prior knowledge of electronics, mechanical systems, and CAM/CAD software. If you're new to building CNC machines, there are plenty of machine builders/users on our forums. **CLICK HERE** to visit MASSO forums.

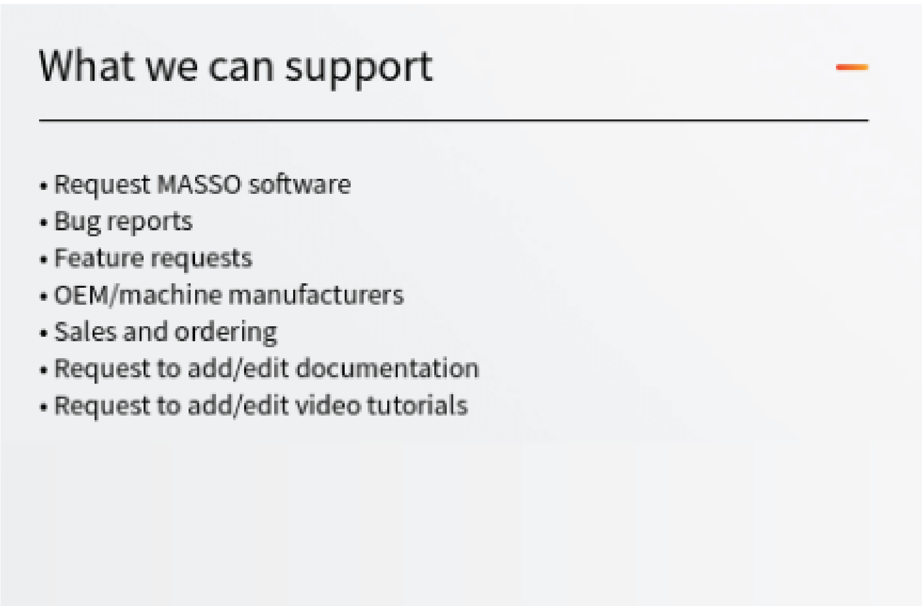
Email Support

MASSO email support can be contacted at support@masso.com.au.

Please NOTE that due to the high volume of basic CNC-related questions, it's not possible for us to reply to all emails. In order for us to do this effectively and fairly for all users, below is a list of what we can and cannot support.

Please read the below points regarding getting support:

Building and operating a CNC machine requires having prior knowledge of electronics, mechanical systems, and CAM/CAD software. If you're new to building CNC machines, there are plenty of machine builders/users on our forums for great information.




What we can't support
• Selecting or wiring motors and drives — See MASSO Forums/Documentation
• How to use CAD/CAM software — See Google/YouTube
• How to design/machine parts — See MASSO Forums
• Educating about electronics and wiring — See Google/YouTube/MASSO Forums
• Retrofitting MASSO to a particular machine — See MASSO Forums
• Setting up and Programming Axis and Spindle Drives (VFD) — See MASSO Forums/Documentation
• Creating/adding features to CAM post-processors — Check with your CAM software provider

27. Reporting Bugs & Issues

If during operations the system behaves unexpected or any bugs are found then the user should email **SUPPORT** the following information so that we

can have the issue resolved at the earliest:

1. Take a screenshot of the current screen by pressing the **Prt Sc** or **CTRL + P** keys on the keyboard and a **.bmp** image file of the current screen will be saved to the USB FLASH drive.
2. Next email the above generated file to **SUPPORT** and a detailed description of the issue.
3. If the issue is related to a particular G-code file then email the G-code file so that we can replicate the problem at our end.

