Temperature Controller

General Description:

The Temperature Controller uses a BS2P24 Parallax module, as well as other components, that controls a pair of Solid state relays for AC powered hardware and isolation. It has a user adjustable working temperature range of 32F to 999F, and is set by means of a pushbutton and a rotary encoder. The temperature is maintained and monitored by use of a Parallax thermocouple. A buzzer is incorporated into the circuitry to let the user know that the desired set temperature has been reached and functions only on start up's. This is especially useful on cold start up's. An Led display shows the current temperature of the thermocouple monitored hardware automatically, and while adjusting for the desired set temperature, the display will show the user's input while rotating a temperature adjustment knob. The set temperature maybe adjusted at any time during operation without having to perform a reset and the circuit will retain its last known user set temperature after shutdown. A reset pushbutton is added to the circuit just as a standard.

This particular Project is used to control two solid state relays in unison, which in turn is connected to a pair of 500 watt heater bands that heats a Molded Injection Machine heater barrel, where the plastic is turned from a solid into a liquid state. The melting temperature varies depending on what type of plastic is used. For this reason, the Temperature Controller is user adjustable. The accuracy is usually a few degree's above or below the selected set temperature. The Thermocouple lead is attached directly to the heater barrel. Although this project was job specific, it can be used for many different applications or projects that require temperature control along with the features of AC isolation and solid state relays.

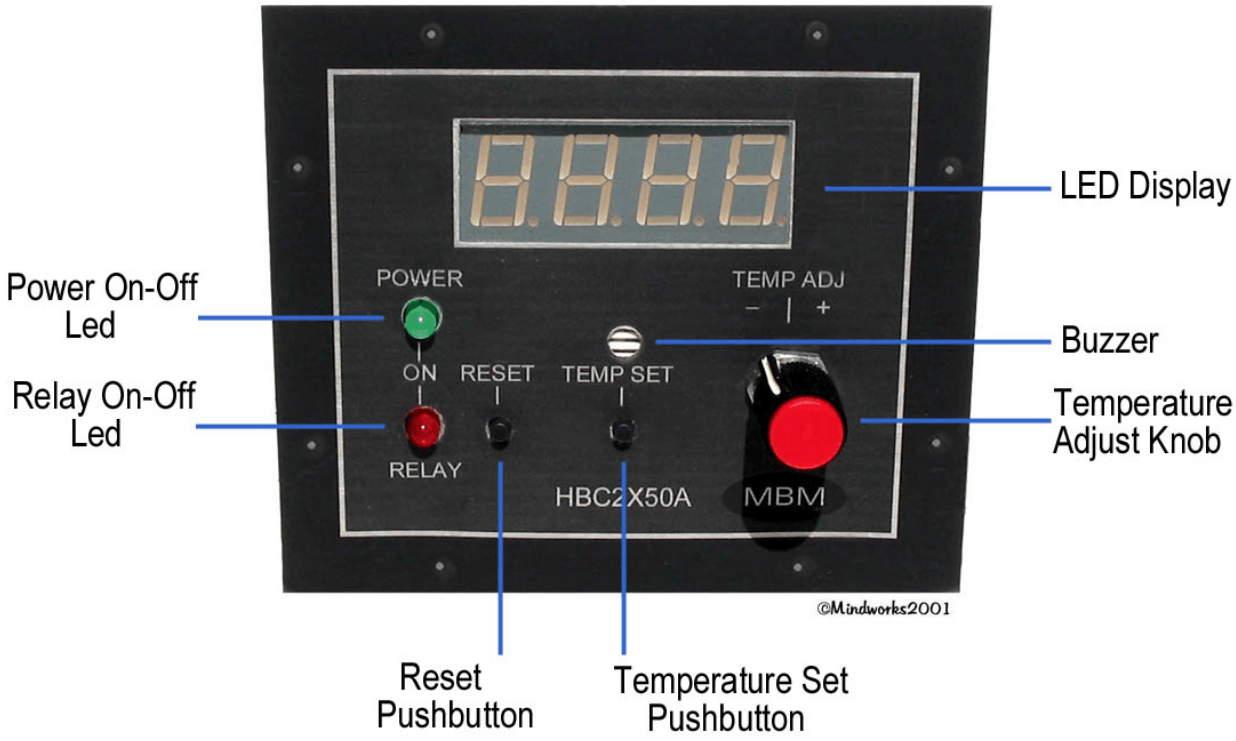
Operation:

