Novusun Controller Wiring

and

MACH3 Software Setup

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Safety Statement

The author of this document is not liable or responsible for any accidents, injuries, equipment damage, property damage, loss of money or loss of time resulting from improper use of electrical or mechanical or software products.

Assembling electrical CNC machine components like power supplies, motors, drivers or other electrical components involves dealing with high voltage AC (alternating current) or DC (direct current) which can be extremely dangerous and needs high attention to detail, experience, knowledge of software, electricity and electro-mechanics or mechanics.

BEFORE MAKING ANY CONNECTIONS OR DISCONNECTIONS POWER MUST BE REMOVED FROM THE DEVICE AND THE CONTROLLER. FAILURE TO DO SO WILL VOID ANY AND ALL WARRANTIES.
Introduction

This document will cover how to wire and setup the following components:

- Novusun CNC Controller – both NVUM and NVEM
- TB6600 Stepper Drivers
- Mean Well LRS-350 24V Power Supply
- MACH3 CNC Controller Software

The wiring and software configuration work well for us and are a result of extensive trial and error and customer feedback. This does not mean that it will work for you and your machine. As always, do your own research and read the manuals for each component and software – errors and omissions excepted.

NVUM/NVEM Controller Features

- Number Axis: 3-6
- Inputs: 12 channel programmable input port
- Output: 10 channel programmable output port
- MPG: 1 channel standard hand-wheel pendant MPG port
- PWM: 0-10V Spindle PWM output control
- Software: Support MACH3
- Interface: USB/Ethernet
- DCDC electrical isolation
- Optocoupler isolation
- Max 200khz stepper motor pulse output – suitable for most CNC milling machine system
- Support extend encoder to adjust FRO, SRO, SJR parameters
- ARM motion control chip

Manual, MACH3 Plugins and more information available on https://www.nvcnc.net/
TB6600 Stepper Driver Features:

- Support 8 kinds of current control
- Support 7 kinds of micro steps adjustable
- The interface adopts high-speed optocoupler isolation
- Automatic semi-flow to reduce heat
- Large area heat sink
- Anti-high-frequency interference ability
- Input anti-reverse protection
- Overheat, over current and short circuit protection
- Input Current: 0.5A
- Output Current: 0.5-4.0A
- Power (MAX): 160W
- Micro Step: 1, 2/A, 2/B, 4, 8, 16, 32
- Dimension: 96x56x33 mm
- Weight: 0.2 kg
Mean Well LRS-350-24 Features:

- Manufacturer: Mean Well
- Output Voltage-Channel 1: 24 V
- Output Power: 350.4 W
- Open Frame/Enclosed: Enclosed
- Input Voltage: 90 VAC to 132 VAC/180 VAC to 264 VAC, 240 VDC to 370 VDC
- Output Current-Channel 1: 14.6 A
- Mounting Style: Chassis
- Length: 215 mm
- Width: 115 mm
- Height: 30 mm
- Input Frequency: 47 Hz to 63 Hz
- Unit Weight: 760 g
MACH3 Software Features:

- Converts a standard PC to a fully featured, 6-axis CNC controller
- Allows direct import of DXF, BMP, JPG, and HPGL files through LazyCam
- Visual Gcode display
- Generates Gcode via LazyCam or Wizards
- Fully customizable interface
- Customizable M-Codes and Macros using VBscript
- Spindle Speed control
- Multiple relay control
- Manual pulse generation
- Video display of machine
- Touch screen ability
- Full screen eligibility
NOTE: It is critical to use the correctly rated/sized wire for all connections. For more details of each connection refer to the Novusun manual.

The Controller, TB6600 Drivers, Power Supply, Stepper Motors, Switches and etc are connected as per the diagram below:

**E&OE.**
This diagram is for reference only. Prior to making any connections read all manufacturer documentation and do your own research. All wiring is to be done by a qualified person. Failure to follow manufacture directions may result in electric shock and may void any warranty.
Below are some images of the wiring:

Note the crimp connectors on the power and stepper cables. This makes for cleaner and better connections.

Also note that each TB6600 has a pair of power cables running from the Power Supply to the Driver and are **NOT** daisy chained, that is, NOT from Power Supply to X Axis Driver, then from X Axis Driver to Y Axis Driver and so forth. If the power is daisy chained then, if all drivers are active, the current on the wire from the Power Supply to the first Driver will carry 4x the current and means the last Driver in the chain will be under powered – **DO NOT DAISY CHAIN POWER TO THE DRIVERS.**
See below for an example of how to layout a controller case. Note fans on the right to assist in cooling the TB6600 and prominent location the Emergency Stop Switch.
The above also has wiring for a spindle control, see the right-side bottom 4 wires on the NVEM.
TB6600 DIP Switch Settings

The TB6600 supports from 1 to 32 microsteps and a stepper motor current from 0.5A to 3.5A. The DIP Switch located on the side is used to set the microstep and current settings. The first 3 DIP switches are used to set the micro steps, and the last 3 set the current.

