



OW Series Objective Warmer



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The **OW Series Objective Warmer** provides a simple and effective method for maintaining the temperature stability of a microscope objective. A temperature stable objective can reduce the thermal gradient between the lens and specimen, a problem commonly experienced with immersion optic microscopy.

The thermally controlled collar mounts onto your microscope objective via two silicone gaskets. These gaskets serve to mechanically isolate the heated collar and prevents it from coming into direct contact with the objective. The collar incorporates a resistor block and thermistor which allows a controller to maintain the warmer at a constant and well maintained temperature as the environmental conditions change.

Heat generated by the collar is transmitted to the objective body via a cushion of warm air trapped between the collar and the objective. This air cushion then, in turn, gently warms the objective. This approach allows the apparatus to take full advantage of the thermal characteristics of the air cushion.

Collars are available to fit objectives from most microscope manufacturers and custom designs are available.



**THIS EQUIPMENT IS NOT DESIGNED NOR INTENDED
FOR USE ON HUMAN SUBJECTS**

INTRODUCTION

A common problem experienced by researchers using immersion optics is the loss of thermal control of the bathing solution directly above the microscope objective. The need to keep a specimen at a temperature different from ambient during observation is directly compromised by the heat-sink character of the microscope objective. While this can be a difficult problem in general, it is particularly nasty when employing an inverted microscope utilizing very short working distance objectives.

Clearly, a change in temperature at the objective is highly dependent on several factors including the temperature of the perfusing solution, the temperature of the objective, the conductance of the objective and the solution flow rate. However, it has been observed that the solution temperature directly above an immersion objective can change by as much as 10°C for a 37°C solution perfusing at 5 ml/min in an apparatus maintained at ambient temperature.

Heating approaches

Several approaches have been taken to address the above outlined issue. These include heating the specimen directly, heating the full microscopy environment, and heating the microscope objective alone.

Specimen heating

Specimen heating is the most direct way to manipulate the temperature of a sample. Examples of this approach include heated cover slides, heated platforms, in-line solution heaters, and various Peltier driven devices. However, specimen heating is also the least effective method when used with immersion optics since the microscope objective is effectively an infinitely deep heat-sink reservoir and the heating regimen cannot transfer thermal energy to the sample quickly enough. This limitation leads specimen heating to be most effective when used in conjunction with one of the other strategies described below

Environment heating

Another approach is to place the entire microscope (or at least the stage, lens and sample chamber) within a specially designed thermal enclosure. An advantage to this strategy is that the microscope and its components are all maintained at a common, uniform temperature. Potential disadvantages are that the system changes state very slowly, the enclosure is bulky, and users must access the stage area through (possibly) restrictive doors and openings.

Objective heating

A direct means to reduce heat losses through a microscope is to minimize the thermal gradient between the sample and objective. This is commonly achieved using an objective heater.

The most common microscope objective heaters, called objective-lens heaters, use a heated collar or resistive wire placed into direct contact with the body of the objective, often near the lens. Objective-lens heaters can be combined with specimen heaters to provide tight control of the thermal gradient between the specimen and objective. Objective heaters allow a specimen heating system, such as an in-line solution warmer, to become more effective and efficient.

One drawback to objective-lens heating is that the heat energy is applied *directly* to the objective. This results in thermal cycling of the objective itself as the heater regulates its output. This cyclic, direct application of heat energy to the objective usually results in a commensurate cycling of the focal plane. It can also shorten the working life of the objective.

An alternative approach to directly warming the objective is embodied in the OW Series Objective Warmer. The OW achieves its task without direct contact with the objective and so does not expose the microscope objective to significant stresses.

SETUP

General Comments

The OW Series Objective Warmer is comprised of a heated collar which mounts onto your microscope objective via two silicone gaskets. A **TC-124** temperature controller is used to power the OW and is powered by a wall mounted adapter.



Assembly

1. Slide the objective warmer over the objective body. The warmer is more effective the higher it is mounted onto the objective body. Proper mounting is shown to the right.
2. Connect the objective warmer to the TC-124.



OPERATION

1. Make all connections as described. Plugging the wall adaptor into the TC-124 temperature controller powers the device.
2. The working (set) temperature of the heated collar can be set via the TC-124. Pressing the HEAT UP or HEAT DOWN buttons adjusts the set temperature of the system.

NOTE: Since the microscope objective is warmed through the buffering heat capacity of the surrounding air, allow sufficient time for the system to stabilize before changing the setting on the temperature controller.

3. The LED display reports the *actual temperature* of the heated collar. Adjustment of the set temperature using either the HEAT UP or HEAT DOWN buttons causes the display to momentarily report the *set temperature*. In addition, pressing the SET TEMPERATURE button will report the set temperature for as long as the button is pressed.
4. Maximum temperature is 60°C. The temperature of the objective should be monitored near the lens with a separate measuring device to determine the proper setting of the heated collar.
5. Ideally, the temperature of the objective should be set to within 5°C of, but lower than, the temperature of the specimen. In practice, this temperature may be difficult to achieve or unadvisable for the objective. In this case, the system should be adjusted to the highest temperature permitted that will minimize the temperature gradient between the lens and the specimen. Once a proper trim setting is found, subsequent adjustments are usually unnecessary.



Note: Lens manufacturers recommend keeping microscope objective temperatures below a specific limit. Adjust the temperature controller to account for the objective manufacturers specifications.

APPENDIX

Specifications

Temperature Range:	37-60°C
AC Power (supplied adapter):	12 VDC; 1.2A
Materials:	Anodized aluminum

Cleaning/Maintenance

The body of the **OW Series Objective Warmer** is constructed of anodized aluminum. It can be easily cleaned with common laboratory detergents or ethyl alcohol (EtOH).

The silicone gaskets can be deteriorated by lens oil. This is a property of the material. Should oil get onto the gasket, then quickly remove it by wiping. Degraded gaskets can be easily replaced.

Do not autoclave.

NOTE: Remove the objective warmer from microscope before cleaning.

Warranty and Service

Warranty

The **OW Series Objective Warmer** is covered by our Warranty to be free from defects in materials and workmanship for a period of one year from the date of shipment. If a failure occurs within this period, we will either repair or replace the faulty component(s). This warranty does not cover failure or damage caused by physical abuse.

In the event that repairs are necessary, shipping charges to the factory are the customer's responsibility. Return charges will be paid by Warner Instruments.

Service

We recommend that all questions regarding service be referred to our Technical Support Department.

- Normal business hours are 8:30 AM to 5:00 PM (EST), Monday through Friday.
- We are located at 1125 Dixwell Avenue, Hamden, CT 06514.
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