Mesa Configuration Tool

John Thornton

Oct 20, 2023

CONTENTS:

The Mesa Configuration Tool creates LinuxCNC configuration files for 5i24, 5i25, 6i25, 7i76e, 7i80db, 7i80hd, 7i92, 7i92T, 7i93, 7i95, 7i96, 7i96S, 7i97 and 7i98.

Note: I'm updating the documents one page at a time so it will take a while.

DESCRIPTION

The Mesa Configuration Tool is designed to create the configuration files needed by LinuxCNC for Mesa Electronics motion control cards.

1.1 Requirements

Debian or Debian based OS PyQt 5.15 or newer.

Debian 11 (Bullseye) has PyQt5.15

1.2 Highlights

- Small 800 x 600 size for small monitors.
- Fully editable ini file by the user, when loaded and saved custom sections and key value pairs and comments are not lost.
- Flash Mesa cards and read the config on the card as well as other card operations
- Information about all the cards as well as the manuals for the cards, some cards have additional information.
- Add MDI commands to the ini file
- Add a Smart Serial card and configure the I/O
- Add customs HAL commands
- Change Motion, Debug, Thread Period Options
- Add a VCP Panel
- Add and configure the Classicladder PLC options
- Get Motherboard, CPU, and NIC information about the PC
- Test the Thread Period
- Check the configuration for errors at any time during the creation
- Load a configuration at startup
- Create a backup of the entire configuration directory with a date and time stamp
- Board layout image of all the daughter boards as well as the selected board
- Wiring diagram for the Smart Serial connection
- HAL funtion assistant to help create custom HAL code

INSTALLING

Mesa Configuration Tool

Note: Tested on Debian 10, 11, 12, 13 and Linux Mint 20.2 but it should work on other Debian type OS's.

Note: Requires Python 3.6 or newer to work.

Use the Debian deb for installing the Mesa Configuration Tool!

Latest Version of the Mesa Configuration Tool (sometimes the Rpi takes a while to show up)

PC 64 bit

Raspberry Pi 4 32 bit

Raspberry Pi 4 64 bit

Previous Version of the Mesa Configuration Tool if you experiance growing pains with current version

PC 64 bit previous

Raspberry Pi 4 32 bit previous

Raspberry Pi 4 64 bit previous

Or use wget from a terminal

```
wget https://github.com/jethornton/mesact/releases/download/2.0.5/mesact_2.0.5_amd64.deb
wget https://github.com/jethornton/mesact/releases/download/2.0.5/mesact_2.0.5_armhf.deb
wget https://github.com/jethornton/mesact1/releases/download/2.0.5/mesact_2.0.5_arm64.deb
```

If you get *bash: wget: command not found* you can install it from a terminal with

```
sudo apt install wget
```

Open the File Manager and right click on the file and open with Gdebi then install.

If you don't have Gdebi installed you can install it from a terminal

```
sudo apt install gdebi
```

If the graphical version of gdebi has problems you can run it from a terminal in the directory where you downloaded the deb with n.n.n replaced by the version your installing.

```
sudo gdebi mesact_n.n.n_amd64.deb
```

If you don't have LinuxCNC installed then the mesact Configuration tool will show up in the Applications > Other menu otherwise it will be in the CNC menu.

If you have problems try running from a terminal with:

```
mesact
```

To flash firmware to the mesact you need to install mesaflash from the LinuxCNC repository.

To uninstall the mesact Configuration Tool right click on the .deb file and open with Gdebi and select *Remove Package*.

To check for newer versions Help > Check for Updates

To upgrade the mesact Configuration Tool delete the .deb file and download a fresh copy then right click on the .deb file and open with Gdebi and select *Reinstall Package*

BASIC USAGE

You can left click Check Config at any time to see if there are any errors.

Build Config will check for errors before build the configuration files.

Some items may not be enabled until the transition from Mesact I to Mesact II.

3.1 Machine Tab

1. Enter a Machine Name
2. Select the Mesa Board
3. Ethernet Boards you must select the IP Address 10.10.10.10 is recommened.
4. Boards like 5i25/6i25, 7i80, 7i92, 7i93, 7i98 to enable the Axes Tab and the I/O Tab you need to select a firmware then select a daughter card.

3.1.1 Quick Start Group

1. Select either Imperial or Metric
2. Pick a Configuration
3. Edit the axis settings to fit your machine then Build Config

3.2 Settings Tab

1. Select a GUI
2. Select Position Offset
3. Select Position Feedback

3.3 Board Tab

1. Select Joint starting with 0

2. Enter Scale, Minimum Limit, Maximum Limit, Maximum Velocity, Maximum Acceleration

3. PID Settings select Default Values

4. Following Error select Default Values

5. For a Step and Direction select your drive or manually enter the Step Time, Step Space, Direction Setup, Direction Hold times

6. For a Servo System select Default Values in Analog Output and enter the Encoder Scale

7. Left Click Check Config to see if there are any errors

The selected board will configure the Inputs and Outputs avaliable and if input debounce is avaliable.

#. Click Select for the I/O you want to use and select what you want it to be used as.

3.4 Spindle Tab

Used to configure an Analog PWM or Stepgen Spindle. For Digital Run, CW and CCW type spindles use outputs.

3.5 SS Cards Tab

If you have a Smart Serial Card attached you can configure it here.

#. Select the Smart Serial Card and the page changes to that card where you can make selections for that card

3.6 Options Tab

Here you can select various options for your configuration and whether to check for Mesaflash at startup or not.

3.7 PLC Tab

If your going to be using the Classicladder PLC you can set number of items created for each type of bit.

3.8 PC Tab

You can get information about the PC CPU and NIC on the PC Info Tab.

If your using a Mesa Ethernet card you can test your NIC speed and get the Packet Time and compare that to Threshold to see if your NIC and CPU are fast enough at the current Servo Period.

