

# Masterbuilt MES 130B smoker

## PID controller addition

These are instructions for replacing the controller of the Masterbuilt MES 130B smoker with an inexpensive PID ("proportional-integral-differential") controller that holds the temperature close to the set point within a couple of degrees, instead of within 20 degrees like the Masterbuilt controller.

This project is based on the common and inexpensive (\$20 or so) Rex C-100 PID controller. It also uses a small "PID interface" printed circuit board that I built, which replaces the Masterbuilt controller while still using the existing relay and 120 volt wiring in the smoker. You don't need to open up access panels (or worse, drill out rivets) to rewire the heavy-duty power, or install a new relay and heat sink.

Masterbuilt has a bewildering number of different models. I don't know which other models this interface will work for. If the controller connects to the smoker with a 4-wire cable (blue, white, black, red), it has a good chance of working. There might be also be another temperature probe cable, but that won't matter; leave it unconnected. If their controller cable has more than 4 wires in it, you will need to do some reverse engineering; let me know what you discover.

The design of the interface board is free, at [www.github.com/lenshustek/smoker\\_mods](https://www.github.com/lenshustek/smoker_mods). It uses only three resistors, a Zener diode, and some connectors. I will make assembled boards available inexpensively, if I have any left, but this is not a business for me.

In fact, this is NOT A COMMERCIAL PRODUCT or even a KIT; it is a DO-IT-YOURSELF PROJECT. IT IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL I BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF, OR IN CONNECTION WITH THIS DESIGN OR HARDWARE OR THE USE OR OTHER DEALINGS OF IT. BEWARE, TOO, THAT YOU ARE PROBABLY VOIDING YOUR WARRANTY FROM MASTERBUILT BY DOING THIS.

No, I'm not a lawyer. I'm an engineer.

Are you in anyway? If so, here are the steps you need to take:

- Buy a Rex C-100 PID controller. There are lots of them to be had on eBay, both the original version from the Japanese originator RKC instrument, and various Chinese clones.
  - Be sure to get one configured for K-type thermocouples and SSR relay output, which is also called "pulse output". The model number I've used is C100FK02-V\*AN.
- Build or buy one of the little interface boards with the 3 resistors and one diode.
- Wire up stuff as follows:
  - Connect the two control ("SSR") outputs on terminals 4 and 5 of the C-100 to the 2-wire connector on the interface board. Make sure + goes to + and - to -.
  - Connect a K-type thermocouple to the C-100. The blue wire goes to terminal 9 and the red wire goes to terminal 10. I used a thermocouple with a 2" long probe (\$8 at <https://www.amazon.com/gp/product/B0748BQ3YL>) so that I could screw it into a hole that I drilled and tapped in the side of the smoker. But you can install it in all sorts of

ways, including running the cable between the door gasket and the frame and laying it on a shelf, or dropping it down a smoke vent hole in the top back.

- Connect the cable that went to the Masterbuilt controller to the 4-pin connector of the interface board instead, being careful to get the colors in the right order. Remove their controller.
  - Connect 120 VAC power to terminals 1 and 2 of the C-100, in series with a switch so you can turn it on and off.
  - In the unlikely event that you have also built my wood chip tray heater board, [https://github.com/LenShustek/smoker\\_mods/tree/master/chipheater](https://github.com/LenShustek/smoker_mods/tree/master/chipheater), connect the two boards together using the three-wire connectors on each.
- Of course, it should all be in a nice box and wired in a careful and safe manner. My photos at the end of this document can give you some ideas, but be creative. I used this 4.7"x4.7"x3.5" plastic project box mounted on a slanted wooden shim that goes where the original controller was: <https://www.amazon.com/gp/product/B083H9G123>.
  - Make a few parameter changes in the C-100 when you power it up for the first time. You do that by holding down the "SET" button for a couple of seconds until the display shows "AL 1". Then push the SET button repeatedly to get to the parameter to be changed, then use the arrows to change the various digits.
    - The following changes are PID values that work for me and are a good starting point. See the "auto tune" section later about making your own changes.
      - r (cycle time in seconds): 10 instead of 2. This keeps the mechanical relay in the smoker from changing too frequently.
      - P (proportional coefficient): 34 instead of 30
      - I (integral coefficient): 472 instead of 120
      - D (differential coefficient): 118 instead of 30
      - Press and hold SET to exit.
  - If your unit's display is in Centigrade and you want to change it to Fahrenheit, you need to do that in the "instrument engineer menu":
    - Press the SET key and the left arrow key together for about 3 seconds, and it should display "Cod". Change Cod to 1 with the up-arrow key.
    - Press the SET button repeatedly until it shows "Unt" (unit), and change the value from 0 to 1 with the up-arrow key.
    - Press and hold SET to exit.
  - To start smoking, use the up and down arrows to set the target temperature (SV: "Set Value") and watch the current temperature (PV: "Present Value").

