

Brewing Automation

Paul Hess



Au·to·mation

- defined as the technology by which a process or procedure is performed without human assistance.
- In brewing terms it is typically the control of temperature (heating and/or cooling) or the use control valves or pumps to route liquids.

Why do we automate

- Consistency and repeatability
- Mash Temperature stability
- Hands off (generally).

- Considerations:
 - Typically it will cost about \$100-\$150 per channel of control.
 - Water of course does not mix electricity and every effort should be made to avoid water contact with electronics.

The Guts

- Temperature Controllers
- Types of probes
- Relays and contactors
- Solenoid valves

Temperature Control

- Types of Controllers
 - Basic Temperature controllers (Ranco or STC-1000)
 - PIDs
 - Auber
 - Watlow
 - Other Manufactures
 - RaspberryPi and Aurduno
 - I am not covering these devices.



Temp Controller VS PID

- Temp Controller has a Set Point and a Dead Band.
- What does PID stand for? Proportional Integrative Derivative.
 - What does this mean?
 - Proportional acts as the dead band where it is the difference between the setpoint and actual value.
 - Integrative controls the “speed” or rate of change. This value will adjust to the system based on performance of the system.
 - Derivative loop helps to control overshoot or ringing. For brewing purposes this term is generally not needed. My set up does not use this term.

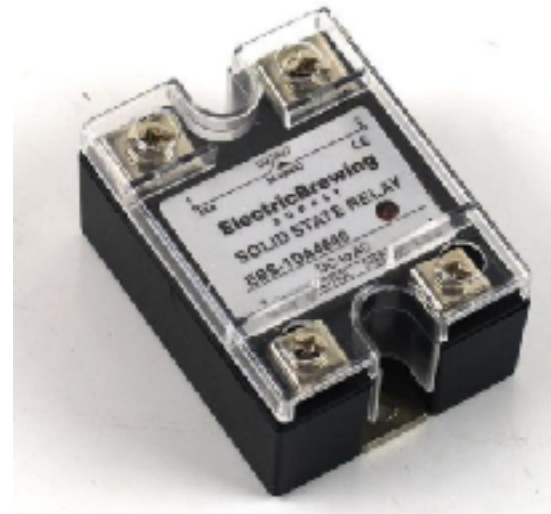
Types of Probes

- Thermistor
 - Operates on the principle of resistance
 - 10k ohm or 100 ohm types (10k most common)
 - Linear response
 - Response time is slower
- Thermocouples
 - Uses the principle of two dissimilar materials to create a difference in voltage
 - Type K or T are most common for brewing
 - Wide temperature range
 - Requires special wire to make extensions
 - Can give incorrect readings if the connection gets wet or hot.
- RTD
 - Linear response
 - Faster response time than thermocouple
 - 3 or 4 wire types
 - Can use standard wire to make extensions



Relays and Contactors

- There are two types of relays that you can use
 - Mechanical relays where a moving contact opens and closes. This can be integrated into the temperature controller. Can be 10v DC or 120v AC
 - Solid State relay where the contact is a dielectric contact that closes when a voltage is applied. No moving parts. Uses 10v DC for control signal
- Contactors
 - Used for 240v applications. A relay is used to close the contactor with a 120v signal.



Solenoid Valves

- Used to control gas for burners or can be used to open and close fluid valves. These are only on/close valves. For brewing applications you want a nominally closed valve. When signal is applied the valve opens. These are typically are 120v AC powered. ASCO valves are the most common like the 8030G016. Look to Ebay for best prices. Expect \$60-150 per valve.
- Variable Control Valves. I have found a few that could work in application. These require a 24v DC power supply and use a 0-10 v DC control signal. The Belimo B212B could work. Cost \$130. I haven't tried it.

