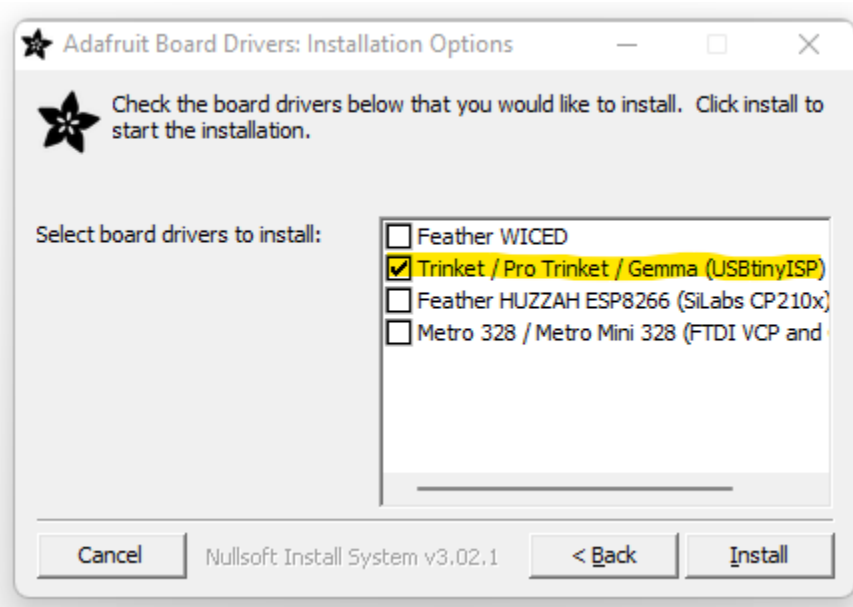


## Programming and Test Procedure

### Setup

1. Turn on the bench power supply.
2. Set the supply voltage to 24 volts and turn the current limit knob all the way counterclockwise then half a turn clockwise (current limit should be roughly 1.5A).
3. Plug the bench power supply into the test harness.
4. Connect the programmer cable to the test harness header, making sure that pin 1 on the cable matches pin 1 on the header.
5. On a Windows computer, install the USBtinyISP:
  - a. Download and run the driver package from [https://github.com/adafruit/Adafruit\\_Windows\\_Drivers/releases/latest](https://github.com/adafruit/Adafruit_Windows_Drivers/releases/latest).
  - b. Install the USBtinyISP driver, as in the following screenshot.



### Test

1. Move the test harness power switch (large switch) to the OFF position (center position). Do not place or remove a control board with the power on!
2. Place the control board onto the test harness.
3. Ensure that the board is pressed down enough to make good contact with all of the pogo pins, then secure it in place with a nut on the center screw post.
4. Move the test harness power switch to the PRG position (right side).
5. Verify that the green light is lit on the programmer and the yellow light is lit on the control board. The display backlight should be on if the board has 5V power.
6. Run install-new.bat to program the board.
7. Verify that you see a success message from avrdude in the command window, then press any key to exit.

8. Move the test harness switch to the PWR position (left side) to power the board with 24V.
9. Verify that you did not hear the bench power supply click its relays (which would indicate current-limiting mode).
10. Look at the current draw on the power supply and ensure it does not exceed 0.1A. If it does, immediately switch off the test harness and inspect the board for soldering problems.
11. Verify that the LCD screen shows RPM at 0, SPIN or PLY mode, and 0.0 hours.
12. Press the ON/OFF switch on the test harness to turn on the motor.
13. Turn the speed knob all the way counterclockwise and verify that the screen shows the RPM at approximately 200.
14. Turn the speed knob all the way clockwise and verify that the screen shows the RPM at approximately 2000.
15. Turn the change rate knob all the way clockwise and verify that when you rotate the speed knob the motor RPM changes slowly.
16. Turn the change rate knob all the way counterclockwise and verify that when you rotate the speed knob the motor RPM changes quickly.
17. Press the ON/OFF switch again to turn off the motor.
18. Move the mode switch back and forth and verify that the screen mode changes between SPIN and PLY.
19. On the bench power supply turn the voltage up to 30V and verify that the control board's overvoltage protection activates (the power supply switches into current-limiting mode). Immediately unplug one of the power cables from the power supply to reset the crowbar. Don't leave the control board in an overvoltage state for a long time.
20. Turn the power supply voltage back down to 24V.
21. Reverse the power cord leads and plug them into the power supply backwards (red to black, black to red). Nothing at all should happen. There should be no clicks or other noise, 0A displayed on the power supply current meter, and no burning smells.
22. Remove the power cord leads and plug them in again correctly.
23. Verify that the LCD display shows the normal data.
24. Move the test harness power switch to the OFF position.
25. Remove the board (ensure the power is off!) and place a "tested" sticker on the back side.

### Optical inspection

1. On the top side, verify that all components are placed correctly:
  - a. All diodes are oriented the correct direction.
  - b. The microcontroller is oriented correctly.
  - c. All resistors are the expected colors for their positions.
  - d. All capacitors are the expected shape, size, and color for their positions.
  - e. The large capacitor is oriented correctly.
2. On the back side, verify
  - a. All pins are well-soldered.
  - b. No large solder blobs are stuck to the board that might come loose and short something.