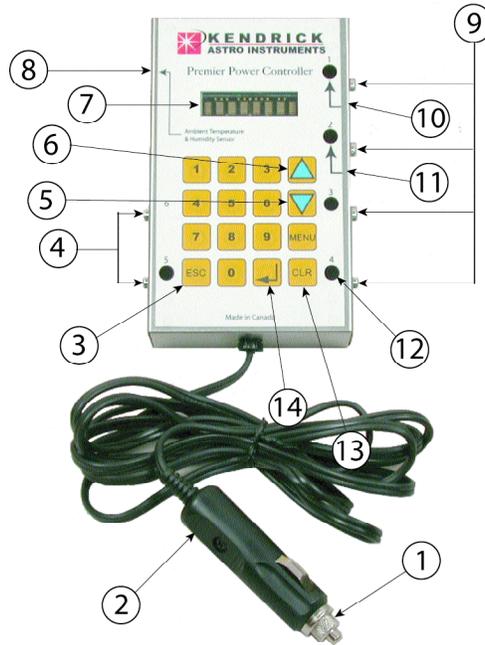


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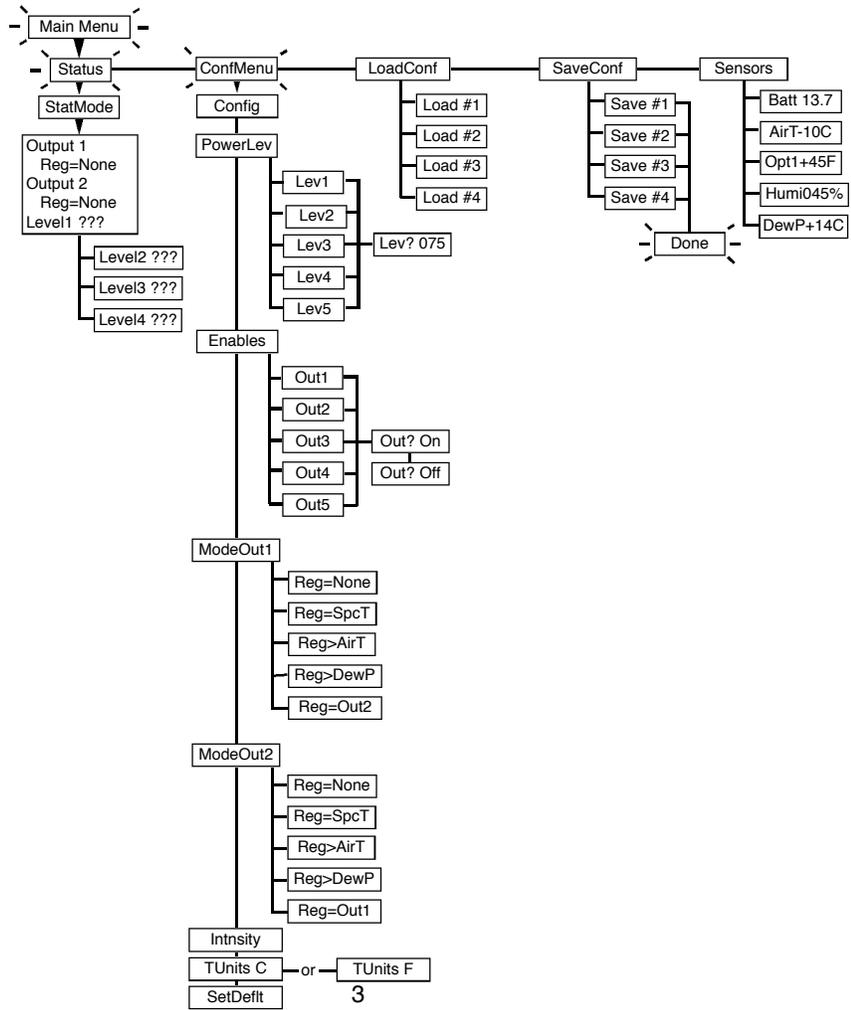
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## KENDRICK PREMIER CONTROLLER



1	Built in Controller fuse	8	Ambient Temp/humidity Sensor Jack
2	Power Cord Plug	9	Heater Power Outputs (1 to 4)
3	Escape Key	10	Optic #1 Temp/humidity Sensor Jack
4	Dedicated 12 volt outputs	11	Optic #2 Temp/humidity Sensor Jack
5	DOWN Arrow Menu Scroll Key	12	LED Power On indicators
6	UP Arrow Menu Scroll Key	13	Clear Key
7	LED Display	14	Enter Key

# Menu Tree



## INTRODUCTION

Congratulations! You have purchased the most advanced Dew Remover Controller available today.

