Incubator Thermostat and Heater Kit Instructions

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The Incubator Thermostat and Heater Kit from MTM Scientific, Inc allows you to build a simple poultry egg incubator using commonly available materials. The kit contains an adjustable electronic temperature controller with the heating elements. The kit requires 12 VDC power to operate. By using this kit with your insulated container you can easily and inexpensively build a working egg incubator.

Getting Started: Circuit Board Assembly

The main kit parts are the circuit board, the heater resistors and the electronic circuit components. A close-up view of the assembled kit is shown in Figure 1.

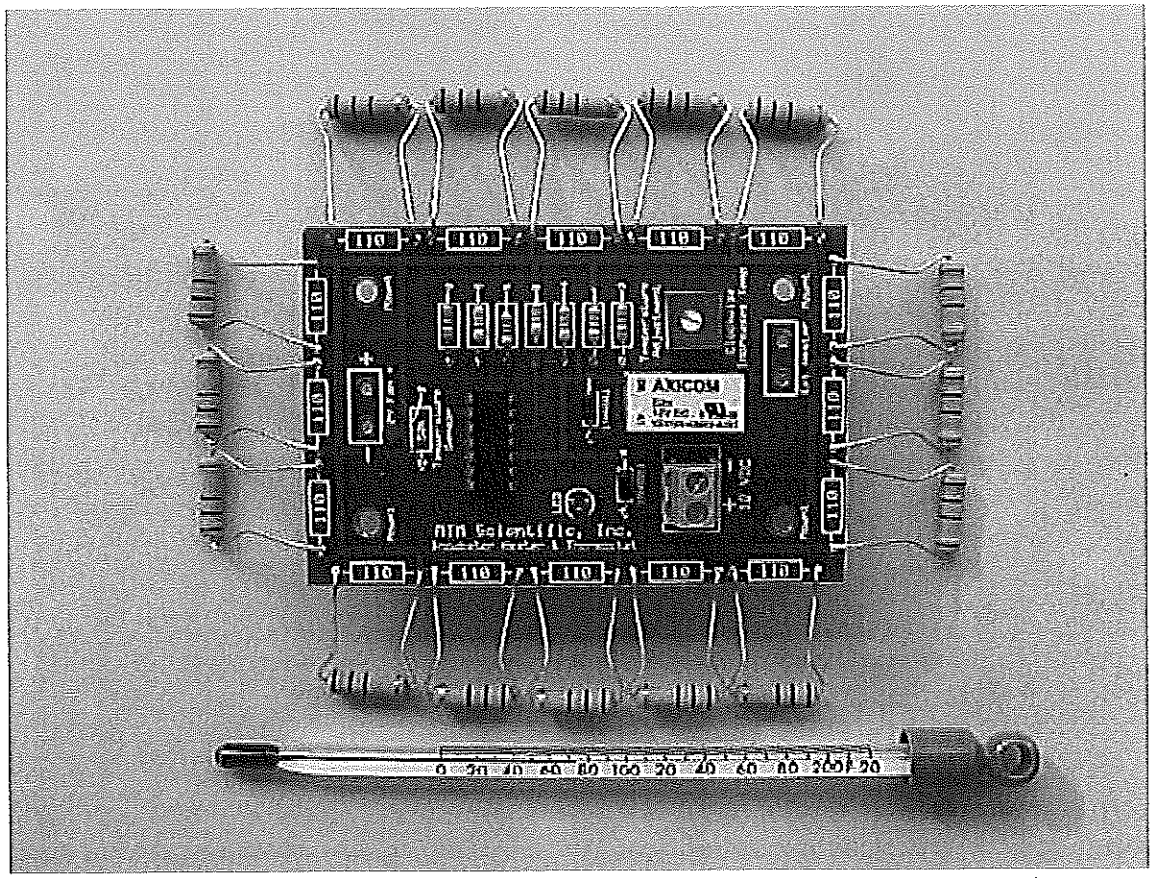


Figure 1: View of the assembled Thermostat and Heater Kit. Note that it is acceptable for the adjacent power resistor lead wires to touch each other.