MACHINE TAB

4.1 Menu

4.1.1 File

- *Open Config* - Opens a file selector so you can pick an ini file to load, same as the Tool Bar button

4.1.2 Downloads

- *Mesa CT PC 64 bit* - Downloads the latest version of Mesa CT for PC's
- *Mesa CT Rpi 32 bit* - Downloads the latest version of Mesa CT for Raspberry Pi's
- *Mesa CT Rpi 64 bit* - Downloads the latest version of Mesa CT for Raspberry Pi's
- *Firmware* - Downloads and installs firmware for the current Mesa card
- *Board Images* - Downloads and installs images of the current Mesa card
- *Mesa Manuals* - Downloads Mesa manuals you select from a list

4.1.3 Tools

- *Check Config* - Checks the Configuration for errors
- *Build Config* - Builds the Congiguration after checking for errors

4.1.4 Help

- *Documents* - Opens up the currently installed MesaCT documents
- ***Check for Updates* - Checks to see if a newer version is on line. Does not** check for updated between versions.
- *About MesaCT* - Displays help information about MesaCT

4.2 Tool Bar

- *Open Config* - Opens a file selector so you can pick an ini file to load
- *Check Config* - Checks the Configuration for errors
- *Build Config* - Builds the Congiguration after checking for errors
- *Documents* - Opens the PDF Documents

4.3 Machine Group

- *Name* - Any letter or number or underscore. Spaces are replaced by an underscore.
- *Path* - Displays the full path to the configuration.
- *Load this Configuration at startup* - Opens the current configuration at startup.
- *Backup Configuration* - Creates a backup copy each time the configuration is built.

4.4 Info Group

- *Status* - Shows if anything has changed in the tool
- *LinuxCNC* - If installed shows the version
- *MesaFlash* - If installed shows the version
- *Coordinates* - Shows the axes
- *Screen Size* - Shows the current screen size
- *Platform* - Shows the OS platform
- *Python* - Shows the version
- *Pyqt5* - Shows the version

4.5 Quick Start

- *Default Imperial* - Sets up a default Imperial configuration
- *Default Metric* - Sets up a default Metric configuration
- *Configuration* - Select a sample configuration then edit the axes

4.6 Mesa Setup

- *Board* - Select the Mesa board
- *IP Address* - If the selected board is an Ethernet board select the IP Address
- *Daughter Cards* - If applicable select the daughter card
- *Verify Board* - Checks to see if the board is found

FIRMWARE TAB
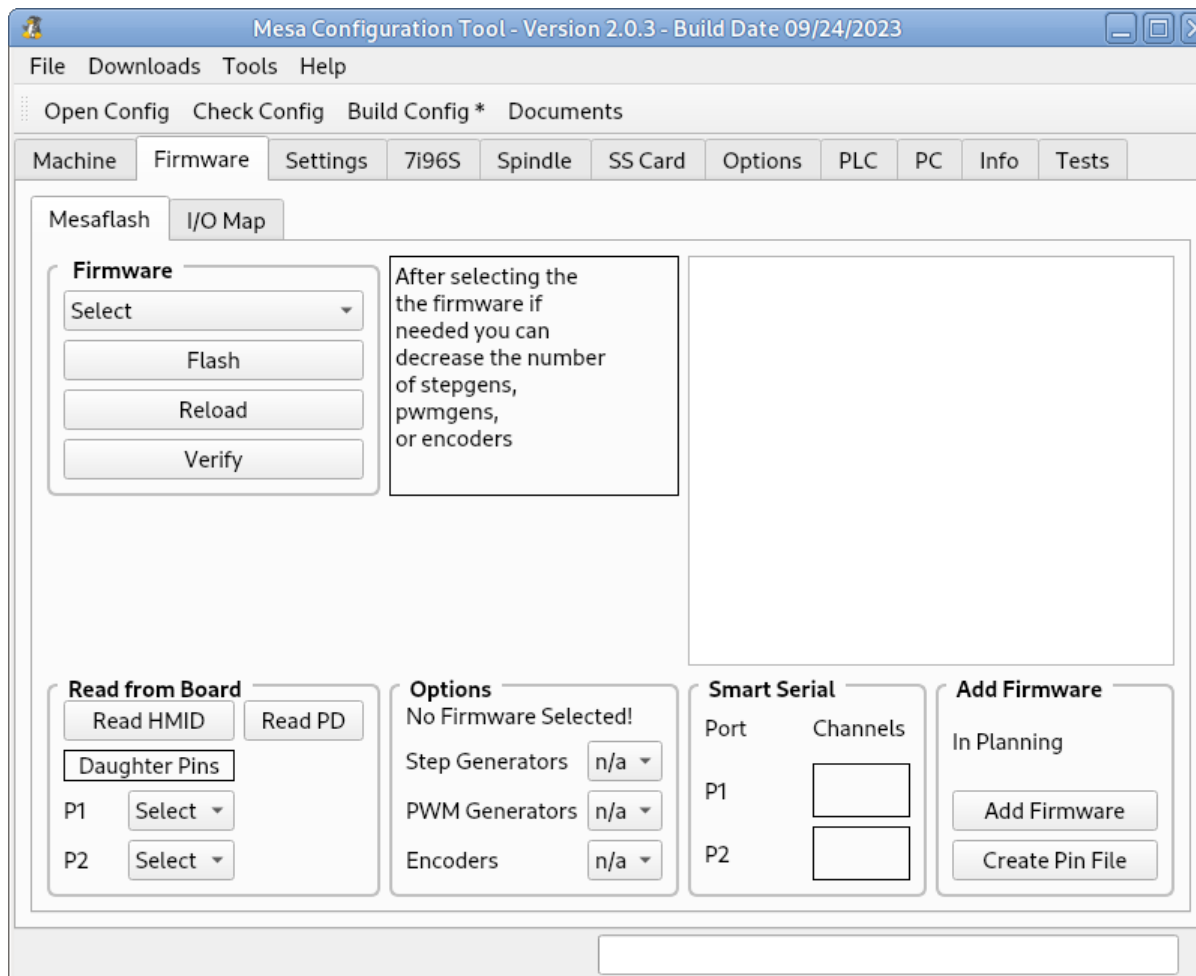
5.1 Mesaflash Tab

After selecting a board on the Machine tab the Firmware combobox is populated with firmware for that board after you download the firmware. If you don't have an internet connection on the PC you can download the firmware files from here and right click on the directory you want and select *Save Link As*. Extract the contents and copy the directory to *.local/lib/libmesact/*. Restart Mesa CT to read the new files.