Due to the increased instrumentation control demands of today's amateur astronomers, Kendrick has developed the Premier Dew Controller.

It has a number of advanced features previously unavailable in our controllers. These new features include:

- Low voltage cut-off to protect your expensive batteries from the damaging effects of excessive current depletion.
- Temperature and humidity sensing.
- Control of heaters via temperature, humidity and dewpoint variances.
- Individual duty cycle control over 4 outputs.
- Two dedicated 12 volt outputs that can be used, for example, to power fans on a dobsonian telescope, digital setting circles, extra heaters or an Astro Systems temperature sensing secondary mirror heater (now available from Kendrick).
- Programmable to have either output 1 or output 2 mirror the settings of each other. Outputs 1 and 2 can be programmed to operate at temperature or dewpoint variances.
- If you have a device that requires heating to a certain temperature for optimum performance, outputs 1 or 2 can be programmed to operate at a set temperature.
- Remote programming and monitoring software is available that will allow control of the Premier Controller from your PC.
- Outputs 1 through 5 can enabled or disabled.
- Temperature may be set to operate in Celsius or Fahrenheit.
- Values can be entered using the up/down arrow keys or the keypad.
- LED brightness controls.
- Downloadable software updates.

## **KENDRICK PREMIER CONTROLLER OPERATION NOTES**

### **POWER UP**

To Power up, plug the controller into a 12volt DC power supply. When powered up, the unit scrolls the message "Kendrick Premier Power Controller Vx.x" on the display. Pressing any button can be used to interrupt this. The serial number is then flashed on the display, followed by the main menu being entered. The controller will only operate on 12 VDC.

### **THE KEYPAD**

The 16 buttons are (generally) used as follows:

- The MENU button is used to return to the first item of the main menu from any part of the menu tree. The words MainMenu are flashed on the display to indicate this.
- The number buttons (0 to 9) are used to enter numerical values such as:
  - power levels
  - temperature settings
  - temperature spreads
- They are also used to go directly to items in a menu (for example, pressing 5 would select the 5th item in the current menu).
- The UP and DOWN buttons are used to cycle through menu items, change values or select outputs in the configuration menu.
- The ENTER (↵) button selects the current menu item, accepts the value shown, etc.
- The ESCAPE (ESC) button goes up the previous menu level, cancels the value shown,etc.

The CLEAR (CLR) button is used to set the current item to the default value (if you are in the Config menu). It is also used to toggle the sign (+/-) when entering a temperature.

## THE CONTROL ALGORITHM

The control algorithm runs on a 5 second cycle. See the CONFIG menu section for details on how the control algorithm works and how it is configured

Heater outputs 1 and 2 have special modes that use optic temperature sensors and an air temperature/humidity sensor to actively control the temperature of the telescope optic. All four heater outputs can be set to a user-specified power level.

The 5 LEDs mirror the current state of the corresponding output, including the pulsing of the four heater outputs and on/off state of auxiliary output 5. Output 6 is always on and does not have a corresponding LED.

## Menu Descriptions

### 1. MAIN MENU

There are five items in the main menu:

#### 1.1 STATUS menu item (displayed as **Status**)

From the main menu, press the Enter button (  ) to enter the Status mode. The message StatMode will flash on the display.

The purpose of the status mode is to display status information about the special regulation modes used with the main and secondary heater output (OUT1 and OUT2) and current power levels of heater outputs 1 through 5.

When first invoked, the regulation modes (see the **CONFIG** menu, pg 8, for a description of these) for both the primary and secondary heater outputs are briefly displayed (each preceded by Output 1 and Output 2). Following which,

the up/down buttons are used to cycle through a number of values that pertain to the current regulation mode of outputs 1 and 2. However, in all cases the current power levels of the four heater outputs are available. You can also use the number keys to directly select the 'nth value.

At any time, pressing the ESC button will return to main menu.

