

# A Build It Yourself Dew Preventer

by  
Dave McCarter  
London Centre, RASC

Any observer knows that dew can quickly put an end to a promising evening, or at least force an intermission as hair dryers are used to dry off fogged optics. In addition, dew may also carry harmful airborne chemicals which attack mirror coatings. While the Kendrick Dew Remover system is very popular, many home brew astronomers and ATM's might want to make their own Dew Preventer.

You don't have to remove dew if you prevent dew from forming in the first place by slightly warming the lens or corrector plate above the dew point. The heater elements, small resistors or resistance wire to which electrical power is applied, are housed inside a fabric shell and held around the lens or eyepiece by Velcro tape. Power can be supplied from either a line operated transformer isolated power supply or 12 volt rechargeable battery.

Only a few watts of heat are required to adequately warm a lens barrel or eyepiece. A heater control box is used to regulate the amount of electrical current delivered to several plug in heater elements. This high speed switching circuit, which does not waste excess power, extends the useful battery life and allows control over the heat delivered to prevent overheated lenses.

## The Control Circuit

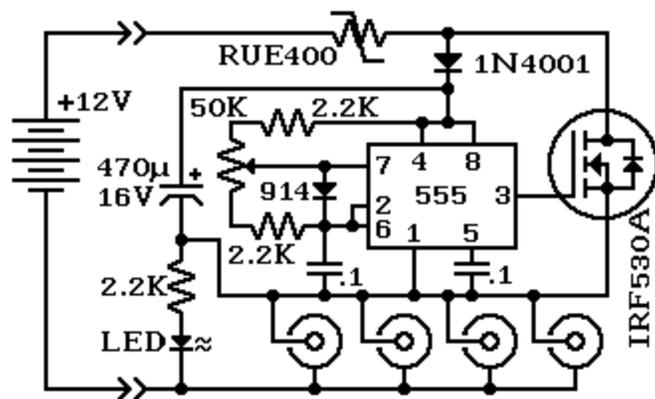
My dew zapper is really easy to put together if you enjoy experimentation with your telescope accessories, and you are not intimidated by soldering small parts.

This circuit, based on the 555 timer IC, produces a variable duty cycle signal to switch the heater current for controllable lengths of time. The longer the current is on, the more heating power is delivered to the lens.

Circuit timing is controlled by the 50K $\Omega$  variable resistor and the timing capacitor connected to IC pin 2 and 6, while the pair of 2.2K $\Omega$  resistors set minimum and maximum switching periods. The 1N914 diode ensures that the switching duty cycle is symmetrical.

The 555 Integrated Circuit has limited current switching capability, so drives a high power enhancement mode field effect transistor which switches the current with little loss and can easily supply up to fifty watts. A self resetting plastic fuse, a RUE400, provides protection from shorted heaters or other calamities, while a red LED indicates the unit is on and roughly the level of heating.

The circuit goes together quickly on my home made printed circuit board, see artwork below, but you could use perf board or "dead bug" construction. The completed P.C. board, control pot, and connectors all fit into a small Hammond type 1591A or 1591L plastic case.



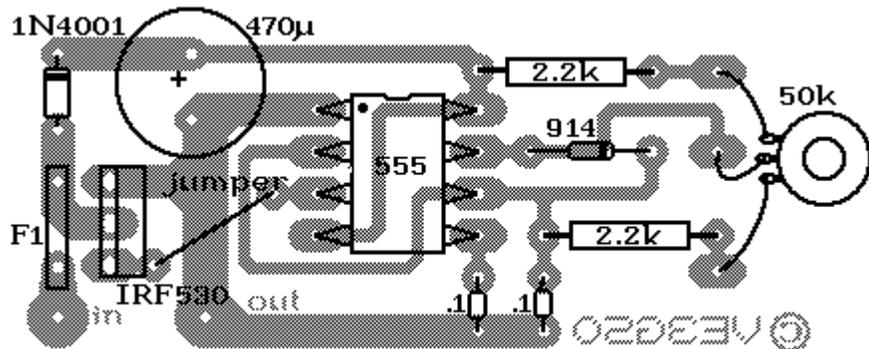
**Table 1: The Controller Parts List** identifies the parts you need to obtain, and the figure below shows the PC board component side layout, where each part fits into pre-drilled holes. The orientation of most parts on the board are very important, and these have been identified with an \* on the parts list. For example, the power supply must be connected properly or the unit may be destroyed.