5.1.1 Firmware Group

- *Select* - Select a firmware file
- *Flash* - After selecting a firmware this will flash the board
- *Reload* - After flashing firmware this will reload the new firmware
- *Verify* - After the board boots up this will verify the selected firmware

5.1.2 Read from Board Group

- *Read HMID* - Shows General Configuration Information
- *Read PD* - Read Pin Descriptions, gives more information than Read HMID
- *Copy* - Copies the contents of display window to the clipboard

5.1.3 Options Group

If the firmware options are known you can optionally reduce step generators, PWM generators or encoders to free up GPIO pins.
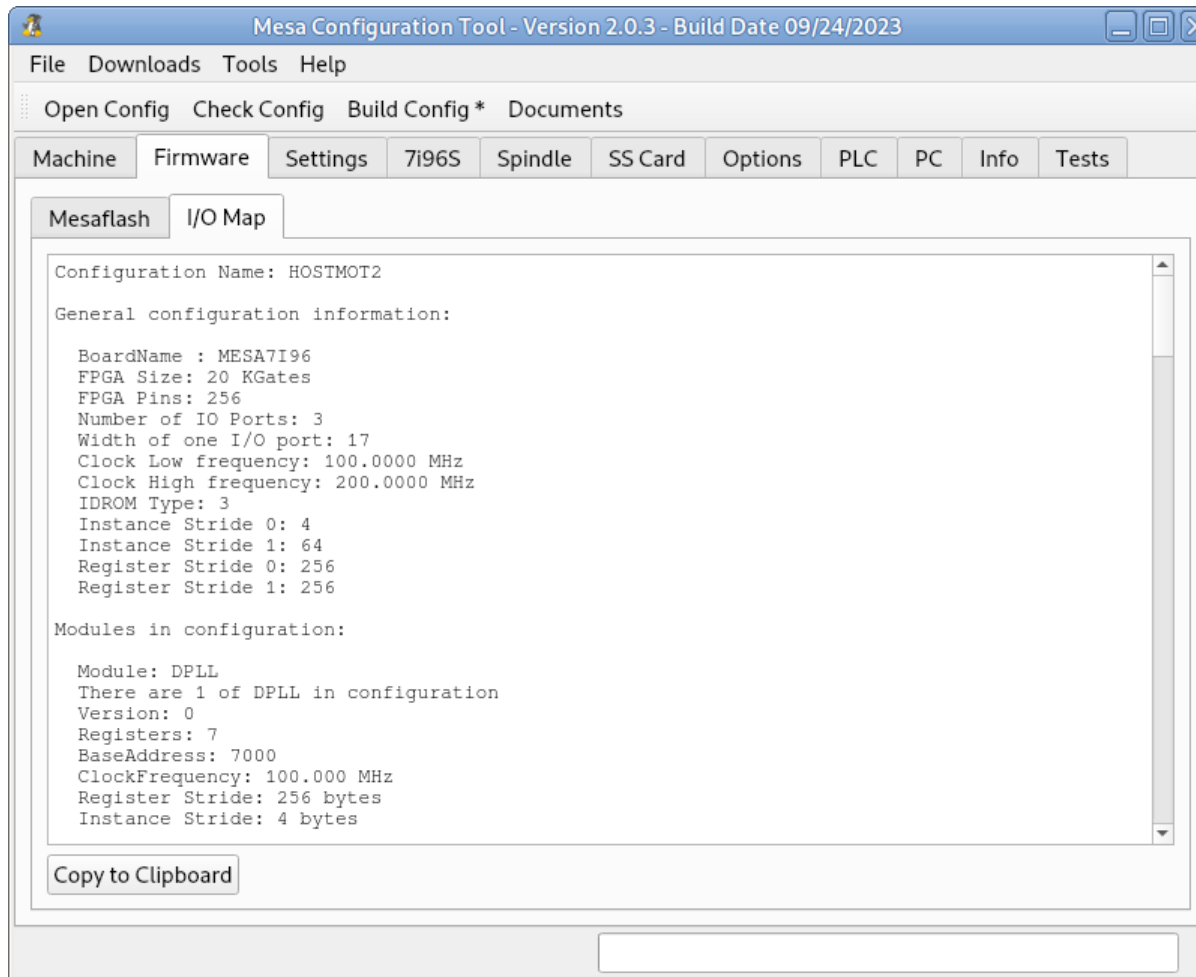
5.1.4 Smart Serial Group

WIP for some boards the smart serial ports change with the firmware

5.1.5 Add Firmware

In planning to have the option to pick a firmware file and add it to the istalled firmware.

