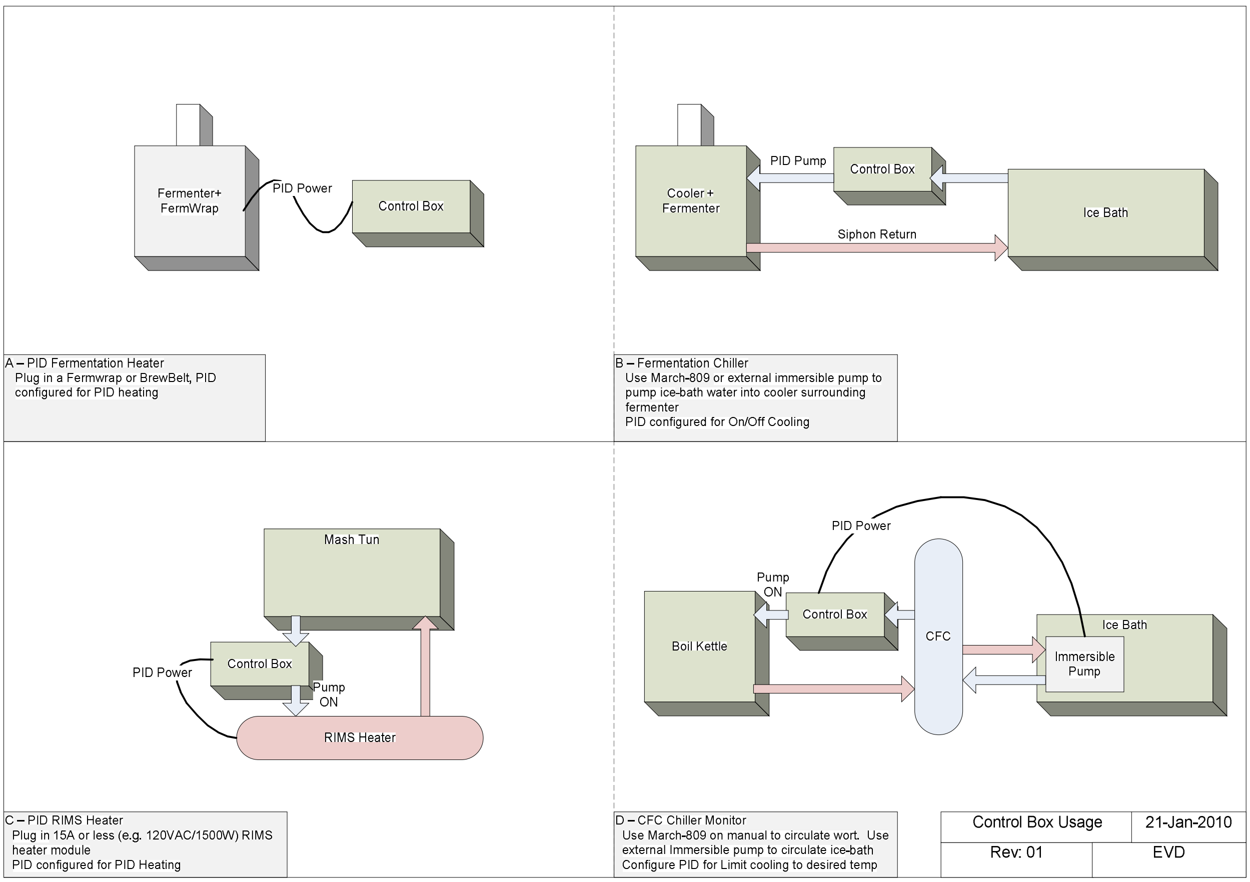
Brewery Controller

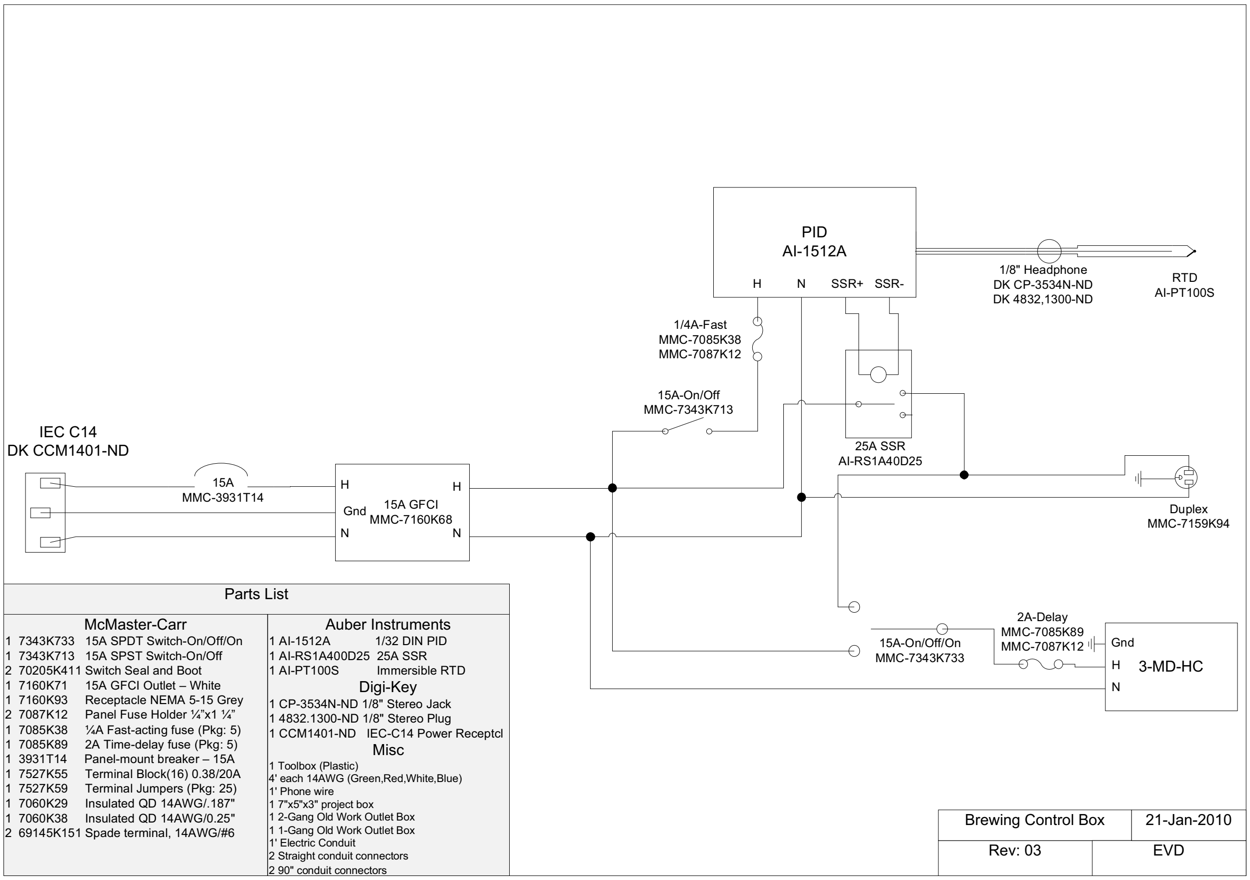
There are three main tasks that I need to get better control of in my brewery: fermentation temperature control, mash temperature control, and faster post-boil chilling. After some research and planning, I realized that they can all be tackled by the combination of a temperature controller and a pump (Figure 1). For those with an immersion chiller, the post-boil chilling still follows the same idea in the figure, except the main pump feeds the whirpool in the kettle, and the secondary pump drives ice-water through the IC.



As with any project, I started my planning by identifying the main components that I would need. I already had a counterflow chiller, and my mash-tun and HLT coolers will easily serve double-duty in the fermentation chilling sceranio, keeping the amount of equipment to store and manage to a minimum. The only elements that I did not have were the pump, controller electronics, and RIMS heater. Due to financial constraints, my construction of the heater element will be delayed until later this year, but I can make immediate use of the pump and controller box, so that is the focus of this article.