Some of the circuit components must be installed in a specific orientation. The LP339 comparator, LED and power diodes must be installed per the visual cues shown in Figure 2. The circuit board has a square-shaped solder pad for each of these components to indicate the correct alignment as shown.

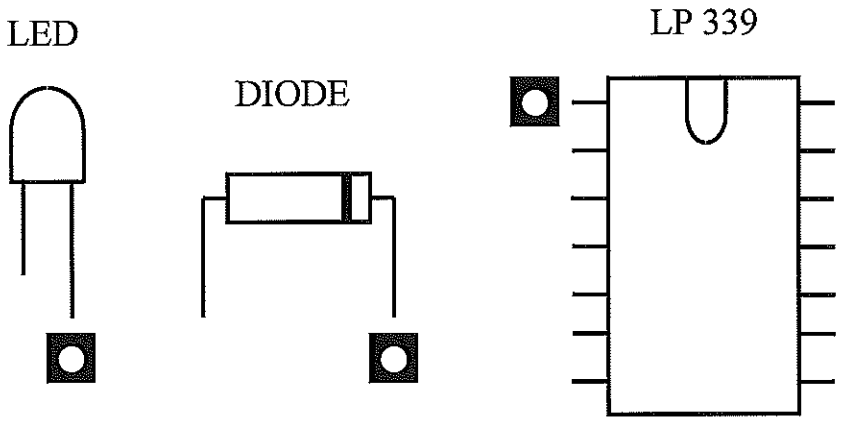


Figure 2: Components should be inserted using the visual cues shown here.

An enlarged view of the circuit board layout is shown in Figure 3. The square-shaped pads can be seen. The resistor color codes for identification are: 3.3K (Orange-Orange-Red), 5.6K (Green-Blue-Red), 47K (Yellow-Violet-Orange) and 2M (Red-Black-Green).

Assembling the kit requires electronic soldering. There is a soldering tutorial on the MTM Scientific website for beginners at http://www.mtmscientific.com/solder.html. The most important points for soldering are using a fine-point tip iron with electronic grade rosin core solder and keeping the soldering tip clean using a sponge wipe.

The large power resistors which provide the incubator heating are arranged around the outside edge of the circuit board. As seen in the photos, the resistor leads are intentionally made as long as possible. The long resistor leads promote the even distribution of heat inside the incubator. Don't worry if the power resistor leads touch each other. It is OK if the leads of a resistor touch the neighboring resistor.