5.2 I/O Map

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ⚙   Mesa Configuration Tool - Version 2.0.3 - Build Date 09/24/2023  [_][□][X] │
├─────────────────────────────────────────────────────────────────────────┤
│ File  Downloads  Tools  Help                                              │
│                                                                           │
│  Open Config   Check Config   Build Config *   Documents                  │
│ ┌────────┬──────────┬──────────┬───────┬─────────┬─────────┬─────────┬──────┬──────┬───────┐
│ │Machine │ Firmware │ Settings │ 7i96S │ Spindle │ SS Card │ Options │ PLC  │  PC  │ Info │ Tests │
│ └────────┴──────────┴──────────┴───────┴─────────┴─────────┴─────────┴──────┴──────┴───────┘
│  ┌───────────┬─────────┐                                                  │
│  │ Mesaflash │ I/O Map │                                                  │
│  └───────────┴─────────┘                                                  │
│   ┌──────────────────────────────────────────────────────────────────┐▲  │
│   │ Configuration Name: HOSTMOT2                                      │   │
│   │                                                                   │   │
│   │ General configuration information:                                │   │
│   │                                                                   │   │
│   │   BoardName : MESA7I96                                            │   │
│   │   FPGA Size: 20 KGates                                            │   │
│   │   FPGA Pins: 256                                                  │   │
│   │   Number of IO Ports: 3                                           │   │
│   │   Width of one I/O port: 17                                       │   │
│   │   Clock Low frequency: 100.0000 MHz                               │   │
│   │   Clock High frequency: 200.0000 MHz                              │   │
│   │   IDROM Type: 3                                                   │   │