If you have space to build a permenant brew-stand, finding the space to house such a controller is easy. However, many of us do not have the luxury of a permenant brew stand, and need something that is portable, easy to store, and easy to use. For that reason, I have housed my brewery controller in a toolbox. All of the electronics fit neatly inside; protected from spills, splashes, or other dangers, they are easily accessible and ready to use come brew-day. By mounting the pump-head outside the toolbox, and keeping the motor inside, I am able to protect its electronics from splashes as well, and have one less item to manage. The two major components of the control box are the temperature controller, and the pump. Most brewers use the March 809 pump, but there are also many complaints about its poor ability to handle height differentials, or have a good flow-rate to get a whirpool going. After a little research, and luck on eBay, I settled on the Little Giant 3-MD-HC pump, which is also a magnetically-driven food-safe pump, but has almost twice the power of the March pump. For the temperature controller, I wanted something compact enough to easily mount inside the toolbox, but still have the ability to run as a PID controller, which is especially helpful when running a RIMS heater. It also must have a simple hysteresis-bounded on/off mode for controlling a pump, which does not hold up under pulsed power like a heating element. I setteled on Auber-Instruments' smallest controller, the 1512A, with an immersible temperature probe, and solid-state relay.

The next step was to design the schematic for the control box. Since most RIMS heaters typically pull about 12.5A of current, I settled on designing for 15A, which means that my main power lines must all be at least 14-AWG. Since this wire is easy to work with, I used it for all the wiring, except the connector for the RTD temperature probe, which used about 6" of old phone cord. I added a SPDT switch for the pump, to allow me to select whether to have it be on, off, or controlled by the PID output, and an external receptacle for use when using a RIMS heater or other external device. For full details, see the schematic in Figure 2. For those of you who can add, you'll notice that if I'm running a 12.5A RIMS element and the 2A pump simultaneously, I'll be close to the 15A limit of the wiring. If This becomes an issue, I will upgrade the main power line and SSR-controlled lines to 12AWG, which will allow a 20A circuit: plenty of head-room. In the mean time, the 15A breaker is easy to reset if necessary.



Parts List

McMaster-Carr

1	7343K733	15A SPDT Switch-On/Off/On
1	7343K713	15A SPST Switch-On/Off
2	70205K411	Switch Seal and Boot
1	7160K71	15A GFCI Outlet – White
1	7160K93	Receptacle NEMA 5-15 Grey
2	7087K12	Panel Fuse Holder ¼"x1 ¼"
1	7085K38	¼A Fast-acting fuse (Pkg: 5)
1	7085K89	2A Time-delay fuse (Pkg: 5)
1	3931T14	Panel-mount breaker – 15A
1	7527K55	Terminal Block(16) 0.38/20A
1	7527K59	Terminal Jumpers (Pkg: 25)
1	7060K29	Insulated QD 14AWG/.187"
1	7060K38	Insulated QD 14AWG/0.25"
2	69145K151	Spade terminal, 14AWG/#6

Auber Instruments

1	AI-1512A	1/32 DIN PID
1	AI-RS1A400D25	25A SSR
1	AI-PT100S	Immersible RTD

Digi-Key

1	CP-3534N-ND	1/8" Stereo Jack
1	4832.1300-ND	1/8" Stereo Plug
1	CCM1401-ND	IEC-C14 Power Receptcl

Misc

- 1 Toolbox (Plastic)
- 4' each 14AWG (Green,Red,White,Blue)
- 1' Phone wire
- 1 7"x5"x3" project box
- 1 2-Gang Old Work Outlet Box
- 1 1-Gang Old Work Outlet Box
- 1' Electric Conduit
- 2 Straight conduit connectors
- 2 90" conduit connectors

For construction, I found that "Old Work" gang boxes were easily mounted inside the toolbox by making a cutout, and bolting them to the box, instead of screwing them into drywall, and a standard project enclosure box from Radio Shack houses the rest of the electronics. The main power plug and 15A breaker are mounted on the left end of the toolbox via the 1-gang electric box, and the GFCI and switched NEMA 5-15 outlets are mounted in a 2-gang box on the toolbox's front. After mounting the terminal strip inside the project box, I bolted it to the toolbox's floor so that it just touched the front and back of the toolbox, giving me a place to mount the switches, fuses, and PID. To mount the pump, I first disassembled the pump head, and then mounted the pump out the right-hand end of the toolbox by running the magnetic drive ring outside the toolbox, and then reassembling the head to sandwich the toolbox's wall between the two halves of the pump head. Making the cutouts was the trickiest part, since most parts were not big enough to mount through both the toolbox and project-box, so I had to make recessed cutouts for them. If you do not have the luxury of a drill-press, you really want to use forsner bits for this, as the plastic is soft enough that the spiral bits get a good bite and cut straight through in an instant. After that, the rest was simply wiring everything up, per the schematic.

To see the final result, just come to the March meeting, where it will be on display!