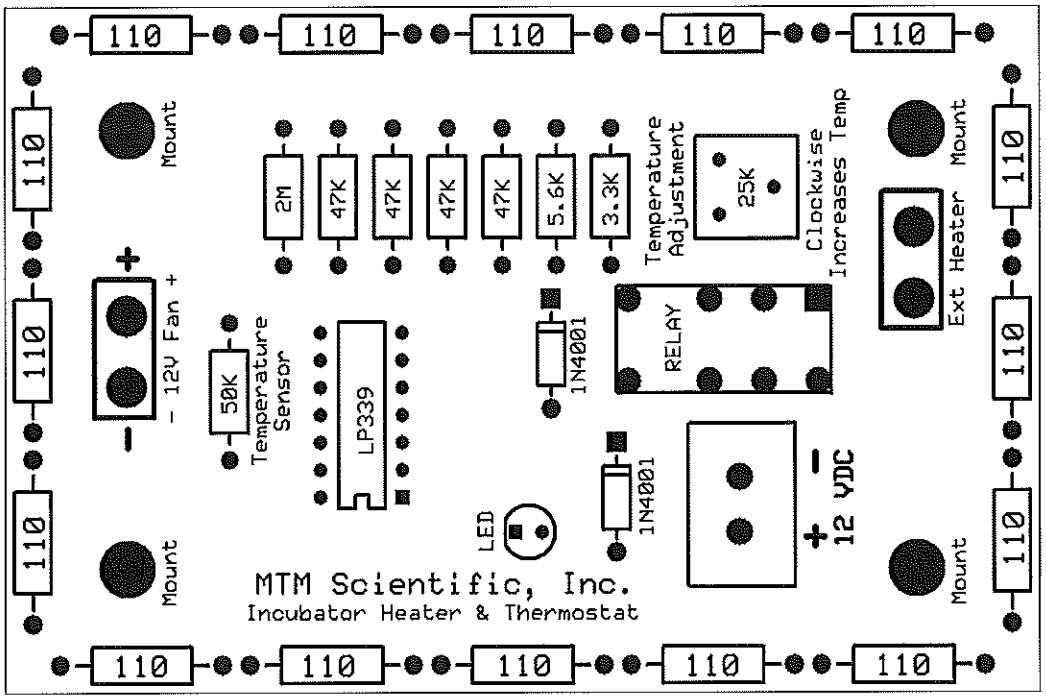


Figure 3: This is an enlarged view of the circuit board layout.

The temperature sensor for the thermostat is a 50K thermistor which is mounted directly to the circuit board. The leads for the thermistor should be about ½ inch long to promote air circulation around the sensor.

Providing 12 VDC Power

The incubator kit requires 12 VDC at 2 amp current capacity to operate. A plug-in type power unit which provides 12 VDC is a good choice. Many mail order electronic suppliers offer suitable notebook computer power units for less than $10. (Marlin P. Jones & Assoc. Inc at http://www.mpja.com offers catalog #16716-PS or #15548-PS) Another power option is an automotive storage battery, especially for remote locations where solar panels are used. Technically inclined hobbyists might consider building their own DC power supply from scratch.

The power supply is connected to the incubator unit at the screw terminal connector. The polarity ('+' and '-') is indicated on the circuit board. The power supply input is polarity protected with a diode. When power is applied the red LED will glow, indicating the heaters are active. The heater resistors will become hot during operation. Do not touch them.

Building the Incubator Box

An ideal container for building a small incubator is a standard cardboard box lined with Styrofoam sheeting and fitted with a Styrofoam lid, as shown in Figures 4 and 5. This method of construction is inexpensive and works well. Note that the thermostat and heater are mounted on the lid of the box. The eggs are arranged in a single layer on the bottom of the box.