- \* 555 timer IC. may be marked MC1455P, NE555N, UA555P etc.
- \* IRF530A or similar N channel Power MOSFET, 50V @10A or better, eg: STD12N05, MTP3055E
- \* 470uF 16V electrolytic capacitor.
- \* 1N4001 silicon diode.
- \* 1N914 or 1N4148 silicon diode.
- \* Red LED light emitting diode.
- \* 50K $\Omega$  linear potentiometer e.g.: P.E.C. type V6U5031
- 3 of 2200 $\Omega$  1/4W resistors.
- 2 of 0.1uF 50 volt Monolithic ceramic capacitors.
- RUE400 Raychem Polyswitch Fuse. May use RUE300 instead
- 1591A or 1591L Hammond plastic case
- Plastic knob e.g.: Augat PKES-60B-1/4
- 4 or 5 chassis phono jacks e.g.: Switchcraft 3501FR.
- 4 or 5 phono plugs e.g.: Switchcraft 3507.
- 18G white two wire "Zip" cord, long enough to go from heater control to power supply, and from phono plugs to heater elements,
- Power Source: 12V car battery, gel cell, 10Ah or more.

**Circuit Note:**

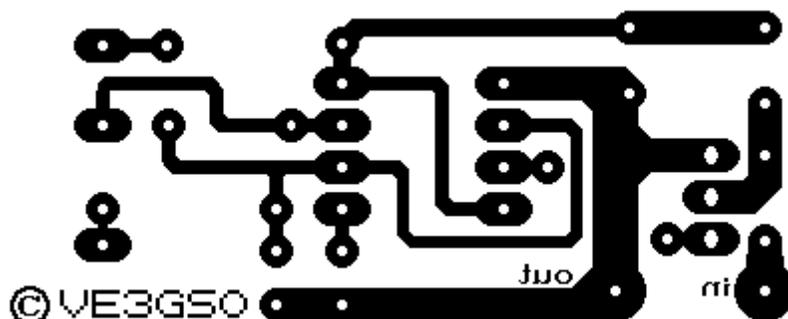
This circuit works in series between the battery positive terminal (the "in" connection) and the resistive heaters (to the "out" connection). There is no ground (battery negative terminal) on the printed circuit board! The battery negative terminal only connects to the body of the heater connectors and to the cathode of the LED. All circuit current therefore goes through heater elements, making the circuit highly efficient.

The potentiometer, heater connectors, and LED mount into holes drilled into the case. The LED in series with the 2.2K $\Omega$  current limiting resistor is wired in parallel with one of the heater controllers. The PC board is cut so that it will slide into the special ridges on each side of the case. Try the parts for fit to decide exactly where to cut the holes to ensure that everything will fit properly.



**Printed Circuit Board Artwork**

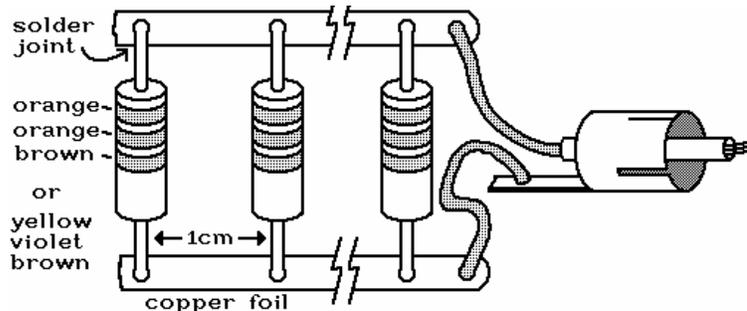
This is the solder side art for the heater controller. As seen here it is about twice finished size. The spacing between IC pins is 1/10 inch, or 2.54mm.



## Heaters

When the controller is complete the next task is to build some heaters. The local surplus electronics store should have a stock of 330Ω or 470Ω 1/4 watt resistors, hopefully on sale cheap, as quite a few are needed. When a 330Ω resistor is supplied with 12 volts the resistor will dissipate 0.44 watt and get very hot, which is usually not a problem on a chilly winter night. The 470Ω resistor will operate closer to the 0.25 watt safety margin, but won't warm the lens as much when the mercury dips low. Of course, if you only need a small amount of heat you turn down the controller.

To build a heater you solder in parallel as many of these resistors as are required to provide the desired level of heat around the lens. I use a strip of copper foil to connect the resistors together, and transfer heat to the lens, but a length of stranded or braided copper wire works well too.