The possible values available for display (depending on the regulation mode) are:

- Current optic temperature for heater 1, for example: Opt 1 +27C means the primary optic temperature is +27 degrees C.
- Current optic temperature for heater 2, for example: Opt 2 + 54F means the secondary optic temperature is +54 degrees F.
- Current air temperature, for example: AirT -05C means the air temperature is 5 degrees C.
- Current dew point temperature, for example: DewP +50 F means the dew point temperature is +50 degrees F.
- The power levels (in %) for the four heater outputs, for example: Out 2 075 means heater output #2 is currently at 75 percent of full power. If the power level is displayed as Off it means that the output is disabled. If it is displayed as 000 it means that the output is currently off due to the regulation process working (ie. The optic temperature is at or greater than the desired temperature).

If a sensor error occurs (usually caused by a faulty sensor or a disconnected sensor) one of the following messages will be displayed:

- "Humi Err" - humidity sensor error
- "Opti Err" - optic 1 temperature sensor error
- "Opt2 Err" - optic 2 temperature sensor error
- "AirT Err" - air temperature sensor error

"DewP Err" - dew point error (actually means either a humidity or air temperature sensor error)

### **1.2 CONFIG** sub-menu (displayed as **Config**)

From the main menu arrow down to **Config**, press the Enter (  ) button to enter the CONFIG menu. The message ConfMenu will flash on the display.

The CONFIG menu is a sub-menu containing six entries and is used to control all of the programmable settings. Use the up/down buttons to cycle through sub-menu items and press the Enter button to select the menu item displayed. You can also use the number keys to directly select the 'nth' item in the menu. Press the Escape button to return to the main menu.

#### **Important Note**

The output regulation algorithms and RS232 (computer hook-up) interface commands are suspended when the user interface is in some items of the CONFIG sub-menu. When finished, be sure to return to the main menu by pressing the ESC key, to resume proper operation.

The sub-menu items are as follows:

#### **1.2.1 POWER OUTPUT LEVELS** sub-menu item (displayed as **PowerLev** )

This menu is used to set the output power levels for the four heater outputs as a percentage of full power (from 10% to 100%). The power level actually sets the duty-cycle of the output. For example, if set at 80% the output would be on for 4 seconds and off for one second in each 5 second cycle.

After pressing Enter (  ) to select this item, the output power level of the primary heater output (Output 1) will be shown. Power levels are displayed as Lev4 060, which means Output 4 is at 60% power.

The up/down buttons are used to cycle through the four outputs. You can also use the number keys 1 through 5 to directly select an output.

Pressing the CLR button at this point will set the selected power level to the default value (75%).

To change the power output level of the selected heater output, press the Enter button, an > appears after the output number and the first digit of the power level starts blinking indicating the active digit.

To enter a new power level you can either:

- enter digits directly with the number buttons. The active digit is the digit that is blinking. After a digit is entered, the blinking digit will move to the next digit to the right. If you make a mistake, you can either press the CLR button as a backspace key or continue pressing numbers until the correct three digits are displayed.

- use the up/down buttons to increase or decrease the output power level by 1% for each button press.

To accept the new power level, press the Enter button. If you enter an invalid power level (greater than 100% or less than 10%) then the display will be replaced with the closest valid power level, but waits for you to accept (by pressing Enter) or correct the entry.

To abort, and not accept changes made, press the Escape (ESC) button.

In either case, the > disappears indicating that you have returned to the mode where the up/down buttons are used to select one of the four heater outputs.

### **1.2.2 ENABLE OR DISABLE OUTPUTS** sub-menu item (displayed as **Enables** )

This item is used to set the output state (on or off) for all four heater outputs and the auxiliary output #5. After pressing Enter to select this item, the on/off

state of the primary heater output (Output 1) is shown. The on/off states are displayed (in this case for output 3) as either Out 3 On or Out 3 Off .

The up/down buttons are used to cycle through the five outputs. You can also use the number keys 1 through 5 to directly select an output.

To change the output state of the selected output, press the Enter button the output state will toggle on or off for each press of the Enter button. If you press the CLR button, it will set the selected output to the default (on) state.

When done changing output states, press the ESC button to return to the CONFIG sub-menu.