The startup is simple and straight forward. With the thermocouple lead mounted to the hardware to be monitored, and the solid state relay's connected, plug in the power supply. The led display will now display the temperature of the device being monitored and the temperature control process will begin automatically controlling the solid state relays. To set the desired temperature of the monitored device, push and hold down the Temp Set pushbutton and rotate the Temp Adj knob until the needed temperature is displayed on the Led display. Release the Temp Set pushbutton to display the current temperature once again on the Led display. Once the current set temperature of the device being monitored has been reached, the internal buzzer will sound off three times and will then be silenced. The buzzer only functions during the startup phase to let you know that the user adjustable set temperature has been reached.

To reinstate the buzzer feature at anytime, simply press and release the reset button. If the set temperature has been reached, the buzzer will sound off. If a new higher set temperature has been programmed in, the controller will automatically turn on the SSR's until the new higher set temperature has been obtained, thus setting off the buzzer once again. When finished using the controller, simply unplug the power supply to shut it down.

Front Panel Description:

Power On-Off Led : Indicates Power is being supplied to the Controller.
Relay On-Off Led : Indicates when relay(s) is on or off.
Reset Pushbutton : Resets the Stamp.
Temperature Set Pushbutton : Press and hold to use Temperature Adjust Knob.
Temperature Adj Knob : Adjust's the set temperature of the monitored hardware by rotating the knob clockwise or counter-clockwise. The Led display will show the temperature increments while being adjusted by the user.



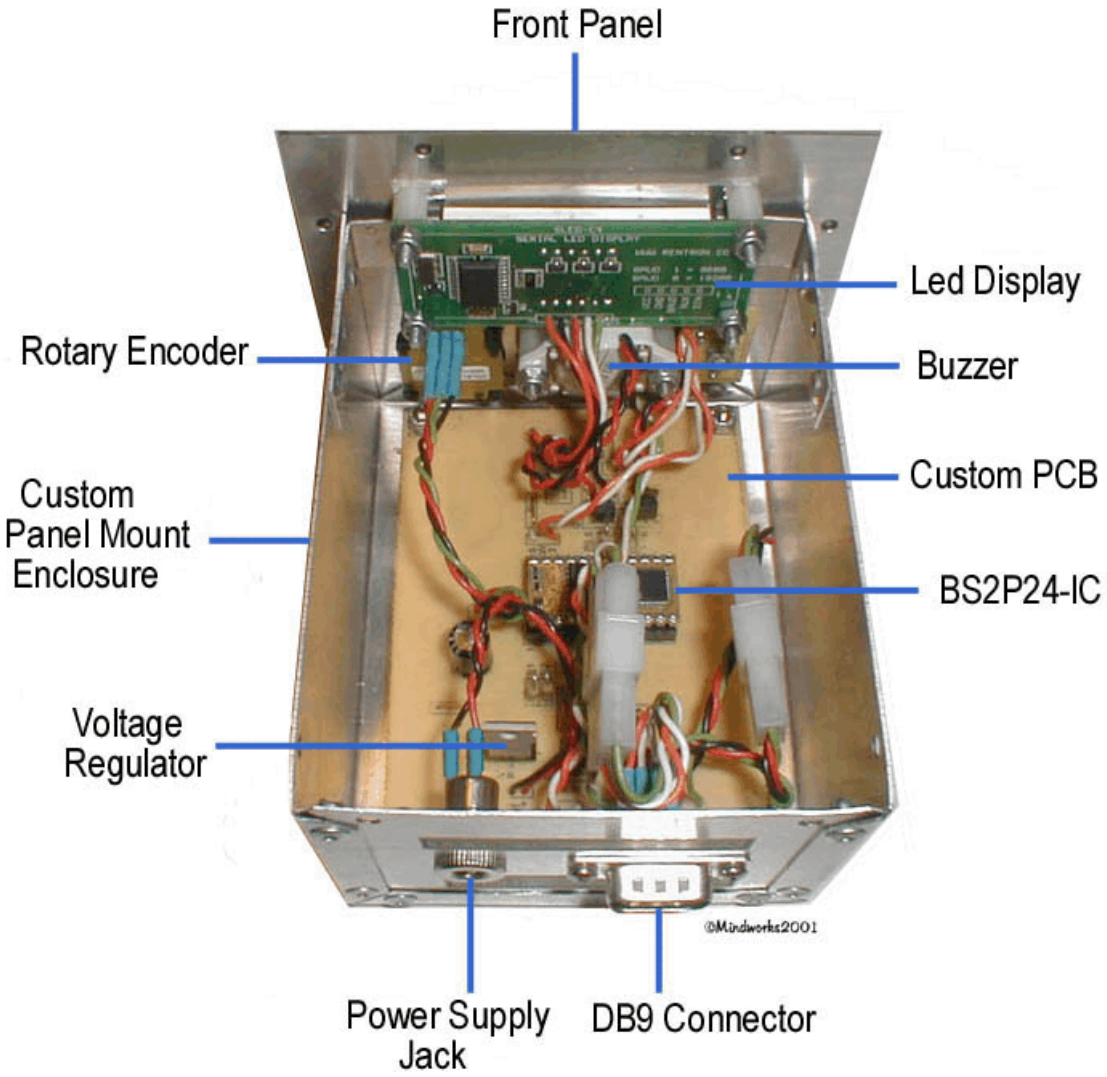
Operational Mode Examples:

