Content

1. GENERAL INFORMATION .................................................................................................................. 3
   1.1. Scope ........................................................................................................................................... 3
   1.2. General Description .................................................................................................................... 3

2. Descriptions of 3-AXIS CNC Board ................................................................................................. 3
   2.1. Photo of 3-AXIS CNC Board ................................................................................................... 3
   2.2. Key Features .................................................................................................................................. 4
   2.3. Electrical Characteristics (recommend) ..................................................................................... 4

3. Hardware Installation ......................................................................................................................... 4
   3.1. Board Connection ....................................................................................................................... 4
   3.2. SELECTING AND CONNECTING STEPPER MOTORS ........................................................... 6
   3.3. CONNECTING with Computer by DB25 ............................................................................... 7
   3.4. Manual Control ......................................................................................................................... 8

Appendix ................................................................................................................................................. 8
   A. Installation of Step Current® Extend Board (Optional) .............................................................. 8
   B. Change the preset current of the board by changing the value of R12/R13, R22/R23, R32/R33 ........ 8
1. GENERAL INFORMATION

1.1. Scope

This document describes the basic functionality and the electrical specifications of Univelop Tech. LLC’s Three Axis TB6560 CNC Driver board.

1.2. General Description

Univelop Tech. LLC’s Three Axis TB6560 CNC Driver board is designed to communicate directly with KCAM4, MACH 2/3, NINOS, etc…, which supports parallel port.

2. Descriptions of 3-AXIS CNC Board

2.1. Photo of 3-AXIS CNC Board

![Three Axis TB6560 CNC Driver Board (Dimension: 100mm X 130mm)](image)

Fig. 1 Three Axis TB6560 CNC Driver Board (Dimension: 100mm X 130mm)

![Step Current® Extend Board(Optional)](image)

Fig. 2 Step Current® Extend Board(Optional)
2.2. Key Features

- Supports KCAM4, MACH 2/3, NINOS, etc…
- Two phase bipolar (chopper) pulse width modulating technology
- Resolution 1, 1/2, 1/8, 1/16 micro stepping output
- Suitable for 4, 6, or 8 wire motors
- Absolute Maximum Ratings: 40VDC @ 3.5 amps(peak) /phase motor output*
- Current adjustable at 100%, 75%, 50%, 20% of full current by on-board switch**
- Voltage regulator is on board for TB6560
- Stop Button for emergency stop
- Limit/Home Signal input
- Manual Control circuit included
- Step Current® Technology (with optional Step Current® Extend Board): Step Current® technology is used to decrease the current up to 1/2, when motors are in idle for all axis so as to protect expensive step motor and driver board for long time running.
- Built-in overheat protection circuit

Comparison between Univelop V 2.0 (TB6560) CNC driver and V 1.0 (TA7835) CNC driver board:

<table>
<thead>
<tr>
<th></th>
<th>V 1.0 (TA7835)</th>
<th>V 2.0 (TB6560)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Overheat protection</td>
<td>N/A</td>
<td>Built-in</td>
</tr>
<tr>
<td>Current Adjustable</td>
<td>100%/50%</td>
<td>100%/75%/50%/20%</td>
</tr>
<tr>
<td>Current for motor</td>
<td>Peak 2.5A</td>
<td>Peak 3.5A [*,**]</td>
</tr>
<tr>
<td>Voltage</td>
<td>Max 35V</td>
<td>Max 40V [*,**]</td>
</tr>
<tr>
<td>Micro stepping</td>
<td>1 – 1/8</td>
<td>1 – 1/16</td>
</tr>
<tr>
<td>Frequency (fOSC)</td>
<td>Max 80kHz</td>
<td>Max 600kHz</td>
</tr>
<tr>
<td>Chip manufactory</td>
<td>Old technology</td>
<td>Current technology, makes IC chips get less heat at the same current</td>
</tr>
</tbody>
</table>

* See TB6560 Datasheet (2007) by TOSHIBA, (at Ta = 25°C)
** The full current is preset at 2.5A by R12/R13 (0.2ohm) for this board (you can adjust it by changing resister).

2.3. Electrical Characteristics (recommend)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSTR</td>
<td>Storage Temperature</td>
<td>- 40</td>
<td></td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>TOP</td>
<td>Working Temperature</td>
<td>- 15</td>
<td>+ 25</td>
<td>+ 85</td>
<td>°C</td>
</tr>
<tr>
<td>ICC</td>
<td>Current</td>
<td>50</td>
<td>100</td>
<td>200</td>
<td>MA</td>
</tr>
<tr>
<td>+12V</td>
<td>Motor Voltage</td>
<td>5</td>
<td>24</td>
<td>34</td>
<td>[*] V</td>
</tr>
<tr>
<td>+7V</td>
<td>Board Voltage</td>
<td>7</td>
<td>9</td>
<td>12</td>
<td>V</td>
</tr>
</tbody>
</table>

3. Hardware Installation

3.1. Board Connection

Follow the following steps to connect the board:
1. Connect board power and motor power to the board as same as following.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>+12V</td>
<td>Motor Voltage</td>
<td>5</td>
<td>24</td>
<td>34[*] V</td>
<td></td>
</tr>
<tr>
<td>+7V</td>
<td>Board Voltage</td>
<td>7</td>
<td>9</td>
<td>12</td>
<td>V</td>
</tr>
</tbody>
</table>

2. Connect the motors to the board (more detail in Section 3.2)

3. Setup the board with S11, S12, S13,
   X-axis: S11, S12, P11; Y-axis: S21, S22, P21; Z-axis: S31, S32, P31:

4. (Optional) Setup the “Step Current” extension board with P11, P21, P31,
   Please follow the Appendix A.

