



## DIFFERENTIAL DEW HEATER CONTROLLER

### Bill of materials

U1 - LM324 quad op amp  
U2 - LM339 quad comparator  
U3 - LM 7808T 3 terminal 8v fixed regulator  
U4,U5 - LM335AZ temperature sensors

D1 - red light emitting diode

Q1 - PN2222 NPN small signal transistor  
Q2 - MPS3055 MOSFET in TO-220 package

C1 - 470uF 25V electrolytic  
C2 - 0.1uF metalized polyester  
C3 - 470pf Ceramic disk

VR1,VR2 - 20K 15T PC mount trimmer potentiometer  
VR3 - 20K ¼" shaft linear taper potentiometer

R4 1K ¼ W 5%  
R5 3.3K ¼ W 5%  
R1,R2 5.1K ¼ W 5%  
R6,R8,R9 10K ¼ W 5%  
R11,R12 20K ¼ W 1%  
R3 62K ¼W 5%  
R10,R13 200K ¼ W 1%

### Additional items

small plastic enclosure with pad per hole pc board  
knob for ¼" shaft  
2.5x5.5mm coaxial dc power plug on 12" leads and strain relief  
2.5x5.5mm coaxial dc power jack panel mtg  
hook and loop fastening material  
panel mtg 5 pin DIN jack and mating plug  
3 conductor microphone cable or similar  
heat shrinkable tubing  
ORION 12V dew zapper heater or other homemade dew heater element

### Construction notes.

The enclosure in addition to supporting the pc board has the 20K pot VR3 and it's knob mounted with LED D1 located nearby. A blank self adhesive label is placed under the knob to allow calibration markings to be directly marked on the unit. The power cable for the unit is a 2.5x5.5mm coaxial DC power plug, center positive, with aproximately 12" of cord. This is mounted using a push in strain relief. The enclosure also will need a 2.5x5.5mm DC coaxial power jack and 5 pin DIN jack mounted in it as well.

The sensor assembly consists of U4 and U5 each with it's leads extended using microphone cable and sealed with heatshrink. These two sensors are soldered to a common DIN plug. U4 will be strapped to the OTA such that it is surrounded by free air. U5 is mounted between the dew heat and telescope.

### Calibration

Apply power and with both sensors taped together to equalize their temperature measure the voltage between the end of R12 opposite that connected to U1 pin three and ground. 2.93 volts is typical. This should be the approximate room temp at 10mv/K.

Now measure between the end of R11 opposite that connected to U2 pin 3. Adjust VR1 until the voltage is as close as possible to that measured above. Repeat the measurements till both sensors agree.

Adjust the voltage between U2 pin 4 and ground using VR3 to .1V. make a tick mark on the self adhesive label under the temperature adjustment knob (on VR3). Continue marking each .1V up to 1.7V. These ticks correspond to temp differential settings of 1 to 17C.

Adjust the voltage between U2 pin 8 and ground to read 1.8V using VR2.

#### Operation.

Note for testing attach a 10 ohm 50 w power resistor to a spare coaxial power plug and plug this into the coaxial DC power jack for the heater. Tape sensor U5 to this resistor to simulate the dew heater

LED D1 functions as both a power indicator (dimly lit) and heater on indicator (brightly lit) with the system cold turn the temp differential adjust knob to a low setting. Say 5C Apply power and observe that LED lights full brightness initially and then goes dim as the resistor warms. It should be possible to watch the heater pulse on and off over a period of several minutes as the resistor heats and cools.

This circuit contains a feature to force the heater on regardless of the temp differential. This is used in the event dew is allowed to form due to an insufficient differential setting to heat all parts of the optics above the dew point. In the event dew does form at a given setting the knob is turned all the way up to force the heater constant on until the dew is cleared, then returned to a higher setting than was initially used.

To test this place sensor U4 in a glass of ice water. (You **did** seal it didn't you?) Warm sensor U5 by holding it in your hand. At this point we have created a difference of more than 20C and the heater should be off under any circumstances. Now turn the temp differential adjust knob beyond 17C to max. The heater should come on.

To use on the scope set the differential to a low value say 5C. After several sessions if dew is still occurring use a higher setting. If no dew forms reduce the heat each session till it occurs again. Somewhere between 3-5C seems to work for me. I've never seen dew at 5C and **almost** never seen dew at 3C