

1 Purpose

Documentation for Simple Brewtroller Firmware

3. Index

1	Purpose	1
2	Objective	1
3	Microcontroller hardware	1
4	Perhipheral hardware options	2
5	Operating Instructions	2

List of Figures

1	Example System	1
2	Perhipheral Hardware	2
3	Table Of Inputs	2
4	Table Of Inputs	3

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 may need selectable open-loop control as well as closed-loop thermostatic control in the same unit.

Figure 1: Example System

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 (“micro”) 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 simply flash the program using the Arduino IDE as if it was an Arduino program and it may Just Work. You are on your own on the Arduino front.

4 Peripheral hardware options

Figure 2: Peripheral Hardware

Input Item	Status	AVR Port Pin	Voltage details	notes
Boil Switch	Optional	PB4	GND=ACTIVE	Applies fixed duty cycle for boiling
ON Switch	Optional	PB5	GND=OFF	kills SSR and contactor outputs
Temp probe	Optional	PC0	0V-5V analog in	LM335 diode temperature sensor
BOIL pot	Optional	PC1	0V-5V analog in	Adjusts heating element power
TEMP pot	Optional	PC2	0V-5V analog in	Adjusts temp setpoint

Figure 3: Table Of Inputs

5 Operating Instructions

Initial Setup

1. With nothing hooked up, the firmware does nothing. You can add functionality by simply hooking up more hardware. The simplest possible hardware is a 2-position (or 3-position “center-off”) switch connected to

Output Item	Status	AVR Port Pin	Voltage details	notes
Blinkenled	Recommended	PB2	LED+resistor	Blinks at star
SSR	Kinda Essential	PB5	Hook to SSR	Switches heating elem
Contactor	Optional	PB5	Hook to NO Contactor	5V=Contacto

Figure 4: Table Of Inputs

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 switch on and off as 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