│   │   Instance Stride 0: 4                                            │   │
│   │   Instance Stride 1: 64                                           │   │
│   │   Register Stride 0: 256                                          │   │
│   │   Register Stride 1: 256                                          │   │
│   │                                                                   │   │
│   │ Modules in configuration:                                         │   │
│   │                                                                   │   │
│   │   Module: DPLL                                                    │   │
│   │   There are 1 of DPLL in configuration                            │   │
│   │   Version: 0                                                      │   │
│   │   Registers: 7                                                   │   │
│   │   BaseAddress: 7000                                               │   │
│   │   ClockFrequency: 100.000 MHz                                     │   │
│   │   Register Stride: 256 bytes                                      │   │
│   │   Instance Stride: 4 bytes                                        │▼  │
│   └──────────────────────────────────────────────────────────────────┘   │
│   ┌──────────────────┐                                                    │
│   │ Copy to Clipboard │                                                   │
│   └──────────────────┘                                                    │
│                               ┌────────────────────────────────────────┐ │
│                               │                                        │ │
│                               └────────────────────────────────────────┘ │
└─────────────────────────────────────────────────────────────────────────┘
```

Displays the I/O Map of the selected firmware if a pin file is found

- *Copy to Clipboard* - Copies the contents of the I/O tab to the clipboard

SETTINGS TAB

- `` -

6.1 Firmware Group

- *GUI -*
- *Linear Units -*
