

# 1 Purpose

Documentation for Simple Brewtroller Firmware

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## 2 Objective

### Goals

The program aims to be a “most simple” firmware suitable for beer brewing. It may also be useful for other temperature control applications that need selectable open-loop control as well as closed-loop thermostatic control in the same unit.

## 3 Microcontroller hardware

The microcontroller used is an ATMEGA328 8-bit AVR© microcontroller. It was selected for its availability. The firmware would run on other AVR microcontrollers with minimal modification. The microcontroller is powered by 5V and runs at 1MHz, which is how it’s configured out-of-the-box. No external crystal is needed, just apply 5V on the Vcc pin and pull up RESET.

Flashing this firmware to the microcontroller will require an in-system-programmer such as the AVRISPv2 or USBTinyISP. Instructions on programming AVR microcontrollers is outside the scope of this document. All the cool

kids are using Arduino nowadays, and you may be able to pretend this is an Arduino program and try to flash it with the Arduino IDE and it may Just Work. You are on your own on the Arduino front.

## 4 Perhipheral hardware options

Input Item	AVR Pin	Voltage details	Function notes
Boil Switch	PB4	GND=ACTIVE	Set boil duty cycle
ON Switch	PB5	GND=OFF	kill SSR and contactor
Temp probe	PC0	0V-5V analog in	LM335
BOIL pot	PC1	0V-5V analog in	Heating element power
TEMP pot	PC2	0V-5V analog in	Temp setpoint

Figure 1: Table Of Inputs

Output Item	AVR Pin	Voltage details	Function notes
Blinkenled	PB2	LED+resistor	Blinks
SSR	PB5	Hook to SSR	5V=heater on
Contactor	PB5	for NO Contactor	5V=Contactor on

Figure 2: Table Of Outputs

## 5 Operating Details

As you can see, the system is configurable. With nothing hooked up, the firmware does nothing. You can add functionality by simply hooking up more hardware. An output for a contactor is provided, but if you leave it disconnected, no problem. An input for a temp probe is provided, but if you leave it disconnected, the firmware just ignores thermostat functionality. The simplest possible hardware is a 2-position (or 3-position “center-off”) switch connected to the “boil” and “off” inputs. With a pull-up resistor on the “BOIL” pot input, this allows 3-way switching between ON, OFF, and BOIL. If you want to control the boil with a knob, hook a pot up to the BOIL input. If you want at thermostat, hook up a temp probe and another pot. A full-featured system has a 3-way, “center-off” switch to select “OFF”, “ON”, and “BOIL”. When OFF, the contactor and

SSR output are both off. When set to BOIL, the contactor is on and the element is fired at the fixed BOIL duty cycle. When on ON, the BOIL potentiometer is used to set the boil duty cycle. If a temp probe is connected, the element is switched on and off according to the temperature and the setting on the TEMP PROBE knob. Note that the BOIL knob setting is still applied even in thermostat mode, so you can either turn it up all the way or leave it to some partial setting to tune system response or avoid overshoot.

END OF DATA