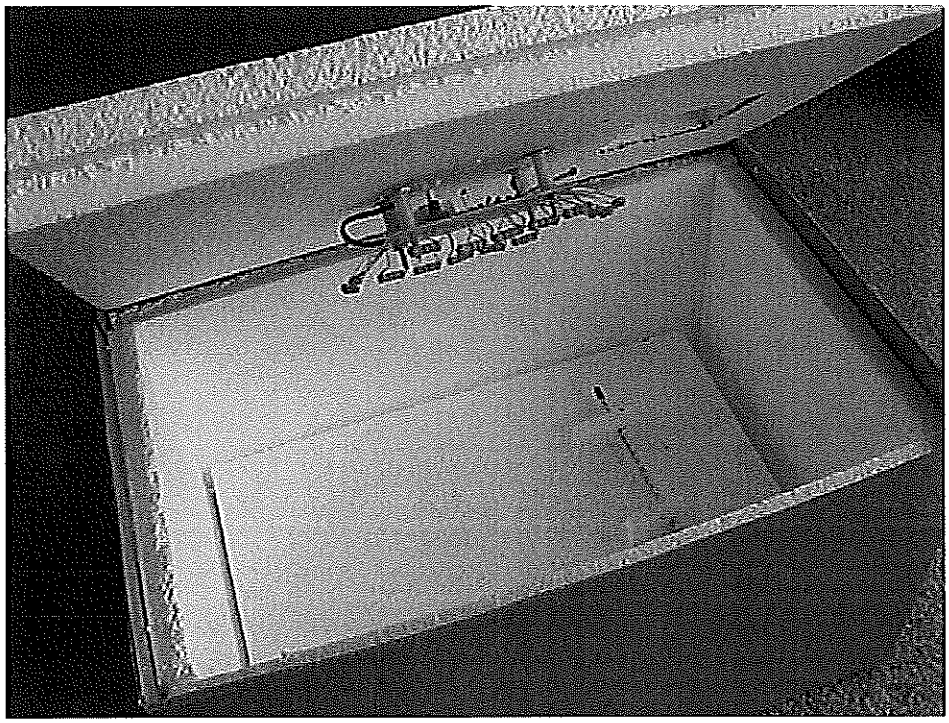
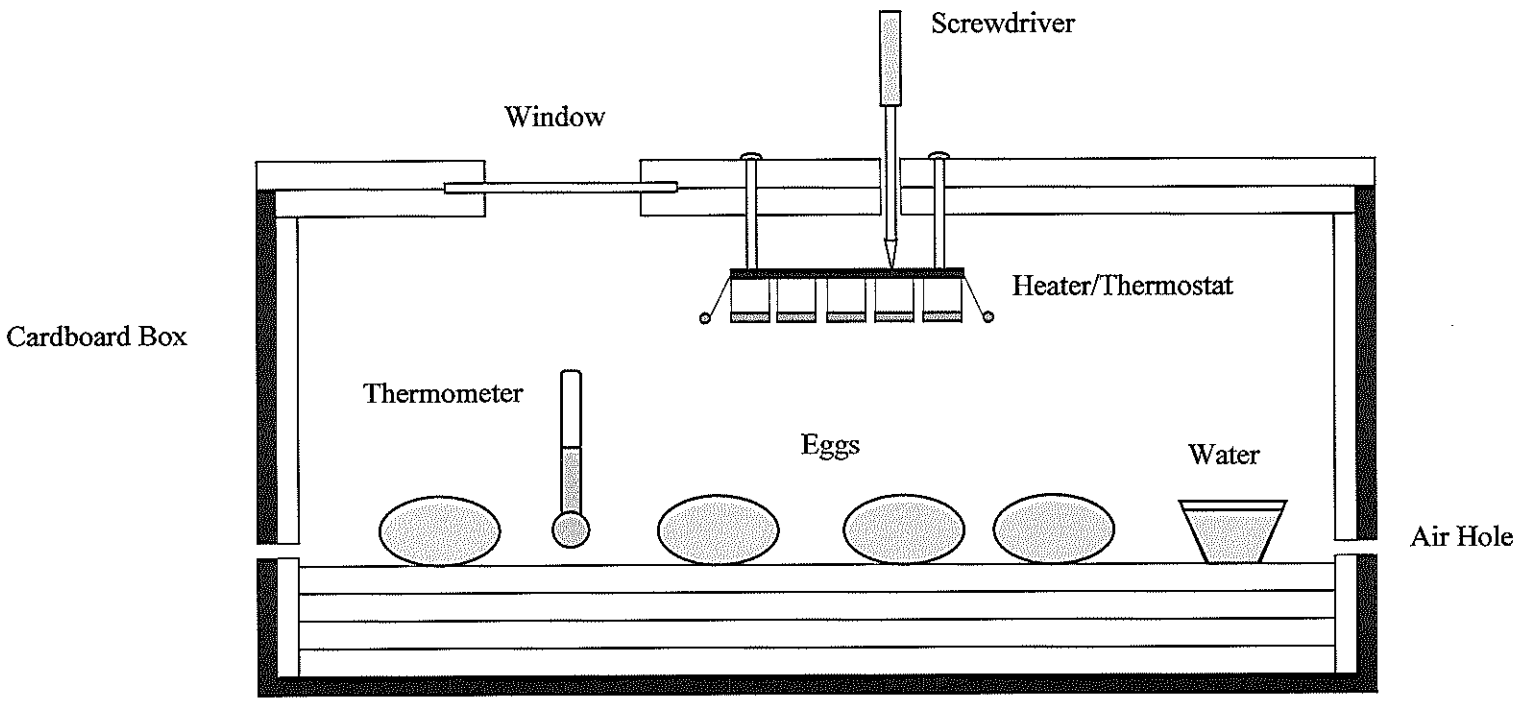