- *Position Offset -*
- *Position Feedback -*
- *Maximum Feed Override -*

6.2 Axis Display Options Group

- `` -
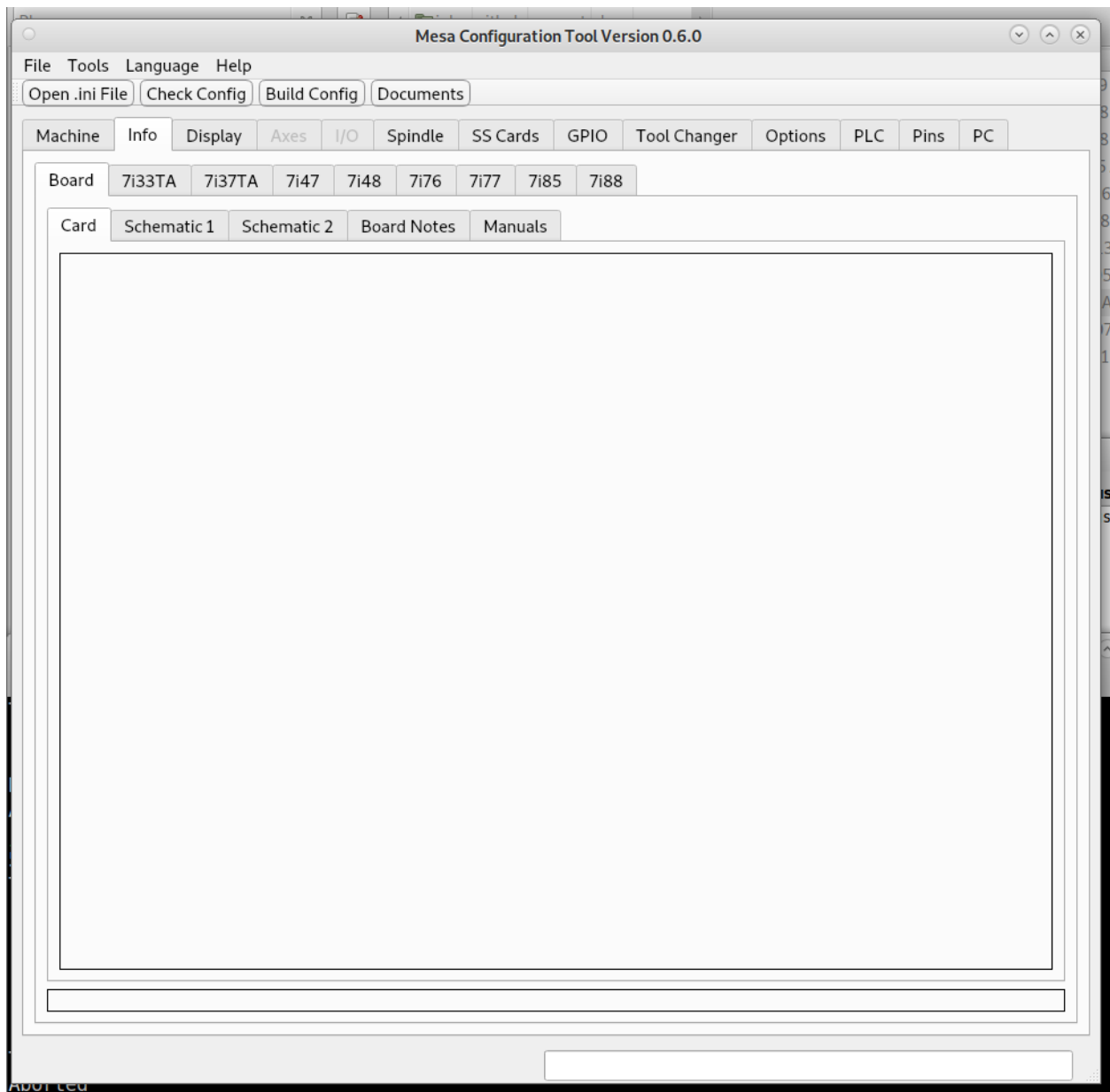
6.3 G code Editor Group
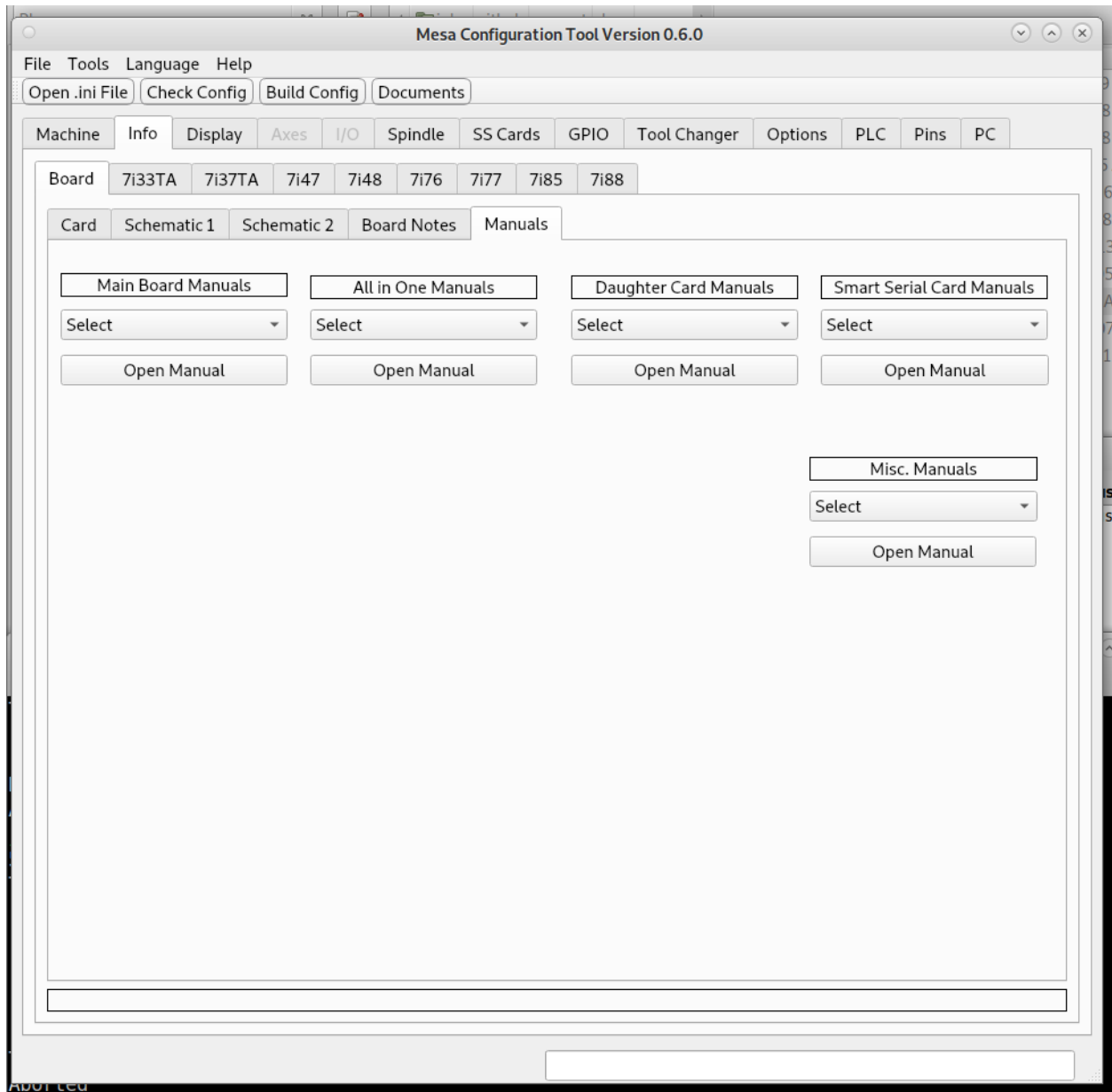
- `` -

6.4 Machine Settings Group

- `` -

6.5 Jog Slider Settins Group

- `` -

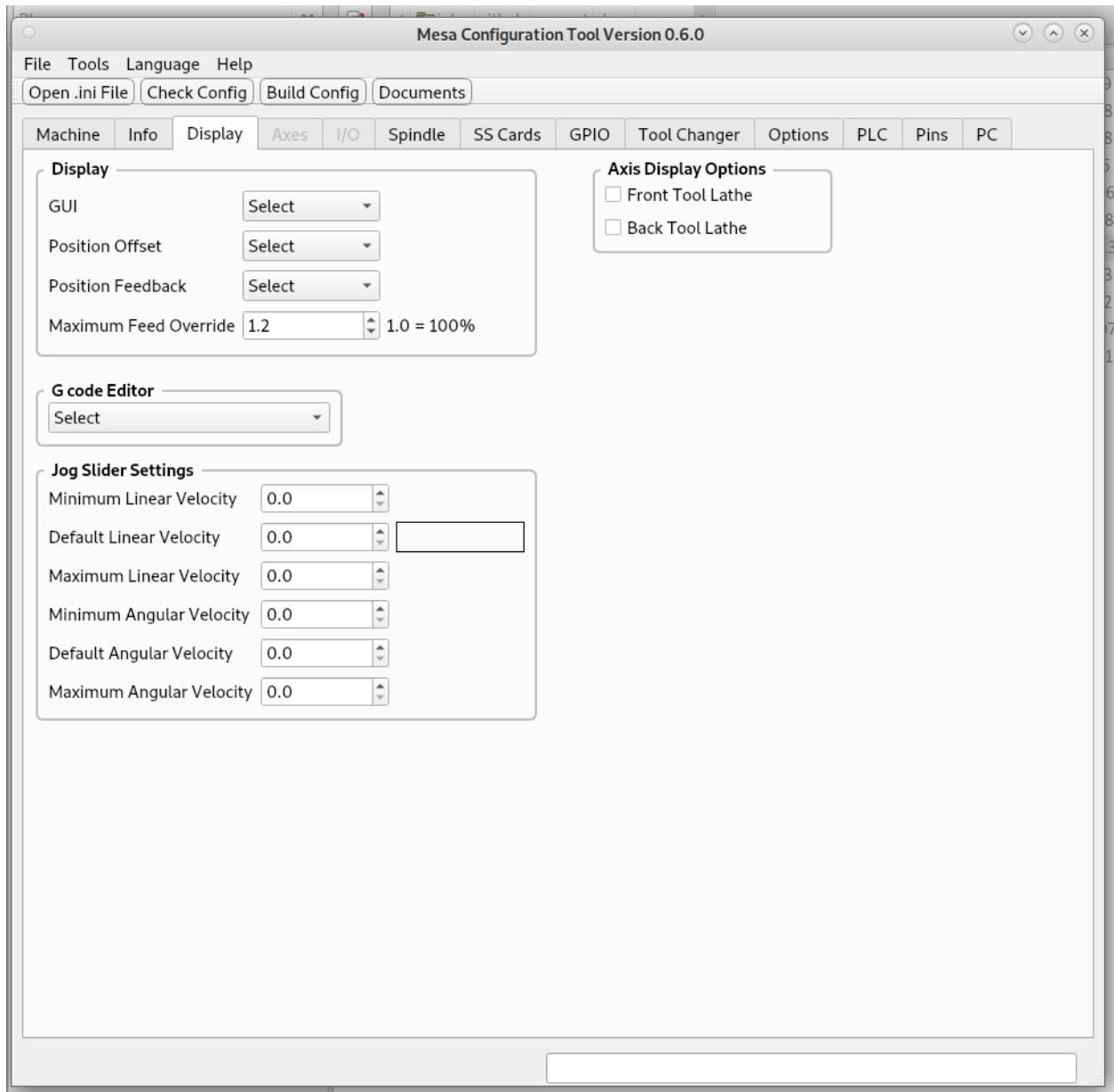# INFO TAB

Warning: This section is out of date

The Info Tab will have a diagram of the current board selected and may have connection schematics and board notes. Also there are diagrams of most daughter cards.

Mesa PDF manuals can be opened on the Manuals tab

EIGHT

DISPLAY TAB

Warning: This section is out of date

8.1 Display Group

- *GUI* - Select the GUI you want to use

- *Position Offset* - Typically Relative is selected which includes any offsets

- *Position Feedback* - Typically Commanded is selected, a servo system when Actual is selected may bounce around and make the feedback change a lot.

- *Maximum Feed Override* - Typically 1.2 is used

8.2 G code Editor Group

- *G code Editor* - Select from the installed editors

8.3 Jog Slider Settings

- *Minimum Linear Velocity* - The approximate lowest value the jog slider
- *Default Linear Velocity* - The default velocity for linear jogs, in , machine units per second
- *Maximum Linear Velocity* - The maximum velocity for linear jogs, in machine units per second
- *Minimum Angular Velocity* - The approximate lowest value the angular jog slider
- *Default Angular Velocity* - The default velocity for angular jogs, in machine units per second
- *Maximum Angular Velocity* - The maximum velocity for angular jogs, in machine units per second

8.4 Axis Display Options

- *Front Tool Lathe* - Normally a lathe is Front Tool that is when the tool holder is on the users side of the spindle
- *Back Tool Lathe* - A Back Tool Lathe the tool holder is on the opposite side of the spindle from the user side.

AXES TAB

> **Warning:** This section is out of date

9.1 Axis Group

1. Select the type of Axis