Warming up to a user Set Temperature of 708F. Green Power Led indicates power on to the circuit. The Red Led indicates the Solid State Relays are on....

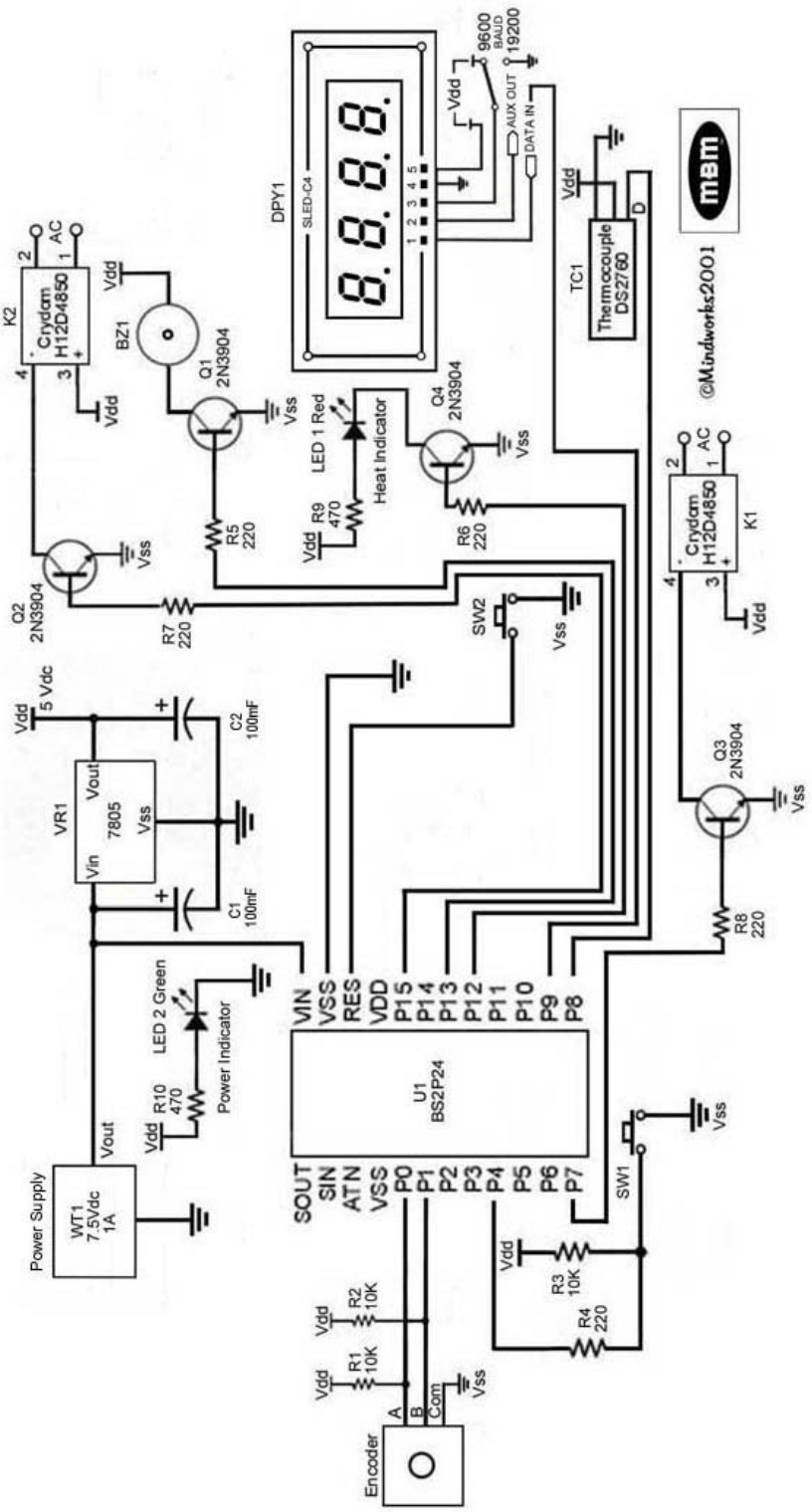
Once the Set Temperature of 708F has been reached, the Red Relay Led turns off and the internal buzzer sounds off three times indicating that the Set Temperature has been reached....