Figure 4: View of an incubator box lined with foam sheeting.

Almost any size cardboard box can be used. It is preferable to choose a box slightly deeper than necessary and stack extra Styrofoam sheets (at the bottom) to obtain the interior height desired. After the hatch, the bottom spacers can be shuffled, or 'flipped over' to create a fresh surface for the next hatch. The sides of the box are also lined with foam. The foam should be held in place using RTV silicone sealant.

The lid of the box is most easily constructed with a double layer of Styrofoam sheets. The box lid must have a small plastic window for seeing inside the box. The window can be made using any convenient piece of clear plastic; in the example shown in Figure 6 we have used the lid from a CD music jewel case. The window and Styrofoam sheets are bonded together using RTV silicone sealant.

Typical poultry egg incubator built using the MTM Scientific, Inc kit.



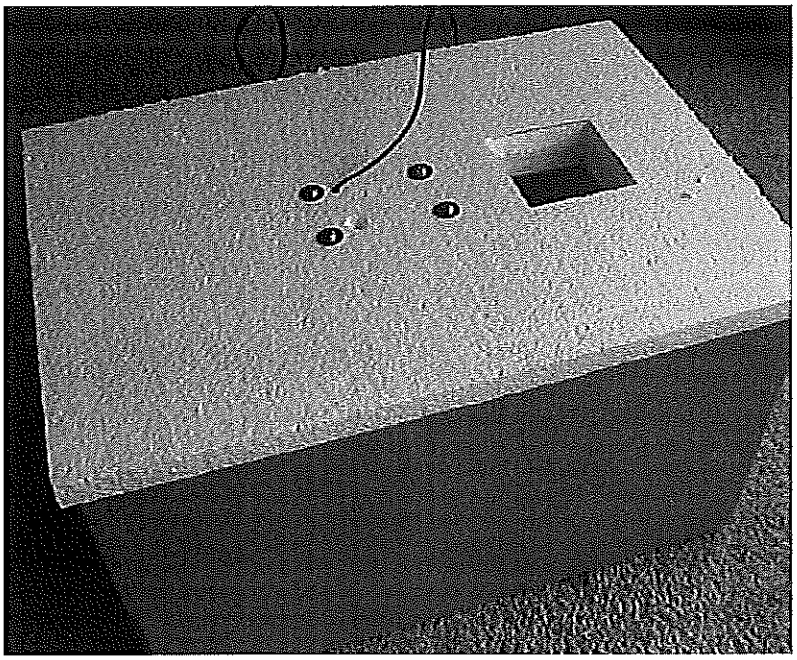


Figure 6: Add a window to the lid for viewing the thermometer and chicks.

The incubator box can also be made from other materials. One option is discarded foam packaging used as shipping inserts. Another construction option is building a wooden box and lining it with Styrofoam sheet as well.

A small ventilation hole should be made in each side wall of the box (4 holes total). A good size is about ¼" diameter. Locate the holes at the floor level of the interior of the box.

Installing the Thermostat and Heater

The thermostat and heater assembly is installed at the top of the incubator box, and is most easily attached to the lid as shown in Figure 5. Mounting screws and spacers are provided in the kit. It is a simple matter to make a small hole in the lid for passing through the electrical wires for the power supply. Mounting the heater assembly at the top keeps it away from the hatching chicks. Top mounting also keeps the assembly more sanitary.

