Brookwood Design
T41BB5X Pro grblHAL Breakout Board Release Notes
Beta Version. V2.52
05/06/21

Thank you for participating in the beta test program of the T41BB5X Pro. Hopefully you will find it useful.

We are hoping to get your honest feedback about the board. We are eager to find about any problems or issues you have with it. We are also very interested in your suggestions for changes. While we may not incorporate them in this version, be assured, we will take them seriously for future versions of the board.

Please send any feedback or questions to phillip.lyne.barrett@gmail.com or

Assembly Instructions.

1. Install the pin headers.
2. Next, install the sockets for the Teensy 4.1 (if using, sockets not provided).
3. Next, install the pluggable screw terminal sockets. If using vertical sockets, take care to determine orientation so that the plugs overhang the outside of the board – the screws should point inward. Otherwise they will interfere at the corners. Horizontal sockets should be pluggable from the outside of the board.
4. Then install the MagJack and USB Host connector.

Powering the T41BB5X Pro

A 12V supply is required. Typically connected via the 12V terminal in the upper left corner of the board. An absolute minimum of 500 mA is needed. 1A is recommended.

There are 3 12V groups: Board Group, Isolated Spindle Group and Isolated I/O Group. The latter two may be powered separately or from the Board 12V power. To be isolated, a group must not be powered from the Board Group.

The Isolated Spindle group can be powered in one of three ways:
1. Use a DC-DC isolated converter (not included) inserted in the M1 section. Note orientation – the case of the converter should fit within the outline on the PCB. Also, note that there is a small amount of clearance between the converter and the Host USB Connector. It fits but the production board moves it a bit farther over.
2. Jumper to the 12V board supply. Note "Jumper for non-Iso 12V" near JP10. Use 2 shorting plugs in vertical arrangement. Better silkscreen info will make the alignment more obvious in the production board. This does not isolate the spindle group from the core electronics.
3. Supply external 12V via the "Iso 12 Input" pin header.

Only one of these methods should be used. More than one in use could damage the board.

Note: do not power the rest of the board from the DC-DC converter. The converter is not sized to provide enough power and will overheat.

The I/O Group can be powered in one of two ways:
1. 12V input via the screw terminal in the lower left of the board. This allows the Limit and Control inputs to be fully isolated.
2. Jumper via the supplied shorting plugs to the 12V board supply. Vertical arrangement. This does not isolate the inputs from the core electronics..

Only one of these methods should be used to avoid damage to the board.

For isolated supplies – a simple wall wart supply is acceptable.

There is also a 5V input terminal. This should only be used if powering relays at 5V or if running the T41BB5X Pro via Ethernet. It is acceptable to power an Ethernet setup via the USB connector on the Teensy 4.1. Generally, do not connect both the 5V terminal and Teensy 4.1 microUSB at the same time. If you need to use both, disconnect the Teensy 4.1 from board +5V by cutting the trace indicated on the bottom of the T41BB5X Pro PCB.

DC- DC Converters.

A DC-DC converter is not included in this kit. Currently I have tested the following:

Manufacturer	Model Number	Distributor link
Traco	TBA 1-0512	https://www.mouser.com/ProductDetail/TRACO-Power/TBA-1-0512?qs=byeeYqUIh0P6X9r%252BCmr0fg%3D%3D
RECOM Power	ROE-0512S	https://www.mouser.com/ProductDetail/RECOM-Power/ROE-0512S?qs=%2Fha2pyFaduhln7RzhMZbMob7W9ttgZ81uhh1MgcdD0WxwMnA2iF8yA%3D%3D
MORNSUN	B0512S-1WR3	https://lcsc.com/product-detail/Power-Modules_MORNSUN-Guangzhou-S-T-B0512S-1WR3_C133158.html
GTL-POWER	B0515S-1W	https://lcsc.com/product-detail/Power-Modules_GTL-POWER-B0515S-1W_C396123.html

The general specifications for a converter:
Voltage in: 5V
Voltage out: 12V-15V
Current out: 50 mA minimum

Any converter that meets those specifications and has a compatible pinout should work ok.

Adjusting 0-10V output.

The 0-10V circuitry uses a 10K potentiometer to allow ajustment of the 0-10V output. It needs to be adjusted to get the correct voltage level.
1. Set your board up for isolated spindle group power as described above.
2. Start up a GCode sender
3. Turn the spindle on to 100%,
4. Attach a digital multi meter (DMM) to the 0-10V output terminal.
5. While watching the voltage reading, use a small screwdriver to adjust RV1 until the DMM reads exactly 10V. Note that it may take a number of turns to change the output voltage level.
6. Optional: A small amount of hot glue on the RV1 screw will hold it in place.

Beta Board errata

The following issues have been found:
1. Isolated DC-DC Converter and Host USB connector spacing is tight. Fixed on production board.
2. 2x2 pinheaders for joining 12V systems together are unclear as to shorting plug alignment. Production board will have better silk screen information.
3. UART1. No level shifting for Enable pin (3.3V only). Level sifting for enable pin added to production board.
4. Screw terminals slightly obscure silk screen in some places. Due to dual vertical/horizontal footprint – fixed in production board.
5. 0-10V linearity is off by up to 10%. Production board replaces R41 (2.2KΩ) with a 1KΩ resistor for 5% linearity.
6. The reset input does not seem to work with grblHAL. Board Test software shows that the hardware itself is working correctly. Investigating.

Additional changes to production board as of this date:
1. Changed to smaller Opto Isolators.
2. Connector footprints modified to create "snap-in" effect for easier and more precise assembly.

Additional information

Web Site for T41BB5X Pro beta test – https://www.grbl.org/t41probb-beta
Please do not share this URL with others.

Schematic and board outline/dimensions are available on the web site.