For a small finder or eyepiece 2 to 3 watts seems plenty, but for an eight inch corrector plate a little more power is needed, maybe as much as 12 watts on a really cold night. Experiment and determine what works for you. The heater resistors should be spaced evenly around the lens cell. I typically place a resistor for each centimetre of circumference on finders and eyepiece heaters, spacing resistors apart a little more for SCT corrector plates.

Lens heaters can be permanently installed on the lens cell, or packaged in a removable casing. My finder objective lens and the finder eyepiece were always getting fogged either from dew or my breath, so I wrapped resistors directly onto the plastic lens housings, and held them in place with electrical tape. The resistors must be electrically insulated from a metal lens cell, and a few layers of adhesive vinyl electrical tape will work.

A short pair of wires, 18 to 20 AWG speaker wire for example, connects the heater element to the RCA phono plug which plugs into the heater control box.

## Keeping in the Heat.

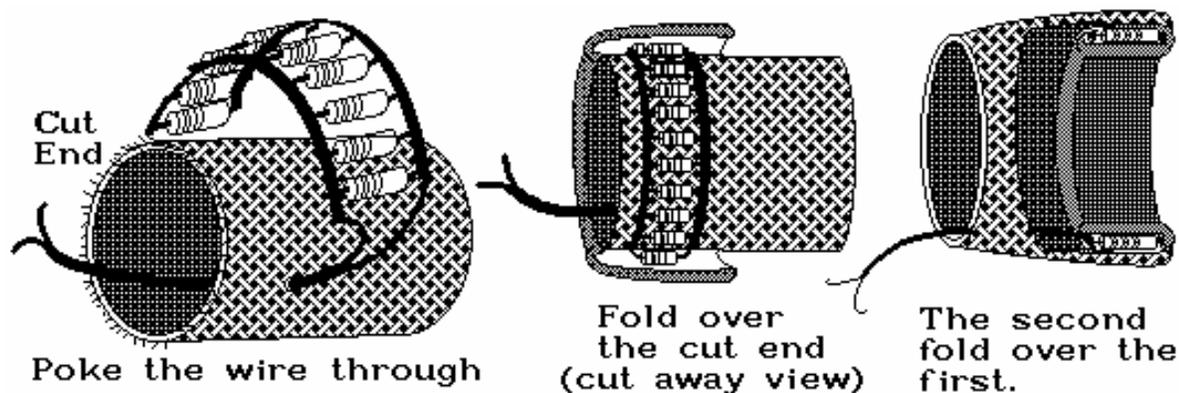
Some form of insulation over the heaters should be used to prevent cold winter breezes from robbing those watts. A piece of closed cell foam used for camping ground roll is formed into a tube large enough to wrap around the front of the telescope. If made long enough the foam tube can also act as a lens hood to shield the corrector lens from stray light.

## Eyepieces

Eyepieces need to be warmed too, but it is often impractical to install heaters on each eyepiece. Flexible cloth heater casings are easy to make. Finally, an astronomical use for that orphan black & fluffy wool sock, it's twin lost to the clothes dryer! Follow the images on the next page to make this process clear.

To prepare the sock, cut off the foot at the ankle and retain the elastic leg portion. Make a heater element long enough to circle your eyepiece and attach the lead wire, but don't solder the connector on just yet.

Thread the lead wire through the sock, from the outside to the inside at the same distance from the cut end as the heater is wide. Fold the cut end over the heater, fold the finished end over the cut end, and sew the folds together. Now two layers of cloth insulate the heater, while one layer will be between the heater and the eyepiece. Easy!



The short length of sock, the finished and elasticised end, goes onto the eyepiece first to hold the heater securely. The fluffy warm end of this contraption forms a comfortable eyecup which also keeps out stray light and even keeps your eye from watering due to cold night breezes. To cosy up to a slightly warm eyepiece is a true pleasure. You'll never do without after you've tried it once.

I have observed for several years with this heater system, and on the many occasions when the scope tube was covered with a layer of dew or ice, all of the glass surfaces were clean and dry. Printed circuit boards, which greatly ease construction, are sometimes available at minimal cost and I can be reached via the RASC mail list for guidance in your construction effort.

Clear Skies & Warm observing!

*Dave McCarter*

Dave V  
 R.A.S.D.  
 dmccarter@sympatico.ca  
<http://www.rasd.ca>

This document available at:  
<http://www.astro.uwo.ca/~rasc/HEATER.pdf>