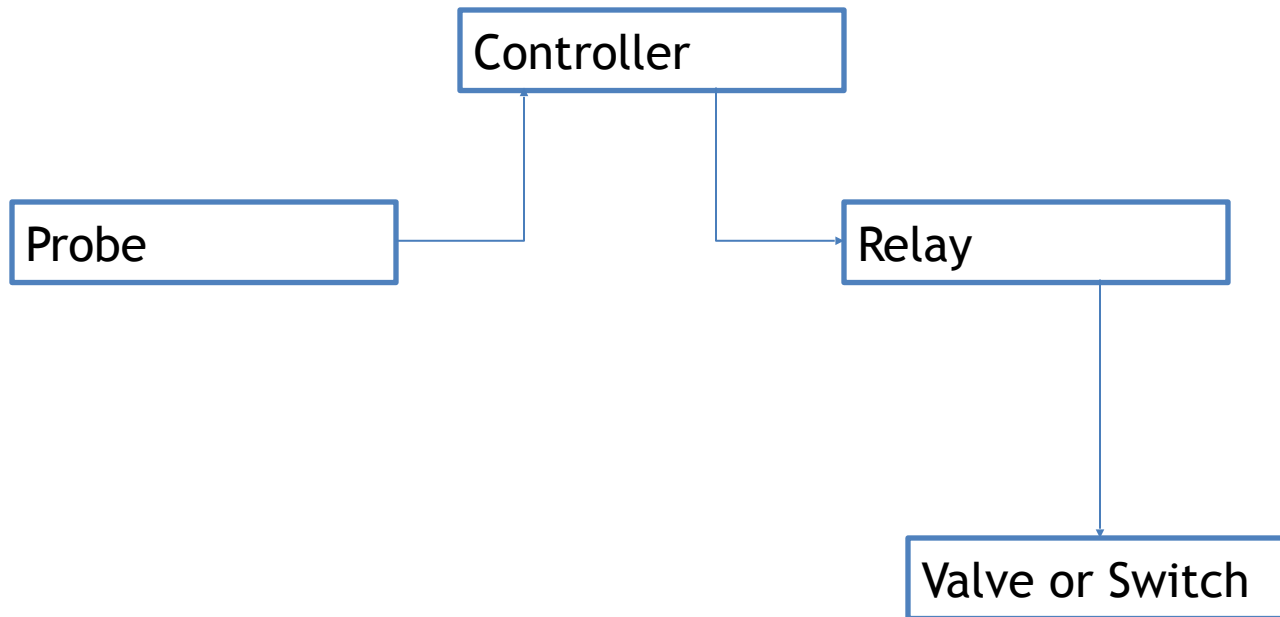


Belimo B212B+TR24-SR US



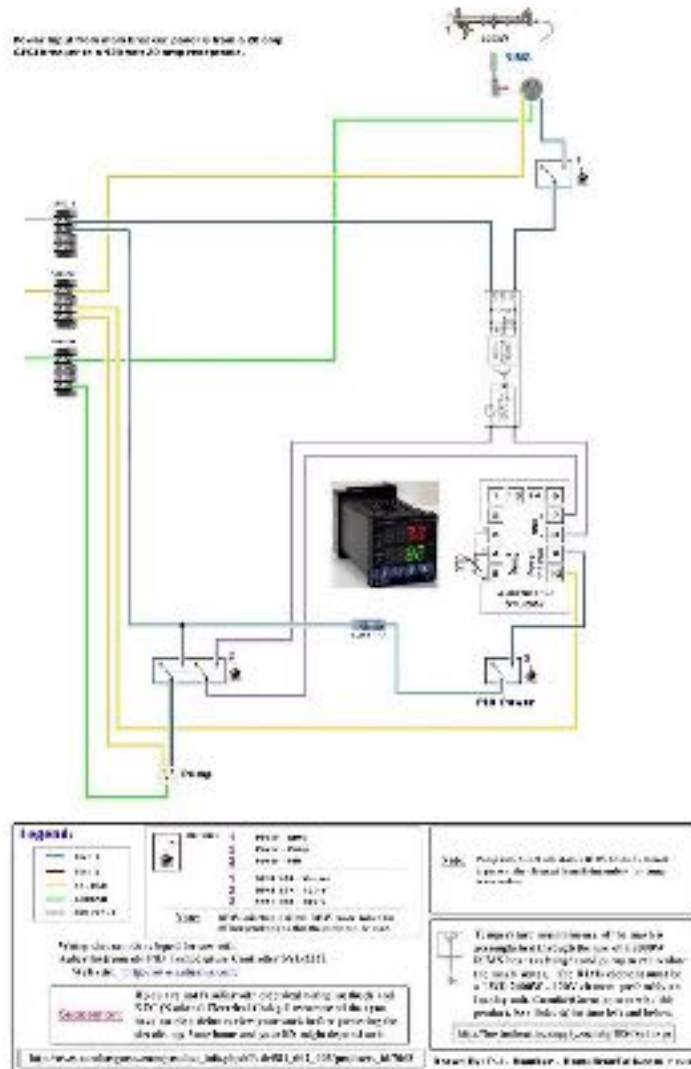
Belimo B212B+TR24-SR US : Belimo 2-Way Characterized Control Valve Assembly

