MAC3-USBCARD-MK-Instructions

Suitable systems:  MACH3

Model:  
XHC-MK4:  With USB interface, 4-axis motion control card
XHC-MK6:  With USB interface, 6-axis motion control card

Mk6 for Mach3 Motion Control Card
Features:

✧ Fully supporting all Mach3 versions
✧ Full support for USB hot-swappable, the card is monitoring USB connection status at any time.
✧ Supports 6-axis
✧ Maximum step-pulse frequency is 200KHz
✧ Status indicator LED can be useful to show the USB connection, and working status by flashing.
✧ 16 general-purpose input
✧ has speed function, the spindle actual speed Mach3 interface in real-time display
✧ has onboard isolated power supply, no external power supply
✧ all IO-port isolation, interference, stable performance
✧ Support WHB04 wireless MPG
### Revisions List

<table>
<thead>
<tr>
<th>Date/ver</th>
<th>Info</th>
</tr>
</thead>
</table>
| 2011-12-10 Ver1.00 | The first version released  
                        IO port control  
                        PWM control, spindle speed adjustment |
| 2012-4-3 Ver1.08 | Continuous processing to solve the instability occurs               |
| 2012-8-2 Ver1.12 | Wireless MPG function                                                 |
| 2012-10-22 Ver1.16 | 6 axis function                                                       |
| 2013-4-18 Ver2.10 | Plasma cutting system applications interference problems              |
| 2013-07-27 Ver2.21 | Spindle PWM speed control output; support spindle pulse + direction output; supports the 0 to 10V analog voltage output. |
1. **Simple connection description**

1. 1 Application Connection Diagram

Support: 6-axis or 4-axis
## 1. 2  Motion control card Dimensions

![Motion control card diagram]

### Parameter Description

<table>
<thead>
<tr>
<th>Parameter Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diameter</strong>: 4X 4.0 mm</td>
</tr>
<tr>
<td><strong>USB</strong></td>
</tr>
<tr>
<td><strong>External power supply</strong></td>
</tr>
<tr>
<td><strong>MCU</strong></td>
</tr>
<tr>
<td><strong>5V isolated power</strong></td>
</tr>
<tr>
<td><strong>84.2 mm</strong></td>
</tr>
<tr>
<td><strong>97 mm</strong></td>
</tr>
<tr>
<td><strong>134 mm</strong></td>
</tr>
<tr>
<td><strong>161 mm</strong></td>
</tr>
</tbody>
</table>

## 1. 3  Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>axis output control</strong></td>
</tr>
<tr>
<td>Drive Current</td>
</tr>
<tr>
<td>Isolated open collector output; 5V, 20mA</td>
</tr>
<tr>
<td>Drive</td>
</tr>
<tr>
<td>Pulse + direction output</td>
</tr>
<tr>
<td>Output frequency</td>
</tr>
<tr>
<td>200KHZ</td>
</tr>
<tr>
<td>axes</td>
</tr>
<tr>
<td>MK4: 4-axis; MK6: 6-axis</td>
</tr>
<tr>
<td>Isolation Voltage</td>
</tr>
<tr>
<td>3. 5KV</td>
</tr>
<tr>
<td><strong>Spindle inverter output</strong></td>
</tr>
<tr>
<td>Analog voltage output</td>
</tr>
<tr>
<td>0——10V</td>
</tr>
<tr>
<td>PWM output</td>
</tr>
<tr>
<td>5V, 2KHZ, Duty; 0-100%</td>
</tr>
<tr>
<td>Pulse + direction output</td>
</tr>
<tr>
<td>5V, 15HZ to 400HZ</td>
</tr>
<tr>
<td><strong>Spindle speed input</strong></td>
</tr>
<tr>
<td>Input</td>
</tr>
<tr>
<td>Isolated input, 5V pulse signal</td>
</tr>
<tr>
<td>Isolation Voltage</td>
</tr>
<tr>
<td>3. 5KV</td>
</tr>
<tr>
<td><strong>8 IO output</strong></td>
</tr>
<tr>
<td>Drive Current</td>
</tr>
<tr>
<td>Isolation : 50mA, 25V</td>
</tr>
<tr>
<td>Isolation Voltage</td>
</tr>
<tr>
<td>3. 5KV</td>
</tr>
<tr>
<td>16 IO input</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>USB interface</td>
</tr>
</tbody>
</table>


2. Preparing for Installation

2.1 Mach3 software ready

This card is a Mach3 USB interface 4/6-axis motion control card external.

The latest version of Mach3 official website:

Mach3 download: as shown below:

![ArtSoft](https://www.machsupport.com/downloads.php)

Downloads

For previous versions of Mach and LazyCam, XML's, and other extra information: Click Here

(Some of the older files are linked directly from the FTP server in order to avoid redundancy. If your download
does not start immediately, please give it a few seconds - it's probably trying to contact/login to the FTP
server.)