### Micro-Step Setting

<table>
<thead>
<tr>
<th>Micro Step</th>
<th>Pulse/Rev</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>NC</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>1</td>
<td>200</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>2/A</td>
<td>400</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>2/B</td>
<td>400</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>4</td>
<td>800</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>8</td>
<td>1600</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>16</td>
<td>3200</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>32</td>
<td>6400</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

### Current Control Setting

<table>
<thead>
<tr>
<th>Current (A)</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>1.0</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>1.5</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>2.0</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2.5</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>2.8</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>3.0</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>3.5</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

For lead screw driven CNC machines, such as the WorkBee and Lead CNC, a setting of 4 microsteps and 3A is a common setting – ON-OFF-OFF-OFF-ON-OFF.
MACH3 Settings

MACH3 is a complex program and there are many settings that can be used to personalise a machine configuration. Below are some, more or less, generic settings that are a good place to start when setting up a lead screw driven machine.

It is outside the scope of this document to detail each setting. For more comprehensive information see the MACH3 and Novusun manuals.

Motor Port and Pin Settings:
Input Port and Pin Settings:

### Engine Configuration: Ports & Pins

#### Port Setup and Axis Selection

<table>
<thead>
<tr>
<th>Signal</th>
<th>Enabled</th>
<th>Port #</th>
<th>Pin Number</th>
<th>Active Low</th>
<th>Emulated</th>
<th>HotKey</th>
</tr>
</thead>
<tbody>
<tr>
<td>X++</td>
<td></td>
<td>1</td>
<td>3</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X--</td>
<td></td>
<td>1</td>
<td>4</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>XHome</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y++</td>
<td></td>
<td>1</td>
<td>5</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y--</td>
<td></td>
<td>1</td>
<td>6</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YHome</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z++</td>
<td></td>
<td>1</td>
<td>7</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z--</td>
<td></td>
<td>1</td>
<td>8</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZHome</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pins 10-13 and 15 are inputs. Only these 5 pin numbers may be used on this screen.
- Automated Setup of Inputs

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#### Engine Configuration: Ports & Pins

<table>
<thead>
<tr>
<th>Signal</th>
<th>Enabled</th>
<th>Port #</th>
<th>Pin Number</th>
<th>Active Low</th>
<th>Emulated</th>
<th>HotKey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input #1</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input #2</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input #3</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input #4</td>
<td></td>
<td>1</td>
<td>1</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probe</td>
<td></td>
<td>1</td>
<td>2</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit Ovrd</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EStop</td>
<td>✔️</td>
<td>1</td>
<td>1</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THC On</td>
<td></td>
<td>1</td>
<td>0</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pins 10-13 and 15 are inputs. Only these 5 pin numbers may be used on this screen.
- Automated Setup of Inputs

---
Spindle Output Port and Pin Settings:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Enabled</th>
<th>Port #</th>
<th>Pin Number</th>
<th>Active Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Trig</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable1</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable2</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable3</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable4</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable5</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Enable6</td>
<td>✔️</td>
<td>1</td>
<td>0</td>
<td>✔️</td>
</tr>
<tr>
<td>Output #1</td>
<td>✔️</td>
<td>2</td>
<td>1</td>
<td>✔️</td>
</tr>
<tr>
<td>Output #2</td>
<td>✔️</td>
<td>2</td>
<td>2</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Pins 2, 5, 1, 14, 16, and 17 are output pins. No other pin numbers should be used.

Spindle Control Settings:
Motor Tuning Settings:

General Configuration Settings:
Motor Calibration

Before calibrating, make sure you have set your units (best to use mm, set by “Config/Set Native Units”).

To calibrate each axis go to the “Settings” screen in MACH3 and click on the button “Set Steps per Unit” on the bottom left.

Choose the axis to calibrate:

Choose the distance you want the axis to move. Make sure to mark or note the start location on the axis (a post-it note is a good way to mark the start point). Then, after the axis moves, measure and enter the actual distance of movement. It is best to start with a small number and run 2-3 times to increase accuracy.
The calibration will change the value for “steps per” in the Motor Tuning Settings.

**NOTE:**
For the following settings:

- Pulses or steps per revolution (set on the TB6600) = **800**
- Lead Screw Pitch = **8**

The Calculation will be:

- Steps per mm = steps per revolution / Lead Screw Pitch
- Or
- Steps per mm = **800/8**
  - = **100** Steps per mm

Using ACME TR8x8(P2) lead screws that are in the WorkBee and Lead CNC Machines the Steps per mm setting is “100”.

If you get another number when calibrating your machine, then one of the other settings will be incorrect (check the TB6600 and Mach3 settings)

If you change the settings on the TB6600 then, of course, the steps per calculation will change.

**Links / Resources:**

- https://www.nvcnc.net/nvum.html
- https://www.nvcnc.net/nvem.html
- https://www.prusaprinters.org/calculator/