When mounting the thermostat to the lid the circuit components should be facing upwards, towards the lid. Drill a ½" hole in the lid of the box, such that a small screwdriver can be inserted to adjust the temperature setting. This is a great convenience for adjusting and maintaining the incubation temperature. The top hole will also provide ventilation, working with the smaller holes in the side walls.

Trial Run: Setting the Temperature at 100 F

The incubator should first be operated without eggs for the initial trial run. The incubator is most ideally located in a location which has a stable room temperature near 70 F. The temperature inside the incubator is measured using the glass thermometer included with the kit. A good general temperature for hatching chicken eggs is 100 F. The thermometer should be horizontally mounted inside the incubator at the exact height of the eggs. A scrap piece of Styrofoam makes a convenient stand for holding the thermometer. Arrange the thermometer to be seen through the lid window.

The incubator will reach operating temperature in about 30 minutes. The ON-OFF operation of the temperature controller is indicated by the red LED on the circuit board. The LED glows red when the heater is ON.

The temperature of the incubator is adjusted by turning the small blue potentiometer with a tiny screwdriver. A clockwise turn will increase the temperature. The full range of temperature adjustment is about ¾ turn. Make small adjustments, and allow at least 30 minutes between changes.

Ideas, Things to Try

The incubator circuit board has connections for 2 optional features: a circulating fan, and an external heater. These circuit options were included for advanced hobbyists and experimenters.

The fan connection is for hobbyists that would like to add a small 12 VDC muffin fan inside the incubator box. A fan enhances air circulation around the eggs, but is not required for successful hatching. In practice the fan will operate whenever the heaters are energized. Small inexpensive DC fans are readily available by mail order. (#16732-FN or #12773-FN from http://www.mpja.com)

The external heater connection allows the possibility of using a different incubator heater, instead of the power resistors supplied with the kit. The external heater connection provides a simple temperature activated switch. The switch is closed ('ON') below the temperature setpoint, and the switch is open ('OFF') above the setpoint. *The external heater connection is only a switch; an external power supply for the special heater is also required.*

Basic Chicken Egg Hatching Instructions

Obtaining chicken eggs for hatching is easier than you might expect. In practice the simplest method may be to simply order them by mail from a hatchery (below). Hatching eggs are often available by mail, even on EBAY (http://www.ebay.com)

Here is the basic procedure for hatching chicken eggs:

1. Obtain fertile chicken eggs for hatching.
2. Place a small tray of water in the incubator to provide humidity.
3. Place incubator in hatch location and stabilize temperature at 100 F.
4. Arrange eggs in a single layer on the bottom of the incubator.
5. Mark tops of all eggs with an 'X' using pencil.
6. Turn eggs twice a day during the first 18 days.
7. Do not turn eggs during the last 3 days.
8. Chicks will emerge in 21 days, and should be removed fluffy dry.

Specifications / Circuit Diagram

Incubator Power Source: 12VDC / 2 Amps
Maximum Heater Output: 20 Watts
Nominal Operating Temperature: 100F (37.8C)