2. Enter the Scale which is the number of pulses to move one user unit. (user unit is either inch or mm)

3. Enter the Minimum Limit for the Axis (usually 0 for X or Y and the amount of travel for the Z axis as a negative number

4. Enter the Maximum Limit for the Axis (usually max travel for X or Y and 0 for Z)

5. Enter the Maximum Velocity in user units per second

6. Enter the Maximum Acceleration in user units per second per second

7. If the direction is backwards after testing check Reverse Direction

9.2 PID Settings Group

- Usually the Default Values are correct

- If you change the Tread Period in the Options tab generate the PID settings again.

The physical meaning of P=1/servo_period (1000 for a 1 ms servo period) is that any position errors are corrected before the next servo thread invocation.

Anything greater than P=1/Servo_period means you will over-correct.

Anything less than P=1/Servo_period means you will under-correct.

Anything greater than P=2/Servo_period means you will have oscillations.

If you are using PID feedback for a stepgen P=1/Servo_period is pretty much necessary. PID is still used with stepgens without encoders as it has advantages over the built-in position mode

In addition you can use a bit of FF2 (FF2= seconds between position read and new velocity write) usually about 0.0001 for Ethernet cards

9.3 Following Error Group

1. Usually the Default Values are correct

9.4 Homing Group

All entries are optional with the exception of a gantry configuration with two or more axes with the same Axis Letter. In this case you must enter the Home Sequence for all Joints used by the gantry.

1. Home is usually 0

2. Home Offset can be used to move the joint off of a home switch

3. Home Search Velocity is the "fast" speed to find the home switch

4. Home Latch Velocity is the "slow" speed to get an accurate location of the home switch

5. Home Final Velocity is the speed that joint moves to home positon, if left blank the a rapid move is used

