24V Motor Control Board Prototype
Overview & Brief Instructions

CAVEATS

This control board is a prototype used in internal development of products, made available to you the customer for your own experimentation ahead of the final product launch. The appearance of this board may vary and may have cosmetic variations from the hand soldering / alteration process. Additionally, this board has the following quirks to be aware of:

1. The USB port is positioned very close to the PCB enclosure in the Tremblr device, so it is suggested you connect the USB port first before installing the circuit board.

2. The programming header exposed is a Tag-Connect header, which you may not have. If you accidentally overwrite the bootloader on the ATMega328, it is socketed so you can build out a breadboard programmer. We suggest you do not accidentally overwrite the bootloader.

3. The remote receiver appears to be even less stable than the one found in the original Tremblr, and sometimes starts receiving pulses instead of a solid signal. It was difficult finding a matching part. Additionally, you will likely have to adjust the solder jumpers on the receiver to match the address of your existing device.

INSTALLATION

As with all modifications, installation is done at the user's risk. To ensure a safe control board swap, please follow these simple instructions:

1. Fully disconnect the power supply and any other cable and tube connected to the Tremblr before servicing. CAUTION: The main circuit board may retain an electric charge after it has been switched off and disconnected. Care should be exercised when handling the electronics within this device.

2. Never remove any connectors forcefully. Avoid pinching or sharply bending wires. Ensure all connections are fully attached during reassembly.

3. Certain components on this circuit board get hot during normal operation. Please be careful when handling the board and allow sufficient time to cool off before handling.

4. Avoid static shock risk! Please ensure that you are working in a static-free area, and use of a grounding strap is strongly encouraged.

That said, please proceed to page 2 for an overview of Installation. Remember, you are doing so at your own risk.

INSTALLATION (Cont.)

1. Remove foam inserts from the inside of the Tremblr case. These are glued and can gently be pried out. Include the two foam spacers underneath. This will reveal the screws on the motor cover.

2. Remove and set aside the large black hex bolts holding the motor cover on. Lift off and set aside the metal motor cover.

3. Triple check that the power is disconnected before you put your fingers in here. Seriously.

4. Disconnect the Air In / Out valve leads from the control board, carefully cut the cable tie attaching the main suction hose to the faceplate, disconnect the main suction hose, and pull the one-way valves out of their holders.

5. Remove the upper foam block from the sides of the motor bracket. Carefully disconnect the fan wire, motor power wire, and two LED wires from the main control board. Ensure the fan wire is carefully moved to the side so it is not pinched when removing the motor. Take note of which wire was connected to the Blue / Red LED connectors.

6. Lift the white plastic mounts up to free the motor bracket. Lift the motor bracket out, ensuring the air hoses and power wires come free and the fan power wire is not pinched. Set the whole motor assembly aside. CAUTION: This bit is quite heavy. Do not pinch your fingers.

7. Disconnect the power in and power switch connections from the main board. Remove the power switch from the faceplate of the Tremblr by pinching in the clips on the side and gently working it free from the hole.

8. Remove the control board. This should be held in by two nuts on top and a hex screw up from the bottom. Lift the control board up from its spacer and set it aside. CAUTION: Static shock. Ground yourself.

9. Thread the new USB connector in from the back of the connection plate on the Tremblr, through the hole the power switch was in. You may optionally add the included cap, or not, your call. Screw the included nut to the front to secure the USB connector.

10. Connect the USB cable to the new control board and loop it so it rests pretty when the board is mounted. Because of the caveat noted above, your USB port may be uncomfortably close to the plastic on the side of the control board area. It'll fit, don't force it. CAUTION: WHAT DID WE SAY ABOUT STATIC?!

11. Secure the new control board in the same fashion as the old one. Ensure the plastic spacers were installed over the screws, and the control board on top of those. Hand-tighten the nuts.

12. Now it's time to do everything in reverse, so we'll breeze through it since this page is out of space: Connect Power In, replace motor assembly, connect LEDs, Motor lead, Air In / Air out. Attach suction tube to panel. Zip tie the tube. White plastic motor thing goes down, reconnect the fan, add the top foam, add the cover, bolt that down, add the lower spacer foams and the fancy foams. Yay.

OPERATING INSTRUCTIONS

Now that it's assembled, and you double checked all your wiring and made sure it's all secure and attached correctly, exactly like the board you just replaced, it's time to power it on.