### **1.2.3 REGULATION MODES** sub-menu items (displayed as **ModeOut 1** and **ModeOut2**)

These two items are used to configure the regulation modes used to control the primary and secondary heater outputs (also called Output 1 and Output 2).

Press the Enter (  ) button to enter a sub-menu that has five entries, one for each available mode. The mode initially shown is the currently active mode.

Use the up/down buttons to cycle through the modes or press a number button ( 1 through 4 ) to directly select a mode, and then press the Enter (  ) button to enable and configure that mode. Pressing the ESC button will return to the CONFIG menu without changing the mode.

The available modes are as follows:

#### **1.2.3a NO REGULATION** (displayed as **Reg=None** )

Selecting this mode causes no temperature regulation to occur. The temperature and humidity sensors are ignored and the output is controlled the same way as outputs 3 and 4 (at a specified duty cycle power level).

### **1.2.3b REGULATE AT SPECIFIC TEMPERATURE**

(displayed as **Reg=SpcT** )

This mode causes the temperature of the optic or device (as determined by its corresponding temperature sensor) to be maintained, at a specific temperature. When selected, the current set point temperature is displayed with the first digit blinking. For example, SpcT+10C means +10 degrees C.

Use the up/down arrow buttons to change the temperature to the desired set point one degree at a time or directly enter the set point using the number buttons. Pressing a number replaces the digit that is currently blinking. To change the sign from positive to negative or vice versa, press the CLR button.

The valid temperature range is -40 to +40 degrees C (or Fahrenheit equivalent). Invalid entries are automatically corrected to be within the valid temperature range.

Press the Enter (  ) button to accept the new set point or the ESC button to reject the change.

### **1.2.3c REGULATE AT TEMPERATURE ABOVE AIR TEMPERATURE**

(displayed as **Reg>AirT**)

This mode causes the temperature of the optic (as determined by its corresponding temperature sensor) to be regulated, by cycling the heater output on and off, at a specified number of degrees (the spread) above the current air temperature. When selected, the current spread is displayed with the first digit blinking. For example, 070AirT means regulate the optic at a temperature 7 degrees greater than the air temperature sensor reads.

Use the up/down buttons to change the spread to the desired value one degree at a time or directly enter the spread using the number buttons. Pressing a number replaces the digit that is currently blinking. Pressing the CLR button cause the blinking digit to toggle between the digits.

The valid spread range is 0 to 40 degrees C (or Fahrenheit equivalent). If you enter an invalid number, the display will be replaced with the closest valid value.

Press the Enter (  ) button to accept the new spread or the ESC button to reject the change.

#### **1.2.3d REGULATE AT TEMPERATURE ABOVE DEW POINT TEMPERATURE**

(displayed as **Reg>DewP** )

This mode causes the temperature of the optic (as determined by its corresponding temperature sensor) to be regulated at a specified number of degrees (the spread) above the current dew point temperature (which is calculated from the air temperature and relative humidity readings). When selected, the current spread is displayed with the first digit blinking. For example, 070DewP means regulate the optic at a temperature 7 degrees above whatever the dew point temperature is calculated at.

Use the up/down buttons to change the spread to the desired value one degree at a time or directly enter the spread using the number buttons. Pressing a number replaces the digit that is currently blinking. Pressing the CLR button cause the blinking digit to toggle between the digits.

The valid spread range is 0 to 40 degrees C (or Fahrenheit equivalent). If you enter an invalid number, the display will be replaced with the closest valid value.

Press the Enter (  ) button to accept the new spread or the ESC button to reject the change.

#### **1.2.3e REGULATE THE SAME AS THE OTHER OUTPUT**

(displayed as **Reg=0ut1** or **Reg=0ut2**)

This mode causes the output state (on or off) of output 1 to mirror output 2 or output 2 to mirror output 1, depending on which output you are configuring. This could be used to regulate the temperature of two optics (of similar thermal

properties) without both having temperature sensors installed.

**1.2.4 LED INTENSITY** sub-menu item  
(displayed as **Intnsity**)

Pressing the Enter (  ) button cycles through 5 LED brightness levels (very dim, dim, normal, bright and very bright) and you will immediately see the change in display brightness. The brightness level Very Dim should be used at night at the telescope.

Normal works fine indoors when configuring the unit. Very Bright may be needed to see the display in outdoor daylight conditions. If you press the CLR button when this menu item is selected, the default (normal) brightness level will be selected.