28. Payment

International Orders (Outside Australia)

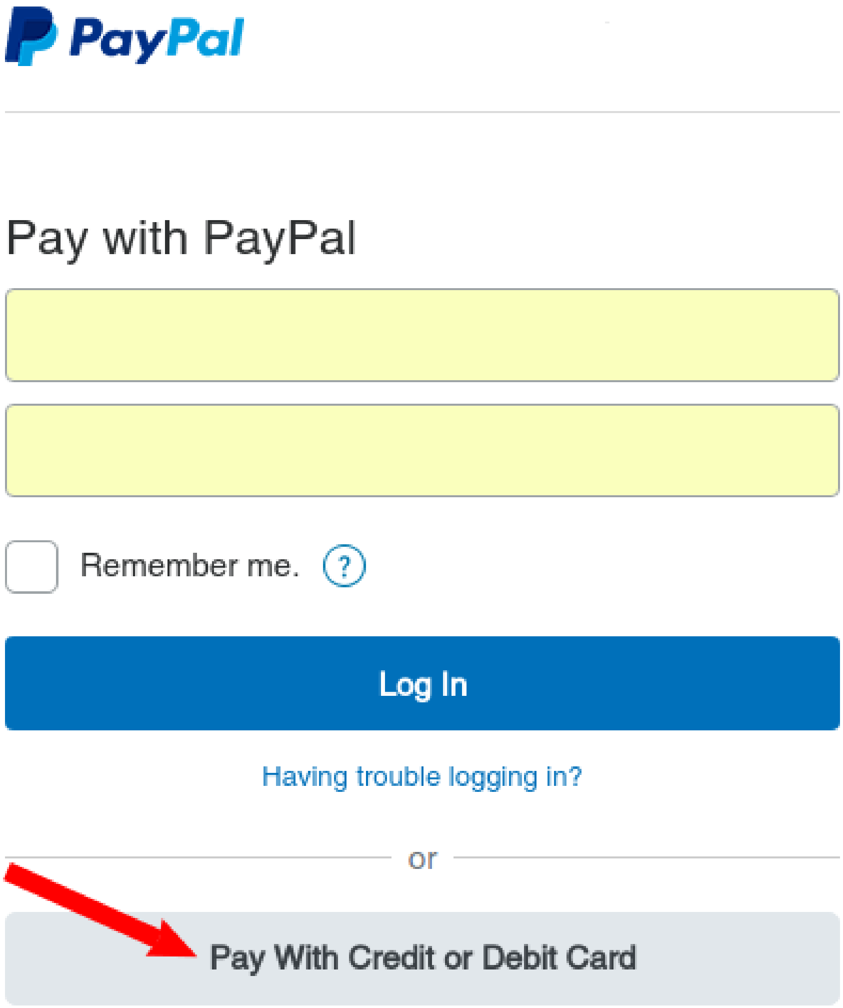
Paying with PayPal

Secure and fast payments can be made via PayPal and all major credit

cards such as Visa, MasterCard, American Express, Discover, JCB, Diner's Club are supported. All payments outside Australia are only accepted in US dollars.

Paying with credit card without PayPal account

If you don't have a PayPal account then you pay directly by entering your credit card details into PayPal. When asked to login to PayPal, simply click the **"Pay With Crebit or Debit Card"**



Domestic Orders (within Australia)

Payments for Australian orders must be done via direct bank transfer. Once you place an order online, you will be displayed with an order confirmation page with banking details and an email notification is also sent with banking details. Orders are only dispatched once we have received the payment in our bank account. To avoid any delays please email us the payment receipt on support@masso.com.au

OEM / Distributors

Payments for OEM's and distributors must be done via direct bank transfer and your MASSO account manager can help you with banking details.

29. Shipping & Delivery

Order processing time

Most of the orders are processed and dispatched the next business day. Orders are not dispatched or delivered on weekends or public holidays. If we are experiencing a high volume of orders, shipments may be delayed by a few days and we will notify via email for any delays.

Shipping rates & delivery estimates

Shipping charges for your order will be calculated and displayed at checkout. If your order contains multiple items that the website is not able to calculate and must be calculated manually, please email us on support@masso.com.au your order list including delivery address for us to provide you the shipping costs.

Worldwide shipping

We have partnered with DHL to provide industry leading door to door service for our clients. DHL Express provides delivery to almost all countries.

Shipment confirmation & order tracking

You will receive a shipment confirmation email with tracking details once your order has been dispatched.