### Auto-tuning

The PID values above work well for me, and are a good starting point, but you can experiment with having the Rex C-100 tune itself for your configuration.

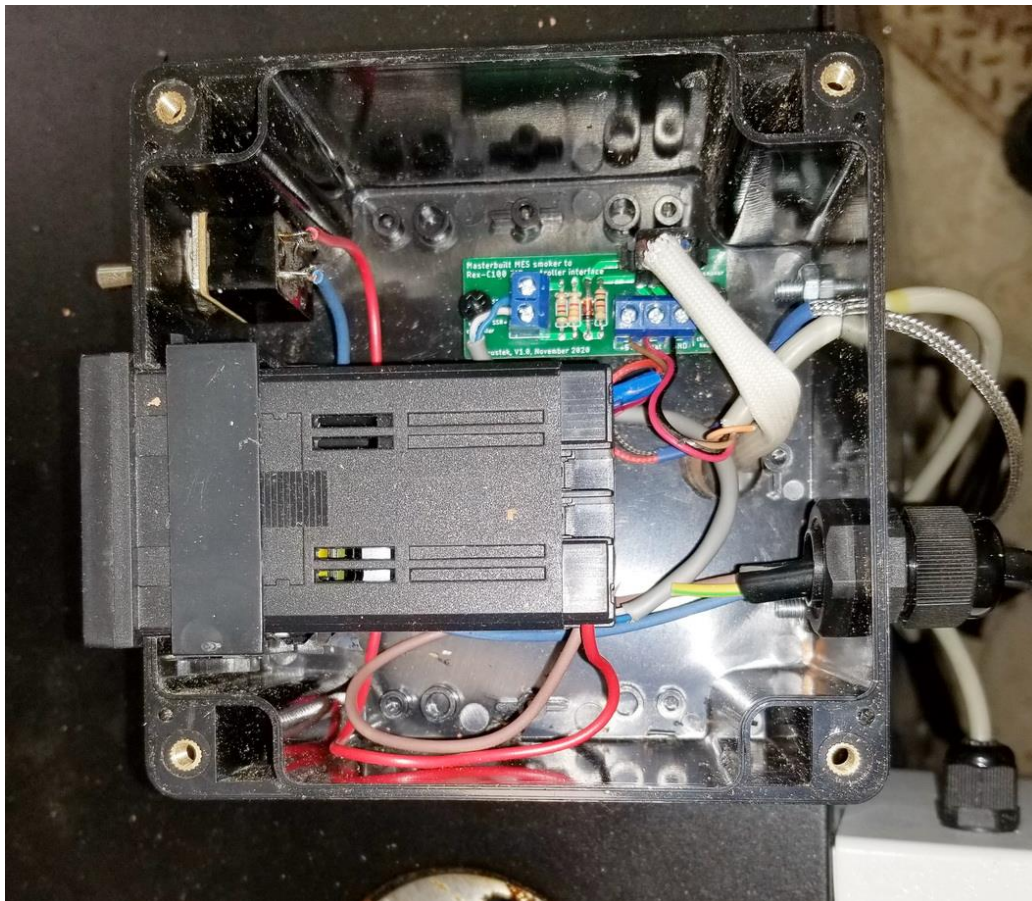
- Set up the unit as normal. Maybe put a 10- or 15-pound pan of water inside to simulate the thermal load of food.
- Set the temperature to 210F and let it get up to about 175F.

- Change the ATU (auto-tune) parameter to 1.
- The "auto" light will come on. Let it run for 15 minutes or so, after which it should turn off by itself. If it doesn't go off after 20 minutes, set ATU back to 0 to stop the auto-tuning session.
- Look at the P, I, and D parameters to see how they were changed. Try that for a while.  
Lather, rinse, repeat: if you auto-tune again, it will tweak the values.