A Look Inside:

Note the clean set-up. The 3½" wide x 3" high x 4 ½" deep Custom Enclosure allows for plenty of room for this project. The Front Panel mounting flange is 3/8".



The Schematic:



Parts List: Cost Column is per piece:

Qty	Part Number	Description	Vender	Cost
1	BS2P24-IC	Microcontroller	Parallax	79.00
1	28022	DS2760 Thermocouple Kit	Parallax	29.95
1	750-00009	7.5v 1A Power Supply	Parallax	10.95
2	400-00001	Tactile Pushbutton	Parallax	1.29
1	SLED-C4	Led Serial Display	Reynolds Electronics	34.95
1	GH3071-ND	Grayhill Encoder 36 Pos Pc	Digi-key	4.71
2	CC1105-ND	* Crydom 50A SSR	Digi-Key	49.60
1	274-1563	Panel Mount Power Jack 2.1	Radio Shack	1.99
1	276-1538	** D-Sub 9 Pin Female	Radio Shack	1.99
1	276-1537	** D-Sub 9 Pin Male	Radio Shack	1.99
2	276-1539	** D-Sub Hood	Radio Shack	1.99
1	273-054	Piezo Buzzer	Radio Shack	3.49
2	272-1028	100mf 35v Electrolytic	Radio Shack	1.29
1	271-1313	220 Ohm 5% 1/4 w 5 Pack	Radio Shack	.99
1	271-1317	470 Ohm 5% 1/4 w 5 Pack	Radio Shack	.99
1	271-1335	10K Ohm 5% 1/4 w 5 Pack	Radio Shack	.99
1	276-1617	NPN Transistor 15 Pack	Radio Shack	2.59
1	276-1770	7805 Voltage Regulator	Radio Shack	1.59
1	276-041	Red Led 5mm	Radio Shack	1.49
1	276-022	Green Led 5mm	Radio Shack	1.49
1	575-11044624	24 Pin Socket	Mouser Electronics	1.04

* = Substitutes Ok, Compare Data Sheets
** = Can be omitted for direct wiring

Parts List Cont: Cost Column is per piece:

Qty	Part Number	Description	Vender	Cost
1	HB001	Custom Pcb Etched-Drilled Main Board	Mfg In House	----
1	HB002	Custom Pcb Etched-Drilled Switch-Led Board	Mfg In House	----
1	HB003	Custom Label- Enclosure	Mfg In House	----
1	HB004	Custom Enclosure-Drilled	Mfg In House	----
1	------	Misl Hardware, Screws, Nuts, Standoffs, Knob, Etc	------	10.00
1	------	Heat Shrink Tubing	------	1.00
1	------	Wiring Etc	------	5.00

Precautions:

As with all Electrical devices, Hardware or Appliances's, use extreme caution and always enclose all Low and High Voltage hardware or sources to protect user's from shock hazards which could result in injury or death....

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Credit:

Thanks to Chris Savage and the Parallax team for the support during this project....