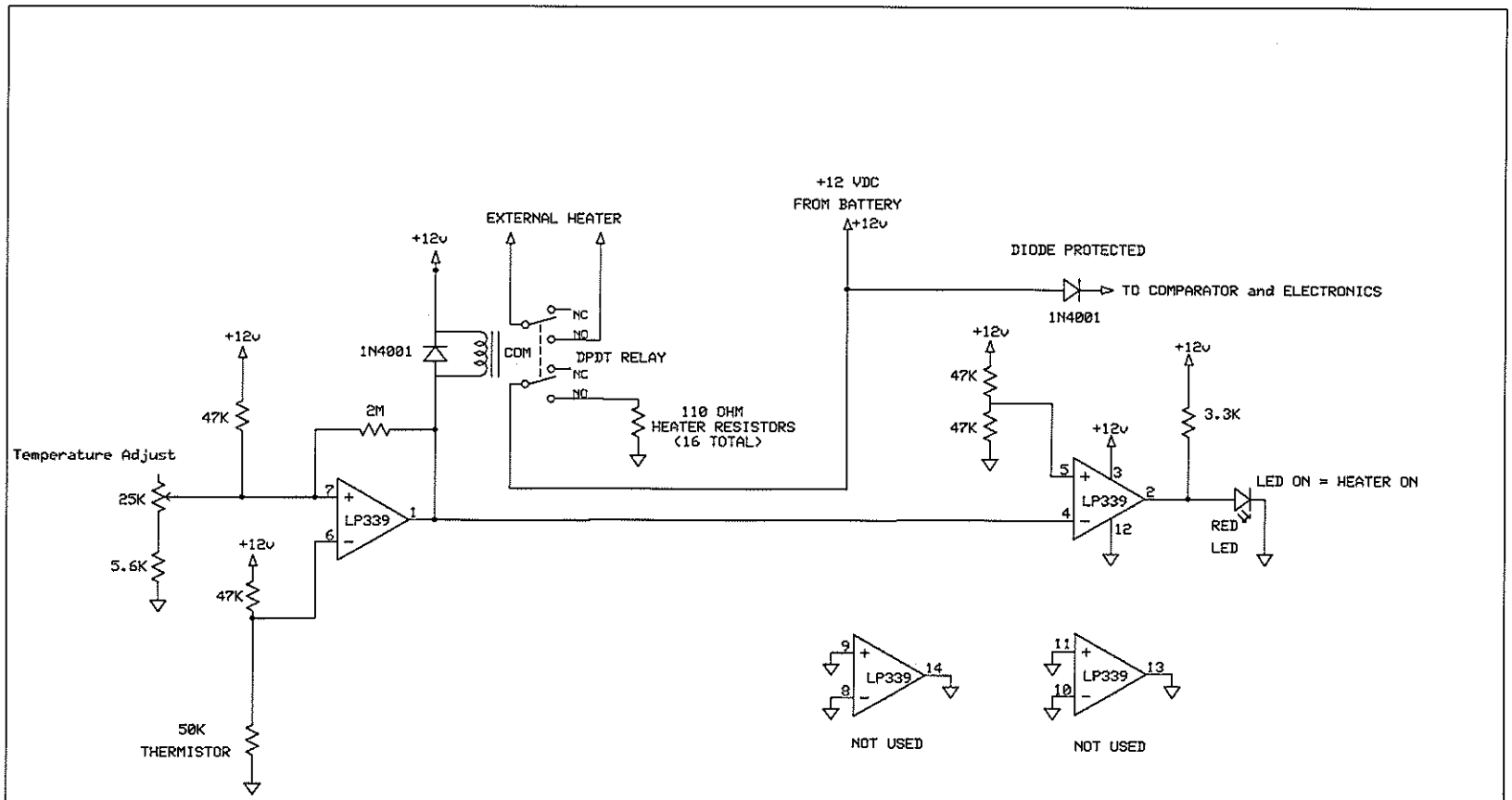
Sources of Additional Information, Egg Suppliers

"Backyard Poultry" Magazine is a good source of information and suppliers. On the web at http://www.backyardpoultrymag.com

"Murray McMurray" Hatchery offers mail order chicks and hatching eggs. On the web at http://www.mcmurrayhatchery.com

"ABC of Poultry Raising" by J.H. Florea is a book which contains basic information about raising and keeping chickens.

There is a great website with many links to homemade incubator projects on the web at http://www.feathersite.com/Poultry/BRKIncubation.html



Notes:
1. Circuit is designed for 100F Temperature (37.8 C)
2. The 2M resistor provides hysteresis
3. External Heater option provides switching only
4. Maximum External Heater 2 A / 30 VDC or 120 VAC

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