Mach

Mach3 is the flagship of the ArtSoft products. It is released in two versions: a Lockdown version, and a
Development version. The Lockdown is a stable, static release recommended for new users, or people trialing
the software. The Development version contains developing features and is released quite often so people
can obtain new (but untested) features and capabilities. Both releases are limited to 500 lines of Gcode until
licensed. Mach3 has a limit of 10,000,000 lines of Gcode even after licensing.

*You must use a Desktop PC running a 32-bit version of Windows if you are using the Mach3 Parallel Port
Driver. Laptops are not supported because the power saving features of the chipsets disrupt the pulse
stream. Mach3 will only be supported on laptops running an external motion controller, such as one of
those found on the Plugins page.*

Lockdown:

Mach3 R3.042.040
Mach3 Changelog
Installation the Mach3:
The Parallel Port Driver does not require.

2. USB cable Prepare

Magnet ring installed in the USB cable at both ends

Attention

Use of acceptable quality USB cable
Motion control card software installation

1. USB cable connected to the PC

Connect the USB cable on the card, it will automatically install the driver. Wait for the indicator light, you can work. As shown below:

When the motion control card status indicator is Lights, USB has been connected successfully.
2. Install plug MACH3
Installing the motion card plug-in. Unzip the NCusbPod.zip, copy or drag NCusbPod.dll into your Mach3\PlugIns folder.

3: Select pulse output
Start Mach3 software, Choose “NCusbPod-XHC-Mach3-USB-Motion-Card”, Choose "Don't ask me this again"

When the LED flashes on the card, which means that the card is already connected with a USB MACH3 completed.
Mach3 software configuration

1. X, Y, Z, A, B, C-axis output configuration
   As shown below: (Config => Ports and Pins)

2. Motor parameter settings
   As shown below: (Config => Motor Tuning): Set the motor acceleration, velocity, impulse equivalent

Mach3 steps per unit:
Mach3 steps per unit = Mach3 steps per rev * Motor revs per unit
2. The Mach3 Menu => Config => Homing/Limits dialog
   Axes direction, depends on the “Reversed”.

3. Setup the input singles.

   There are 16 general-purpose input channels. The channels number is from 0 to 15 (at J4).

   Suggest Active Low = ”X” (Set High signal Level for Inputs)
4. Setup the Output signals.
There are 8 general-purpose (open-drain) output channels,
The channels number is from 0 to 7 (at J5).
Suggest Active Low =”√” (Set Low signal Level for outputs)

3.6: MACH3 spindle speed settings
MACH3 motion control card supports the following three kinds of ways Spindle speed control: PWM, pulse + direction, analog voltage 0 to 10V
Refer to the following figure, enter the spindle speed settings window:
Parameters setting:
Spindle speed control mode selection:
If the PWM control spindle speed, or use 0 to 10V analog voltage to control the spindle speed, then select the PWM control;
If using stepper + direction control spindle speed, select step / direction motors.
Select Stepper + direction control spindle speed: also need to set the following parameters
Set the minimum and maximum speeds:
3. USB motion control card configuration interface description:
   USB motion control card configuration interface, describing the motion control card USB IO port status of the input and output, USB data transfer parameter settings.
   Through the following ways to enter USB motion control card configuration interface:

   Mach3 Config⇒Config Plugins, PlugIn Control and Activation

   configuration interface:

   Description of the parameter settings:
   1. Card Work Status: Indicates the current operational status of the card: idle, processing, or limit stop
   2. IO output state: When there is motion control card IO input signal or output signal when the show will be in that position

   After setting, point applications into force

   Description of the parameter settings:
   1. Card Work Status: Indicates the current operational status of the card: idle, processing, or limit stop
   2. IO output state: When there is motion control card IO input signal or output signal when the show will be in that position
3. Homing Status: Displays the current card is going back to the origin of the X or Y or Z or A axis
4. Homing mode selection: Set the card the way back to the origin
   NO HOMING:  Prohibit card homing
   SINGLE STAGE:  Single-homing, when this mode is selected, execution back to the origin, then straight back to the home position
   DUAL STAGE:  Dual homing, when this mode is selected, the Executing homing, the home position is reached, it will roll back an offset, return to origin
5. Homing Offset settings:  When you select DUAL STAGE mode, set the offset back
6. Spindle speed settings:  When the spindle speed adjustment mode is selected as pulse + direction, set this parameter indicates that the spindle revolution, the number of pulses required
7. G code buffer time settings:  Set G-code buffer time, according to the different PC performance, adjusting this parameter, it will optimize the processing fluency
8. USB transfer interval setting:  According to different computer performance, adjusting this parameter, it will optimize the processing fluency
Motion control card hardware connection and electrical characteristics

1. Block diagram of motion control card

The board is used USB power source, with isolated power source module, external power supply is not requested. All outputs, including 4 axes pulse/DIR/8 output controls/Spindle-speed PWM output, are set to be high-impedance state (Hi-Z) when USB is connected. When running Mach3, Level is controlled by Mach3. Suggest: All output signals in Mach3 can be set to be Active Low.
Motion control card application connection schematic
Input IO Signal Description

Using isolated input, active low input.