**1.2.5 TEMPERATURE UNITS** sub-menu item  
(displayed as either **TUnits C** or **TUnits F**)

Pressing the Enter (  ) toggles between the use of either Celsius (C) or Fahrenheit (F) temperature units. This setting affects all temperature displays and the user's setting of temperature values and temperature spreads. Note that the internal calculations and storage of temperature values use integer Celsius temperatures, so rounding will occur when converting to and from Fahrenheit values. Fahrenheit temperatures over +99F are displayed as +99F.

**1.2.6 SET DEFAULTS** sub-menu item  
(displayed as **SetDefit**)

This item sets the current configuration to the default values. It does not save these values to non-volatile memory (see the SAVE CONFIGURATION menu, pg 15, to do this). The default values are as follows:

- all outputs set to on
- power levels of heater outputs set to 75% control mode for main (special) heater output set to no regulation
- set point temperature set to +10 degrees C

- temperature spread set to 7 degrees C
- LED brightness set to Normal (medium brightness)
- Temperature units set to Celsius
- current non-volatile storage area set to 1

The message "Done" is displayed momentarily to confirm that the operation was successful.

### **1.3. LOAD CONFIGURATION** menu item (displayed as **LoadConf** )

This menu item is used to load the current settings from one of four non-volatile storage areas (EEPROM). After pressing Enter to select this menu item, the up/down buttons are used to select which of the four areas are to be used (1 to 4). These are displayed as Load # 1 through Load # 4 . You can also select one of the four areas by pressing the corresponding number button.

Pressing the Enter (  ) button causes the current configuration settings to be loaded from the selected storage area the message "Done" is displayed momentarily to confirm that the operation was successful. The loaded configuration is also selected as the storage area used when the controller is powered-up.

Pressing the Escape (ESC) button returns to the main menu without loading the configuration settings.

### **1.4. SAVE CONFIGURATION** menu item (displayed as **SaveConf** )

This menu item is used to save the current settings to one of four non-volatile storage areas (EEPROM). After pressing Enter to select this menu item, the up/down buttons are used to select which of the four areas are to be used (1 to

4). These are displayed as Save # 1 through Save # 4 . You can also select one of the four areas by pressing the corresponding number button.

Pressing the Enter ( ↵ ) button causes the current configuration settings to be saved in the selected storage area the message Done is displayed momentarily to confirm that the operation was successful. The saved configuration is also selected as the configuration used when the Controller is powered-up.

Pressing the Escape button returns to the main menu without saving the configuration settings.

#### **1.5 SENSOR DIAGNOSTIC** menu item (displayed as **Sensors** )

After pressing Enter ( ↵ ) to select this menu, the up/down buttons are used to cycle through continuously updated displays of 6 available sensors. You can also more directly select a sensor value by typing a number from 1 to 6 . The sensor values are display as follows:

Battery voltage in volts:	Batt 13.7	means a battery voltage of 13.7 volts
Air temperature:	AirT-10C	means the air temperature is -10 degrees.

#### **Fahrenheit**

Optic temperature:	Opt 1 + 45 F	means optic sensor #1 is +45 degrees <b>Fahrenheit</b>
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#### **Celsius**

Relative humidity in %:	Humi 045 %	means the humidity is 45%
Dew point:	DewP+14 C	means the dew point temperature is +14 degrees <b>Celsius</b> .

Press the Escape (ESC) button to return to the main menu. If an error occurs reading any sensor (usually because the sensor is not plugged in), then the letters Err replace the sensor value.

#### **LOW VOLTAGE CUT-OFF**

Outputs 1 through 5 will shut down when the voltage in a battery reaches about 11.6 volts. Output 6 will continue to operate.

### USING THE TEMPERATURE / HUMIDITY FUNCTIONS

One temperature/humidity sensor and one 4' long temperature sensor cable are included with this controller. The short sensor is for the controller and it senses ambient air temperature and humidity. The sensor cable is to be used for monitoring temperature of an optic or device. Additional cables may be purchased and up to two can be used on this controller.

When used in conjunction with a heater strap the cable is to be placed underneath the heater strap, between the heater and the optic or device being heated. See Figure 1. The sensor is secured to the heater by flipping the sensor's velcro tab onto the back of the heater.