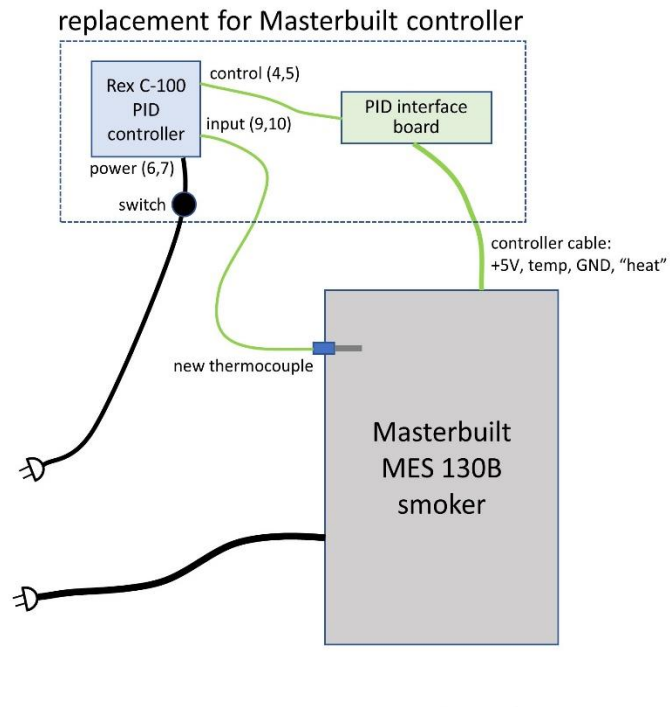
If you build this, let me know how it goes. Maybe post about your experience in this thread at SmokingMeatForums: <https://www.smokingmeatforums.com/threads/a-newbies-technical-review-and-mods-to-a-masterbuilt-mes-smoker.302909/>

Enjoy.

Len Shustek  
29 November 2020

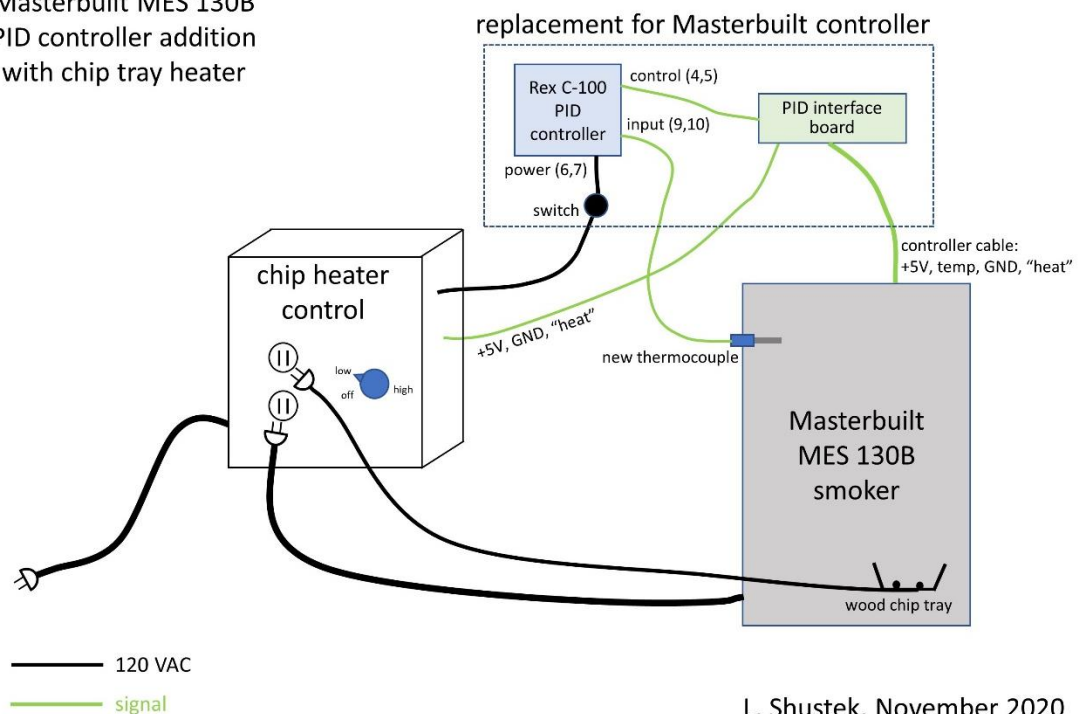


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Masterbuilt MES 130B  
PID controller addition  
with chip tray heater



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