Important information regarding DHL deliveries

Please note that it is the responsibility of the receiver to monitor shipments and reach out to their local DHL customer service team for tracking, delivery, delay in delivery, customs clearance or any other questions or concerns. If your shipment is taking too long then please contact your local DHL number as DHL might be waiting for some additional information from the receiver.

DHL can only hold the shipment for usually two weeks and after that, the shipment will be either returned or destroyed depending on the destination countries rules. If the shipment is returned or destroyed because of no communication by the receiver with the clearance process or delivery address issue then its client responsibility to cover the costs involved to send the shipment again.

Customs, duties and taxes

Depending on the country of import, customs and taxes are calculated.

Each country has its own tax or customs rules and rates, some countries have free trade agreements and do not charge any taxes or customs on some items. For more information about this, please contact your local customs authorities about charges applicable for your country.

All customs and taxes imposed during or after shipping are the responsibility of the customer.

Damages

MASSO is not liable for any products damaged or lost during shipping. If you received your order damaged, please contact the shipment carrier to file a claim. Please save all packaging materials, photos and damaged goods before filing a claim. You can also email us for any support in this matter so that we can assist you in the process.

30. Warranty

All units are warranted to be free from defects in workmanship, material

and are warranted to meet the Company's published specifications, but no other warranty, expressed or implied, is made by the seller unless expressly set forth. Hind Technology warrants its equipment for one (1) year to be free from defects in workmanship and material.

Hind Technology shall have no obligation or liability under this warranty:

1. For special, indirect or consequential personal or property damage arising from the failure of its equipment.
2. If the equipment was not installed, operated or maintained in accordance to Hind Technology's installation instructions.
3. If the equipment was serviced, repaired, altered or modified in any way by a third party other than Hind Technology authorized personnel.

Hind Technology further reserves the right to the following:

1. The right to repair or replace customers' units at its discretion.
2. The right under this warranty to refuse or reject any and all warranty claims for any reason whatsoever if, based on the Company's estimation, damage to subject equipment was not caused by component or factory workmanship defects.
3. Any unit sent back to Hind Technology for warranty repair must have prior notification and approval for the return or the unit will be refused delivery.
4. All transportation costs, both in-bound and out-bound freight, are the responsibility of the customer.

31. Returns

Return Policy

Definitions

Customer means the person or legal entity identified in the Invoice.

Hind means Hind Technology Australia Pty Ltd

Refund Policy

Our policy lasts 30 days. If 30 days have gone by since your purchase, unfortunately we can't offer you a refund or exchange. We are always here to listen and help our clients and if you think that our products are not as per your expectations or has some issues or missing features that are stopping you from using our products then please email us on support@masso.com.au so that we can work out a solution if possible.

To be eligible for a return, your item must be unused and in the same condition that you received it. It must also be in the original packaging.

PayPal fee

As per the new PayPal policy, the fees charged by PayPal on the purchase of the items will not be refunded. Refund issued by Hind will not include the fees charged by PayPal.

Additional non-returnable items:

- Downloadable software products.
- There are certain situations where only partial refunds are granted: (if applicable).
- Any item not in its original condition, is damaged or missing parts for reasons not due to our error.
- Any item that is returned more than 30 days after deliver

Refunds (if applicable)

If an item has to be returned for refunds, the customer is responsible for paying for return shipping costs. Both shipping costs (Initial shipping cost when the item was purchased & return shipping) paid by the client are non-refundable.

PayPal or any other bank fees charges on the purchase of the items will not be refunded.

Once your return is received and inspected, we will send you an email to notify you that we have received your returned item. We will also notify you of the approval or rejection of your refund.

If you are approved, then your refund will be processed, and a credit will automatically be applied to your credit card or original method of payment, within a certain amount of days.

Return shipping

To return your product, please email on support@masso.com.au first so that a support ticket can be generated including the return address instructions.

The customer is responsible for paying for return shipping costs. Shipping costs are non-refundable.

Depending on where you live, the time it may take for your return products to reach us, may vary.

If you are shipping an item over $75, you should consider using a trackable shipping service or purchasing shipping insurance. We don’t guarantee that we will receive your returned item.