When used with a primary mirror in a Newtonian or Dobsonian telescope for example, the sensor should be taped against the side of the optic. See Figure 2. Tape is not included with the sensor.

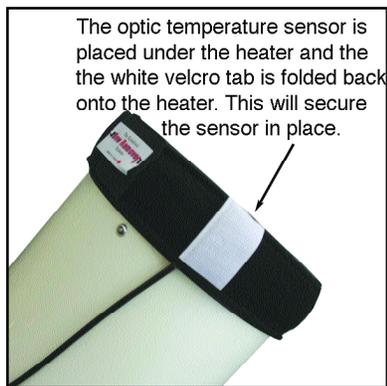


Figure 1

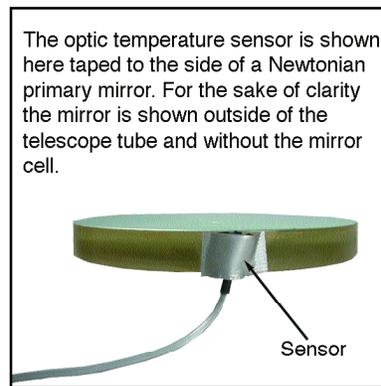


Figure 2

## **OPERATING THE CONTROLLER REMOTELY**

Software may be purchased that will allow the controller to be programmed and monitored remotely. This is a needed feature for anyone operating a telescope remotely (ie: someone doing CCD imaging from the comfort of their living room) or for anyone wishing to perform diagnostics on their heaters.

The software includes an RS232 cross-over cable that connects the controller to a COM port on the computer. This cable can be extended up to 200ft with a standard telephone wire.

The software will create a text file that is stored on your desktop and can be opened in a spreadsheet to help in diagnostics.

### **System Requirements for this software are:**

- PC with a Pentium-class processor. Pentium 90 or higher processor recommended.
- Microsoft Windows 98 or later operating system. Microsoft Windows NT 4.0 SP3 or later.
- 24 MB of RAM (32 MB recommended).
- Hard-disk space required: 10 MB. CD-ROM drive.
- VGA or higher-resolution monitor; Super VGA recommended. VB6 SP5 runtime environment (included).
- Null-modem RS232 cable and an available COM port.
- Kendrick PREMIER Dew Controller

## **TECHNICAL SPECIFICATIONS**

Weight: 418 grams /15 oz.

Dimensions: 142mm x 93mm x 32mm / 5.59" x 3.66" x 1.25"

Voltage (input and output): 12 vdc

Maximum amperage output per output: 10 amps

Maximum amperage output total: 10 amps

Sensor accuracy: +/- 1°C

## **TROUBLE SHOOTING**

1. Controller will start up when it is plugged in.

Check the fuse in the tip of power plug. To access the fuse, unscrew the tip and remove. Inspect the fuse. If it is blown, replace with a suitably sized fuse, preferably between 7 and 10 amps.

2. Controller goes through start up sequence but all the LEDs go out once the controller starts operating.

You most likely have a short in one of the heaters or devices that is plugged into the controller. Contact Kendrick to further trouble shoot a heater problem or the supplier of the device in question.

3. Error message for sensor inputs.

If a sensor is plugged into the sensor jack then make sure the sensors are properly plugged in. If it is plugged in and an error message persists, the sensor may be defective.

If one of the sensor inputs does not have a sensor cable plugged into it, it will display an error message. This is normal.

## **Recommended Settings**

### **•Duty Cycle**

For larger optical lenses and surfaces we recommend a setting between 40 & 100%, depending on your environment (ie: air temperature, dewing conditions). For smaller optics (6" or less), Newtonian primary and secondary mirrors and finderscopes, 40% or less will be adequate. For Telrads and Rigel Quik Finders a setting of 40 to 100% should be adequate. For eyepieces a setting of 40 to 100% will be adequate depending on the size of the eyepiece being heated and your environment.

### **•Dewpoint & Temperature variance**

The default variance is 7° C above ambient. Do not set the variance too close to ambient temperature as the controller will only begin to operate once the variance is met. If set too close to ambient temperature, it may be difficult for the controller to keep dew off the optics due to thermal loss in the optic being heated. Some experimentation will be required by you to determine what setting is best for your optic or device under your user conditions.