Basic Layout

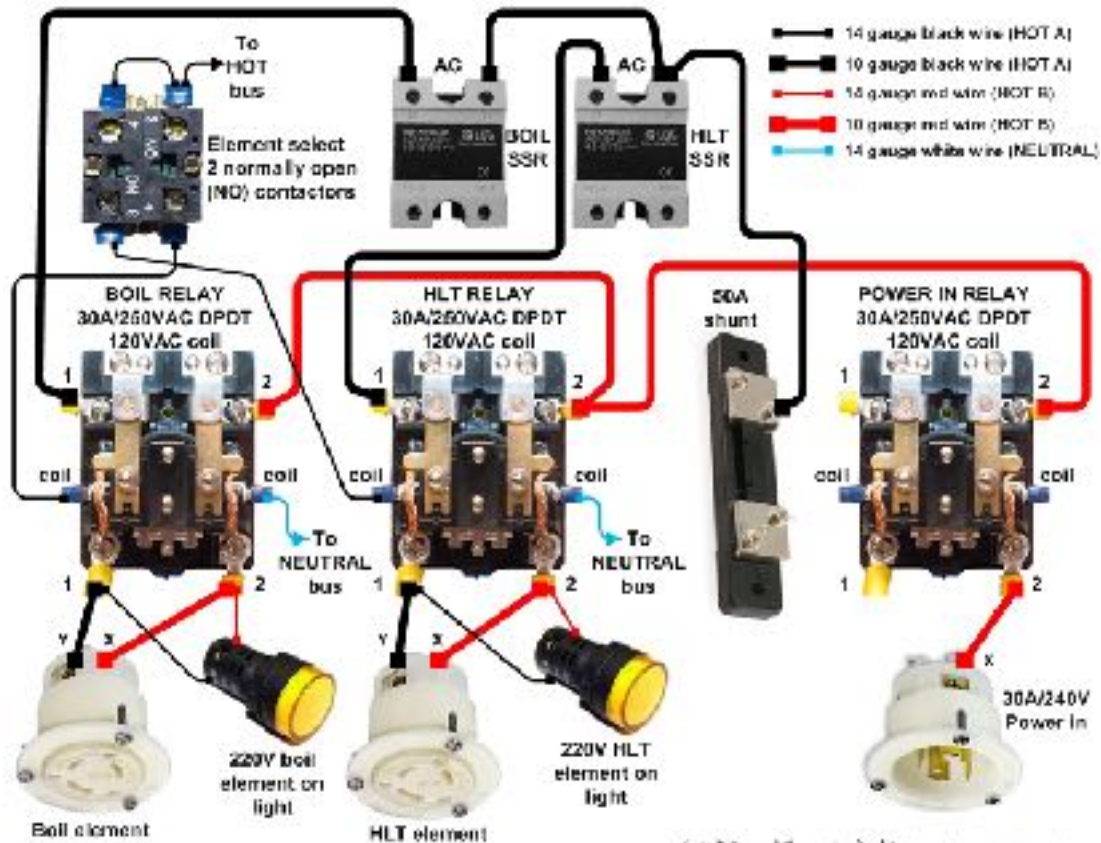


Gas Burner Layout

This diagram will work for both gas and 120V heating applications.



Electric Kettle 2



Locations

- Temperature
 - www.watlow.com
 - <http://www.auberins.com/>
 - https://www.amazon.com/Elitech-STC-1000-Temperature-Controller-Centigrade/dp/B00Y8T9YZG/ref=sr_1_2_sspa?ie=UTF8&qid=1522618554&sr=8-2-spons&keywords=stc-1000&psc=1
- Sensors
 - <http://www.auberins.com/>
 - ebay
- Relays
 - https://www.auberins.com/index.php?main_page=product_info&cPath=2_30&products_id=9
- Contactors
 - <https://ebrewsupply.com/collections/ssr-spdt-and-contactors/products/2-pole-63a-220v-coil-din-rail-contactor>
- Valves
 - www.asco.com
 - https://www.energycontrol.com/Belimo-B212B-TR24-SR-US-p/b212b-tr24-sr_us.htm