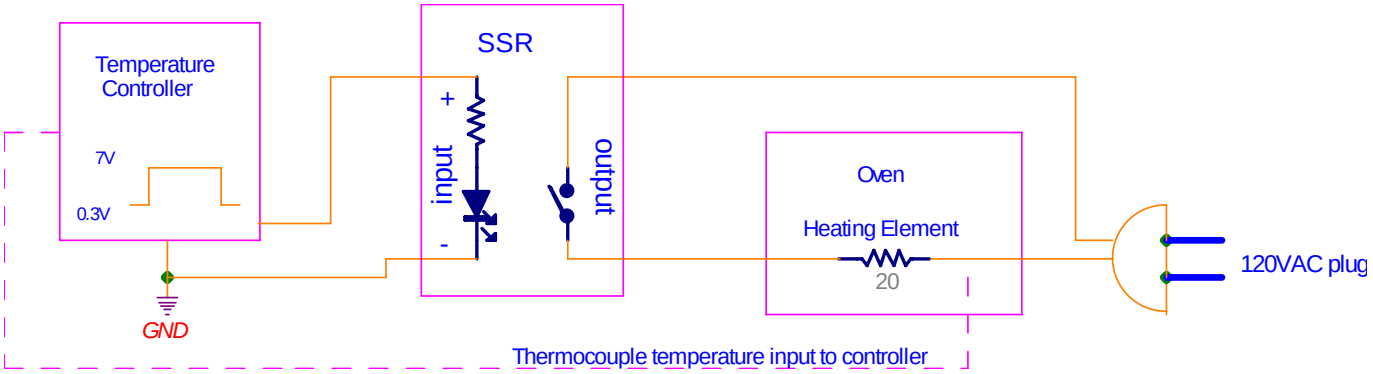
HWK #3 Solution (Solid State Relay)

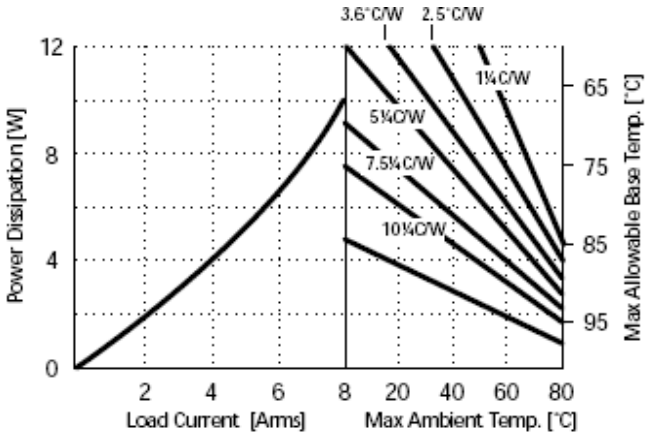


Since the load is a 20Ω resistive heater powered from the wall socked the max current will be: 120V/20Ω = 6A. You should be able to trigger the solid state relay from the controller output which is 7V at up to 20mA.

SSR Requirements:
AC SSR output: >6A, >120VAC
SSR Input: <7VDC, <20mA

You always want to have a safety margin so the pick a relay with contacts rated at >= 8A and an input that can be triggered with say 5VDC at less than 20mA. I searched digikey.com for solid state relays and picked the following SSR:

Digikey #: CC1129-ND, Manufacturer #: S218
Output: 8A@140VAC
Input: 3.5-8VDC (18mA @5V)



Since the input requires less than 20mA the output of the temperature controller will be able to turn on the relay.

Note: The relay lists a maximum voltage drop of 1.6V (worst case) when on (i.e. it's not a perfect switch so it will dissipate power and get hot). The power dissipation vs. current graph shows that with a load current of 6A the SSR will dissipate about 7W. If the relay's thermal resistance is given you can determine the temperature rise of the relay. The datasheet assumes you will be bolting it to a heatsink and only provides the thermal resistance between the junction and the case and not between the case and the ambient air.

We're given that the junction will be 1.5C/W hotter than the base plate. If we bolt on a heatsink with a thermal resistance of 5C/W the junction would be (5C/W + 1.5C/W)*7W = 45.5C above ambient. With a 25C ambient temperature the die would be 70.5C and the heatsink would be 60C. The graph above lists the maximum base plate temperature as **68C** when using a 5C/W heatsink with an ambient temperature of 25C. We calculate that the baseplate would be **60C**. This safety margin is too small as the temperature calculations are estimates and the ambient temperature can change. To play it safe use a heatsink with a thermal resistance of 3-4C/W (or less).