6. Home Sequence defines the order that the axes home, it must start 1 or 0 and is negative in the case of a gantry

Step and Direction Drives

9.5 StepGen Settings Group

Either enter in the values for your drive or select your drive from the combo box. The Custom can be changed for your drive name if desired.

Analog Drives

9.6 Analog Output Group

Usually the Default Values are correct

9.7 Encoder Group
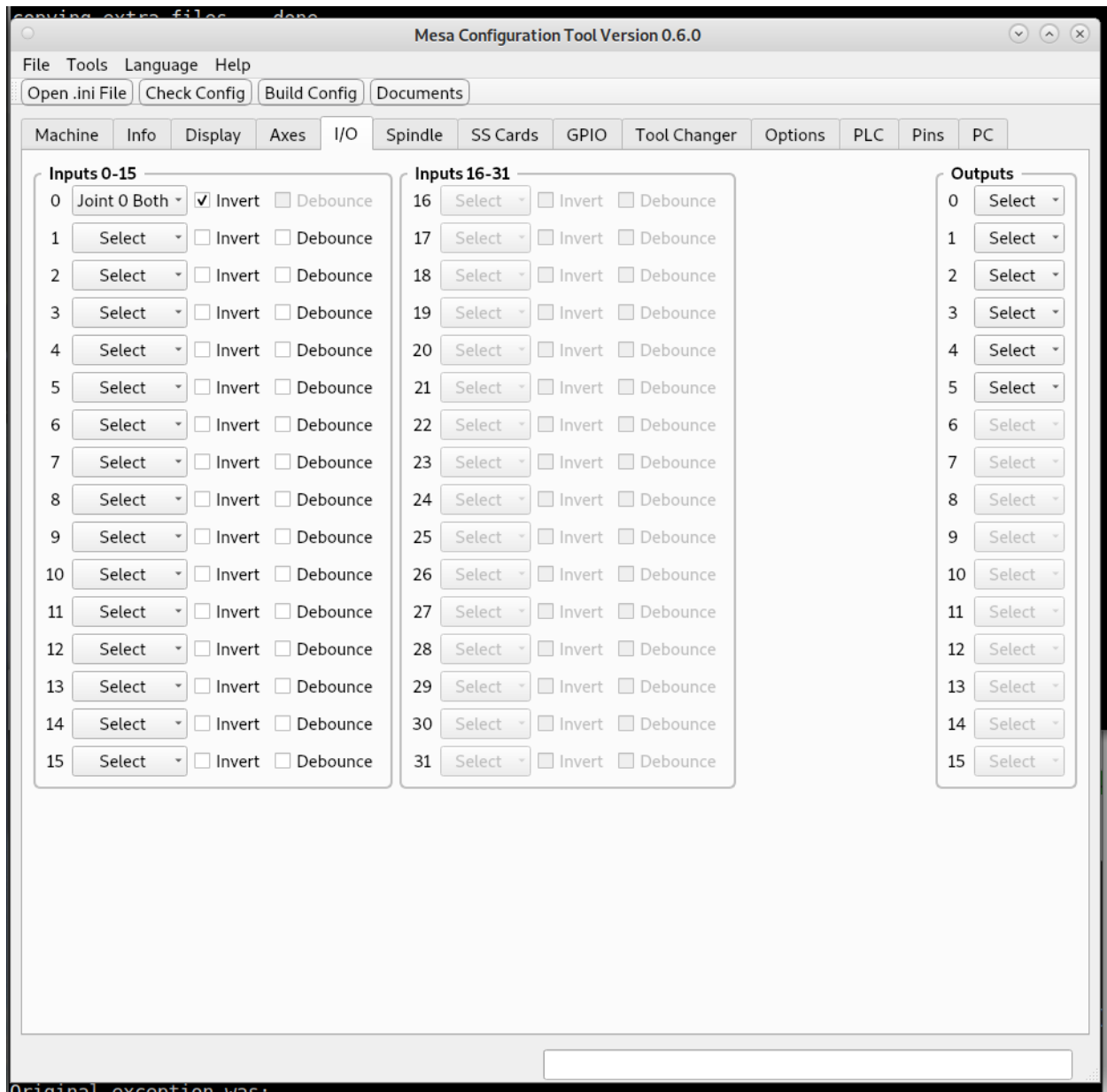
Enter the scale for your encoder for one user unit

I/O TAB

Warning: This section is out of date

10.1 Inputs

Select the input function from the combo box. To deselect pick Select from Not Used.

If you need to invert the sense of the input check Invert.

Some cards have a built in debounce function. If you check Debounce then Invert is not avaliable and the same goes if you check Invert then Debounce is not avaliable.

Inputs are enabled based on the board in the case of an all in one board or the daughter card.

10.2 Outputs

Select the output function from the combo box. To deselect pick Select from Not Used.

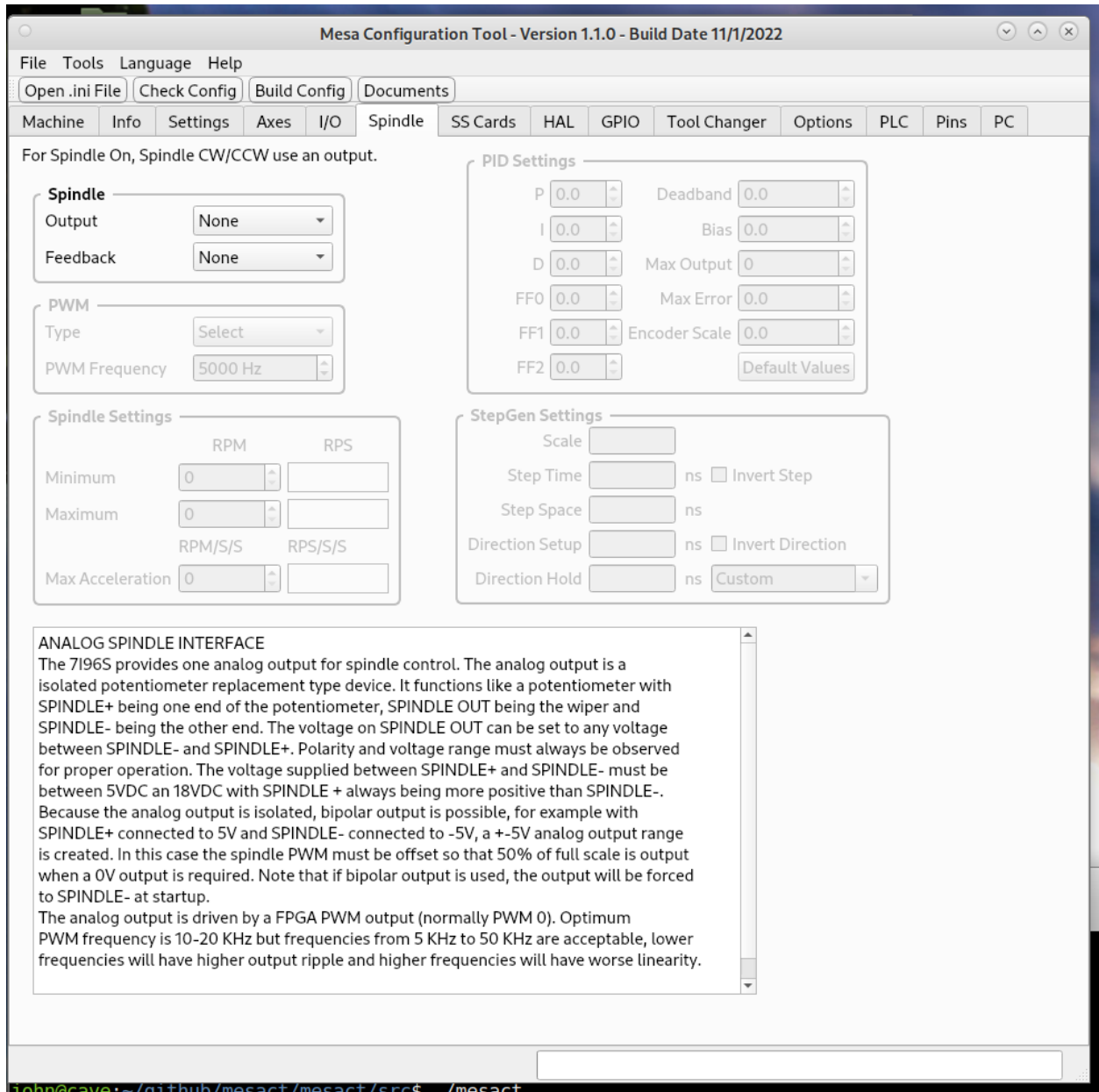# SPINDLE

Warning: This section is out of date

On the Spindle Tab you can create Analog, Digital or Stepgen spindle.

For a Digital Spindle select the outputs to be used on the I/O tab or on the SS Cards tab.

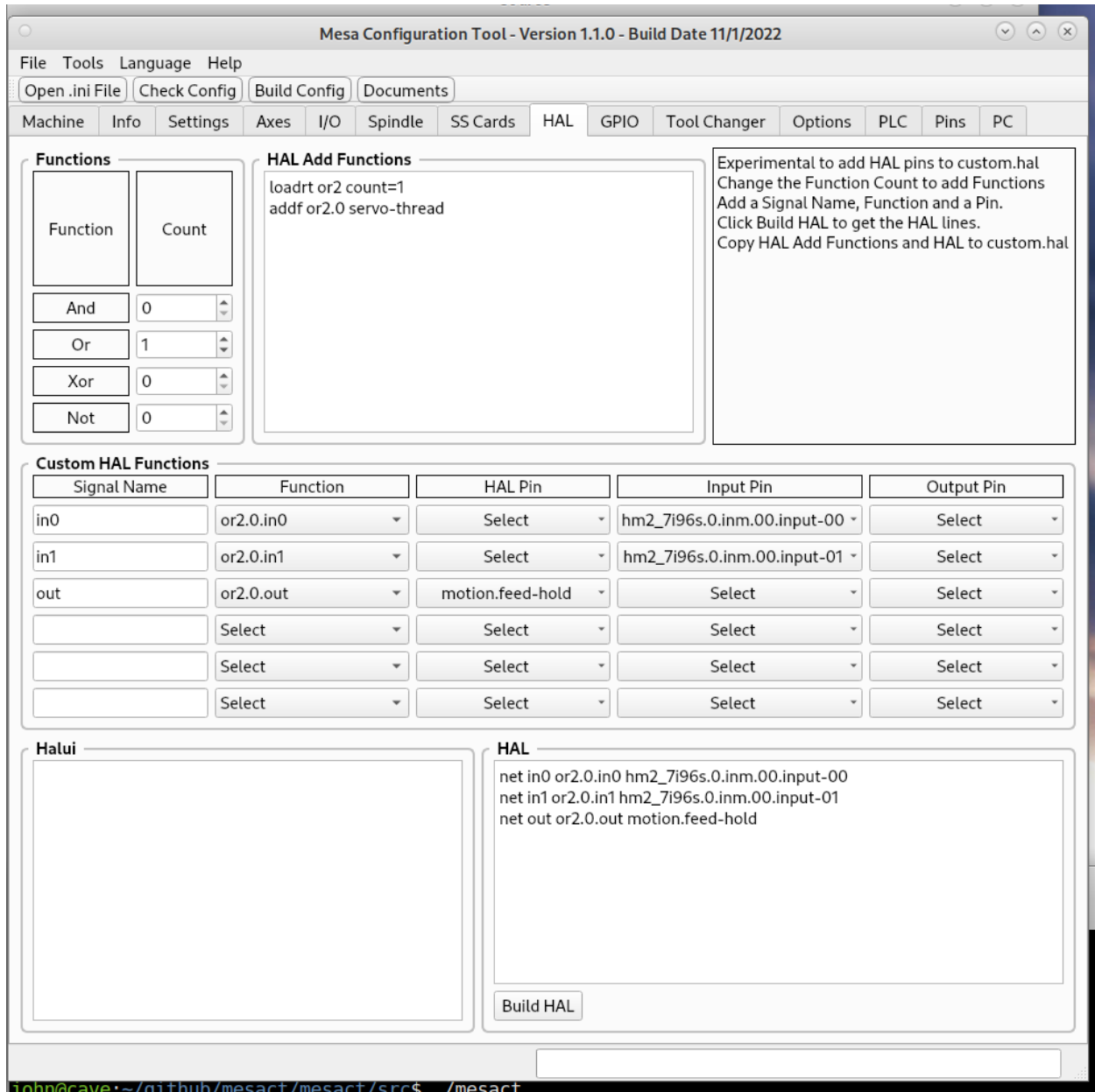Notes about the card if any are shown in the lower window.

TWELVE

HAL

> **Warning:** This section is out of date

Build custom HAL commands and copy and paste them into your custom.hal file.

1. Change the count of a function to greater than 0 and in the HAL Add Functions window the commands to add the function and add function to the servo-thread are shown.

2. Create a signal name, pick the function and select a pin.

3. Click on Build HAL to get the code to copy and past to your custom.hal file after the HAL Add Functions code.

Note: This section does not check for duplicate functions that may be in another hal file.