5. (Optional) Connect the limit switches to the board.
   P1: Emergence Stop
   P2: Limit X
   P3: Limit Y
   P4: Limit Z

* Do NOT connect any pins to P11, P21, P33 except our StepCurrent Extension board.

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[Diagram showing board connections and settings]
Signals are Active Low.
4. Connect DB 25 with parallel port in a computer
   More details are in section 3.3.
5. Turn on the board power and motor power, as well as the computer.
   - Connect suitable power supply at Input outlet on front of controller
   - 24vdc @ 2-6amp switching power supply recommended
6. Attempt to jog each axis with software (if axis turns in opposite direction of desired direction - attempt axis rotation reversal via software- if unable to do so switch 2 wires for one coil (i.e. switch A with A#, do not switch wires between coils)
7. You are now done and able to begin using your new stepper motor drive

REMEMBER NEVER CONNECT OR DISCONNECT MOTORS WHILE POWER IS ON

### 3.2. SELECTING AND CONNECTING STEPPER MOTORS

**WARNING:** INCORRECT WIRING OF THE STEPPER MOTOR TO THE DRIVE BOARD CAN LEAD TO IMMEDIATE DAMAGE OF DRIVE BOARD - DO NOT CONNECT OR DISCONNECT MOTORS WHILE POWER IS ON

4 Wire, 6 Wire, and 8 Wire stepper motors can be used with 3-AXIS CNC Board. 4 Wire motors are recommended as they are by their manufacture true bipolar motors and easier to properly connect to stepper motor drive controller. It is critical to obtain a proper motor coil diagram of any motor you wish to utilize (making cross connections between the two coils will destroy the control circuitry) 1.8 deg per step resolution is the industry standard for most automation grade stepper motors and is recommended for most applications

#### 4 WIRE STEPPER DIAGRAM

Each wire is connected to its corresponding terminal block location (i.e. A# wire is connected at A-

#### 6 WIRE STEPPER DIAGRAM (SERIES WIRING)

Center wire of each coil not connected (insulate termination)
Remaining wires are connected to their corresponding terminal block location (i.e. A# wire is connected
8 WIRE STEPPER DIAGRAM

2 center wires of each coil connected (insulate connection) Remaining wires are connected to their corresponding terminal block location (i.e. A# wire is connected at A- location).

If using 6 or 8 wire motors, connected using series wiring method, reduce labeled amperage rating by 50% (i.e. a motor rated at 4 amps should thus be considered now rated at 2 amps)

3.3. CONNECTING with Computer by DB25

The following is to aid in the setup of the use of controller with various CAM software programs operating on your computer.

**DB25 Female Pinout**

<table>
<thead>
<tr>
<th>Pin in Parallel Port</th>
<th>In/Out</th>
<th>Signal</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Out</td>
<td>Step X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Out</td>
<td>Dir X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Out</td>
<td>Step Y</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Out</td>
<td>Dir Y</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Out</td>
<td>Step Z</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Out</td>
<td>Dir Z</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Out</td>
<td>Enable Y</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Out</td>
<td>Enable Z</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Out</td>
<td>Enable X</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>In</td>
<td>Emergence Stop (low*** )</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>In</td>
<td>Limit X (low*** )</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>In</td>
<td>Limit Y (low*** )</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>In</td>
<td>Limit Z (low*** )</td>
<td></td>
</tr>
<tr>
<td>1,15,16,17</td>
<td>N/A</td>
<td>Not Utilized</td>
<td></td>
</tr>
<tr>
<td>18-25</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***Signals are Active Low
It is critical that the connection between computer parallel port and motor drive board be direct with the use of adapters (If your computer does not feature a DB25 outlet, you must install one, (these can be achieved via PCMIA cards on laptop computers)) The use of adapters and hubs is not advisable and most likely will not work.

### 3.4. Manual Control

**Manual control:**

Using S1 to control X-axis, S2 to control Y-axis, S3 to control Z-axis.

- **X-axis:** Connect the DB25 pin 14 to +5v to enable X, Short S1.2-3 to drive the motor, short S1.5-6 to change the direction of the motion.
- **Y-axis:** Connect the DB25 pin 8 to +5v to enable Y, Short S2.2-3 to drive the motor, connect S2.5-6 to change the direction of the motion.
- **Z-axis:** Connect the DB25 pin 9 to +5V to enable Z, Short S3.2-3 to drive the motor, short S3.5-6 to change the direction of the motion.

### Appendix

#### A. Installation of Step Current® Extend Board (Optional)

Insert the step current® extend board into P11 (see Figure 3 for positions) for X-axis, insert the step current® extend board into P21 for Y-axis, Insert the step current® extend board into P31 for Z-axis. After the board is powered, the LED indicator will be turned on.

![Figure 3. Positions for P11, P21, P31](image)

#### B. Change the preset current of the board by changing the value of R12/R13, R22/R23, R32/R33

The value of $I_{out}(A)=0.5V/R12(Ohm)$, $I_{out}(A)=0.5V/R13(Ohm)$. The peak of $I_{out}$ can’t be exceed 3.5A.