C A U T I O N : As is the case with the original Tremblr, connect the barrel jack power connection to the Tremblr B E F O R E connecting the power supply to mains!! When turning off the device, disconnect the power supply from mains (that's the wall outlet) BEFORE unplugging the barrel jack. Always use the device on a stable surface so it doesn't get tripped over.

(For the curious nerds: There's a heckin' chonker of a decoupling cap on the motor's power supply in both devices, and nothing to limit it's inrush current. We're adding an NTC to this in our next revision, it'll be great.)

Operation of this device is subject to whatever firmware you have uploaded. The example firmware included replicates the functionality of the Remote Control, but with an added flash of the red LED to let you know the button was actually, you know, registered with the device.

The USB port exposes a serial connection to the ATMega328, which by default will let you use TS-Code commands to control your device from a computer. More on that here:

https://github.com/MausTec/ts-code

The default firmware can be found here:

https://github.com/MausTec/tremblr-control-328

For immediate fun, send the device: 'T0BV255'. This firmware may have bugs, it is an example. You are welcome to flash your own firmware! That's kinda the whole point of this board!!

PROGRAMMING

Firmware can be flashed using 'avrdude', as is the default for the Arduino Uno and similar boards. There is a jumper between the ADC header and the remote header, connect that to ensure the USB port resets the device. Disconnect that if you don't want the device resetting every time you connect to it.

The example firmware was written with PlatformIO, and can easily be flashed to the target by running the following:

```
pio run -t upload -e default
```

Since this firmware handles all the hardware setup for you, it's strongly recommended you fork that and work from there. For your convenience, an ADC header has been exposed so you can use the unused GPIO pins of the microcontroller. Aren't we generous?!

Please have fun!

HARDWARE DETAILS

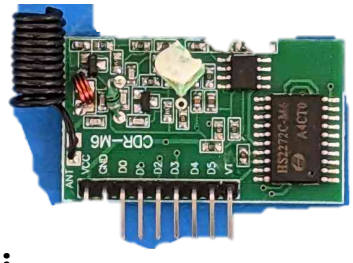
Some things cannot be altered with software. This is by design to ensure this board safely and consistently operates the Tremblr-like device it was installed into. These limitations are:

1. Fan detect / safety cutoff: If the cooling fan stalls, this board will stop the motor and signal a fault. This can be intercepted and cleared in software but will always override the software control of the power supply if the fault condition remains.

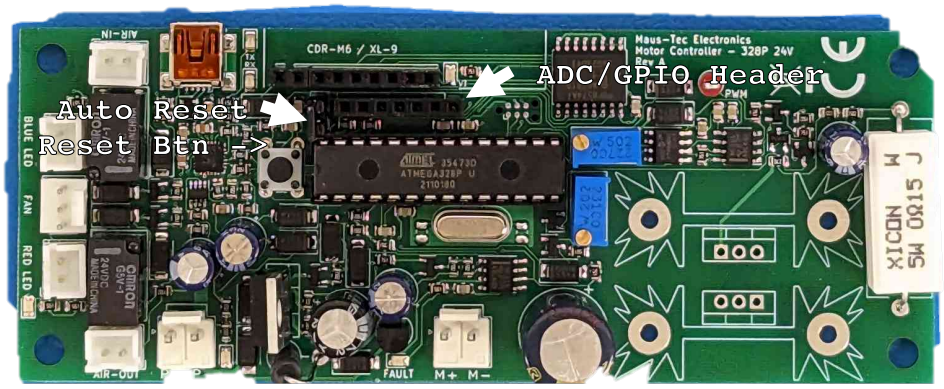
2. Motor stall / over current cutoff: If the motor stalls or draws excessive current, a similar fault condition will be raised.

3. Discrete PWM generator: The PWM signal for the motor is generated using discrete circuitry instead of using the timers of the microcontroller. This is controlled using the connected digipot.

Remote Receiver:



Main Board:



From left to right, the connections on the ADC / GPIO header should be: A4, A3, A2, A1, A0, VCC, GND

Auto Reset jumper can be removed to prevent the device from resetting when DTR changes state.

The blue trimmers adjust the minimum speed of the motor (Top) and the cutoff threshold for the stall/overcurrent protection (bottom).

That's it, have fun and enjoy this prototype board! May you do something fun with your now slightly smarter Tremblr-like device!