MACH3 configuration table

<table>
<thead>
<tr>
<th>MACH3-IO</th>
<th>USB Card input terminals</th>
<th>MACH3 configuration capabilities</th>
<th>Input Voltage</th>
<th>Input Current</th>
<th>Input Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1.0</td>
<td>IN1</td>
<td>X-axis homing</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.1</td>
<td>IN2</td>
<td>Y-axis homing</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.2</td>
<td>IN3</td>
<td>Z-axis homing</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.3</td>
<td>IN4</td>
<td>A-axis homing</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.4</td>
<td>IN5</td>
<td>X, Y, Z, A-axis limit</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.5</td>
<td>IN6</td>
<td>Freely defined</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.6</td>
<td>IN7</td>
<td>Z-axis height trigger</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.7</td>
<td>IN8</td>
<td>Emergency Stop</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
<tr>
<td>P1.8—P1.15</td>
<td>IN9—IN16</td>
<td>Freely defined</td>
<td>5V or 24V</td>
<td>5mA</td>
<td>Active low</td>
</tr>
</tbody>
</table>
Output Signal Description

Schematics

MACH3 configuration table

<table>
<thead>
<tr>
<th>MACH3- IO</th>
<th>USB Card Terminals</th>
<th>MACH3 configuration capabilities</th>
<th>Output</th>
<th>Output Current</th>
<th>Drive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT#1</td>
<td>OUT1</td>
<td>Spindle Forward</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
</tr>
<tr>
<td>OUTPUT#2</td>
<td>OUT2</td>
<td>Spindle CCW</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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<tr>
<td>OUTPUT#3</td>
<td>OUT3</td>
<td>Coolant ON / OFF</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
</tr>
<tr>
<td>OUTPUT#4</td>
<td>OUT4</td>
<td>Cooling gas ON / OFF</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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<tr>
<td>OUTPUT#5</td>
<td>OUT5</td>
<td>Freely defined</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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<tr>
<td>OUTPUT#6</td>
<td>OUT6</td>
<td>Freely defined</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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<tr>
<td>OUTPUT#7</td>
<td>OUT7</td>
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<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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<tr>
<td>OUTPUT#8</td>
<td>OUT8</td>
<td>Freely defined</td>
<td>Isolated open collector output</td>
<td>50mA</td>
<td>Active low</td>
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</table>
drive signal description

Schematics

MACH3 configuration table

<table>
<thead>
<tr>
<th>MACH3 configuration</th>
<th>usb card terminal</th>
<th>Name</th>
<th>Output</th>
<th>Output Drive Current</th>
<th>Output Level</th>
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</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>XP-</td>
<td>X-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td></td>
<td>XD-</td>
<td>X-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td>Y-axis pulse</td>
<td>YP-</td>
<td>Y-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
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<tr>
<td></td>
<td>YD-</td>
<td>Y-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td>Z-axis pulse</td>
<td>ZP-</td>
<td>Z-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td></td>
<td>ZD-</td>
<td>Z-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td>A-axis pulse</td>
<td>AP-</td>
<td>A-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td></td>
<td>AD-</td>
<td>A-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td>B-axis pulse</td>
<td>BP-</td>
<td>B-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td></td>
<td>BD-</td>
<td>B-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td>C-axis pulse</td>
<td>CP-</td>
<td>C-axis pulse</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
<tr>
<td></td>
<td>CD-</td>
<td>C-axis direction</td>
<td>Open 5V output isolation</td>
<td>20mA</td>
<td>Active low</td>
</tr>
</tbody>
</table>
Spindle Speed Signal Description

Reference to the control card schematic, the Hall sensor and motion control card connected

Set the parameters MACH3:

MACH3 motion control card supports the following three kinds of ways Spindle speed control: PWM, pulse + direction, analog voltage 0 to 10V

Refer to the following figure, enter the spindle speed settings window:

Refer to the following figure: the spindle speed adjustment parameter settings:
Parameters setting:

Spindle speed control mode selection:
If the PWM control spindle speed, or use 0 to 10V analog voltage to control the spindle speed, then select the PWM control;
If using stepper + direction control spindle speed, select step / direction motors.
Select Stepper + direction control spindle speed: also need to set the following parameters
Set the minimum and maximum speeds: