AE2 Dual Temperature Controller User Manual

AE2 Dual Temperature Controller

--- Status Menus ---
Press ↑↓ to Adjust
↑↓ Show Relay Modes
Press <ENTER> to Set

12 VDC Power Input
Temp Sensor Inputs
Relay Outputs - 8 Amp

4x20 LCD Display

AE2 Dual Temperature Controller

DIN Rail Mounts

Touch Buttons

Size: 3.875 inch width, 3.5 inches tall, 1.75 inches tall with DIN Clips
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Important Note: We strive to provide accurate documentation and information. However it is possible there are errors and mistakes in this document. As such, please use this information at your own risk. We offer no guarantee of the completeness of the drawings and documentation herein. We assume no liability for errors, incomplete information, or false information and any resulting damages.
AE2 Dual Temperature Controller Features

**Inputs:** Four (4) temperature inputs + 1 optional onboard Relative Humidity Sensor

Uses NTC 10K sensors

**Outputs:** Two (2) dry relay contact outputs (with N.O, COMMON, and N.C contacts) (120VAC/30VDC, 8 amps breaking). Each relay can be controlled from one of 10 different control modes.

**Low Power:** DC: 10–15 VDC, approx 1.2W maximum power consumption with both relays active.

**Supported Control Modes:** Differential Heating/Cooling, Heat / Cool Thermostat, Time of Day Timer, Cyclic Timer, RH Humidistat/DeHumidistat

**Connectivity:** Screw terminals for all inputs, outputs, and power connections for ease of installation and maintenance.

**Display & HMI:** 4x20 LCD display with backlight, 5 capacitive pushbuttons for operation, configuration, and status monitoring via the LCD display.

**Programmable:** AE2 is fully programmable with FLASH memory configuration backup for automatic power restarting with no configuration necessary. Real time monitoring of the controller operation, temperature inputs and historical averages and relay on/off times are provided on the display.

**Mounting:** AE2 controller comes with DIN rail mounting clips and DIN Rail for flexible mounting.
GENERAL DESCRIPTION

The AE2 Temperature Controller is a full featured two output temperature controller with the ability to control two temperature control loops simultaneously.

It has four temperature sensor inputs that supports many common 10K NTC temperature sensors to make it extremely flexible and simple to retrofit older temperature controllers.

The AE2 is powered from a 12VDC power supply not provided with the kit.

Configuration and monitoring of the controller is extremely easy. You can configure the controller by using the touch buttons and LCD display. Nothing external is needed for programming.

The AE2 has two independent output relays that can switch either DC or AC loads (upto 30VDC or upto 120VAC, 8 Amps).
APPLICATIONS of AE2 DUAL TEMPERATURE CONTROLLER

Solar Hot Water / Solar Air Heating, Root Cellar and Attic Cooling - Differential Temperature Control – Fully Configurable with DeltaT On / Off, HIGH/LOW shutdown temperatures, and freeze protection options. Also includes minimum on/off time options. Both heating and cooling modes of differential control.

Thermostat Heat / Cool Control – Fully Configurable thermostat with set point and dwell adjust, industrial temperature range (-30F - 257F)

Humidity / Temperature Alarming – Condensation Mitigation and Control, Environmental Monitoring alarming, RH Monitoring and Alarming. RH Sensor is optional and must be ordered with controller.

Greenhouse Control – Control Cooling fans, watering, grow-lighting, freeze protection heating control, and humidity control.

Time of Day Control – Provide two on and off time selections. Use for watering and light control.

Configurable Control - All parameters of the controller can be configured and monitored on the display.
TOUCH BUTTONS
The AE2 has 5 touch buttons along the bottom of the printed circuit board. This are used to configure the controller.

1. **ON/OFF Button** - Pressing this button will put the AE2 into a power saving, relay disabled mode (OFF), or Enable the AE2 controller for normal operation. The AE2 will remember the ON/OFF state of the controller after the power is lost.

2. **STATUS / SETUP Button** - Pressing this button will take you to either the main status menu selection screen or the main status menu screen.
   a. From the **status menu screen** you can select display the relay control mode screen for either relay where you can monitor the controller operation, or temperature sensor menus where you can see current and long term averages for each temp sensor/RH, or relay status menus where you can see activations and on/off times for each relay over the day.
b. From the setup menu screen you can select setup menu groups for setting up the relay control modes, the current clock time, and the temperature units the controller will use and display.

3. ENTER Button - This button is used to accept the current displayed option or updated values you’ve selected. Normally the ENTER button is used after selecting a parameter with the UP and DOWN adjustment arrow buttons.

4. UP / DOWN Arrow Buttons - These buttons are used to adjust and select parameter choices. Use these buttons to choose menu options or adjust values when you see the UP/DOWN arrows at the beginning of a line in the LCD display (see top line of display below). That indicates its a selectable option you can choose with the arrow buttons.
RELAY CONTROL MODES
The AE2 supports 10 different programmable control modes for each relay. Any mode can be selected for either relay from the setup relay modes menu.

1. **Force Off**: This control mode is used to keep the relay off all the time.
2. **DeltaT Heat**: This control mode is used for solar hot water and solar air heating using differential control. Anytime you want to collect and store heat, use this mode
   a. Heating Sensor: This allows you to choose which temp sensor input will be attached to the heating device (typically a solar collector). Range: T1-T4 input
   b. Heat Storage Sensor: This allows you to choose which temp sensor input will be attached to the heat storage tank (typically a hot water tank or perhaps a room for solar air heating). Range: T1-T4 input
   c. DeltaT On: Use this to set how many degrees hotter the heating sensor is than the heat storage sensor before turning on the relay. Setting to higher values will reduce short cycling the pump. The value you set here must be greater than the DeltaT Off value to function. Range: 2-99 degrees.
   d. DeltaT Off: Use this to set how many degrees hotter the heating sensor is than the heat storage sensor before turning off the relay. This is normally set to a low value and is used to account for losses between the collector and the tank. The value you set here must be less than the DeltaT On value to function correctly. Range: 1-9 degrees.
   e. Max Storage Temp: Use this to set the maximum temperature you want your heat storage to get. For air heating this might be 80F, for a steel water tank this could be 180F depending on your application. When the Tank is greater than this setting, the relay will not turn on. Range: 0-255 degrees.
f. Freeze Protect: This setting (when set for YES) will turn on pump when the heating sensor gets below 34F. Mainly used for non-drainback systems. Range: YES (ON), NO (OFF)

g. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the deltaT off value is met earlier. Range: 0-60 minutes

h. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the deltaT on value is met earlier. Range: 0-60 minutes

3. DeltaT Cool: This control mode is used for root cellar and attic cooling using differential control. Anytime you want to collect and store cold, use this mode.
   a. Cooling Sensor: This allows you to choose which temp sensor input will be attached to the cooling device (typically outside air). Range: T1-T4 input
   b. Cool Storage Sensor: This allows you to choose which temp sensor input will be attached to the cool storage tank (typically a root cellar or perhaps an attic or room). Range: T1-T4 input
   c. DeltaT On: Use this to set how many degrees cooler the cooling sensor is than the cool storage sensor before turning on the relay. Setting to higher values will reduce short cycling the pump. The value you set here must be greater than the DeltaT Off value to function. Range: 2-99 degrees.
   d. DeltaT Off: Use this to set how many degrees cooler the cooling sensor is than the cool storage sensor before turning off the relay. This is normally set to a low value and is used to account for losses between the collector and the tank. The value you set here must be less than the DeltaT On value to function correctly. Range: 1-9 degrees.
   e. Min Storage Temp: Use this to set the minimum temperature you want your cool storage to get. For root cellar cooling this might be 40F. When the cool storage is less than this setting, the relay will not turn on. Range: 0-255 degrees.
   f. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the deltaT off value is met earlier. Range: 0-60 minutes
   g. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the deltaT on value is met earlier. Range: 0-60 minutes

4. Heat Thermostat: This control mode is used for heat thermostat. Anytime you want to keep something hotter than a setpoint temperature by controlling a heating source.
a. Temperature Input Sensor: This allows you to choose which temp sensor input will be used for monitoring the thermostat temperature. Range: T1-T4 input

b. Setpoint Temperature: This parameter is set to the desired setpoint temperature for the thermostat. Range: -30 - 257 degrees

c. Hysteresis: Use this to control how much hysteresis temperature. When set to a value > 0, this will keep the heating on past the setpoint by the hysteresis value. Can be used to reduce short cycling. As an example if setpoint is 50 and hysteresis is 10, controller will turn on at 49 and turn off at 60. Range: 0-99 degrees.

d. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes

e. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes

5. Cool Thermostat: This control mode is used for cool thermostat. Anytime you want to keep something cooler than a setpoint temperature by controlling a cooling source.

a. Temperature Input Sensor: This allows you to choose which temp sensor input will be used for monitoring the thermostat temperature. Range: T1-T4 input

b. Setpoint Temperature: This parameter is set to the desired setpoint temperature for the thermostat. Range: -30 - 257 degrees

c. Hysteresis: Use this to control how much hysteresis temperature. When set to a value > 0, this will keep the heating on past the setpoint by the hysteresis value. Can be used to reduce short cycling. As an example if setpoint is 50 and hysteresis is 10, controller will turn on at 51 and turn off at 40. Range: 0-99 degrees.

d. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the setpoint value is met earlier. Range: 0-60 minutes

e. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes

6. Cyclic Timer: This control mode is used for misting, lighting, circulating pump, watering. Anytime you want to turn something on and off with a set of on and off time duration repeatedly.

a. On Time: Set this value to how long you want to relay to stay on in seconds. Range: 1-9999 seconds.
b. Off Time: Set this value to how long you want to relay to stay off in seconds. Range: 1-9999 seconds.

The relay will turn off for the On Time setting seconds, then stay off for the Off time seconds, repeating this continuously.

7. **Time Of Day**: This control mode is used for misting, lighting, watering. Anytime you want to turn something on and off at specific times based on the current clock setting. This time works in minutes only.
   a. Turn On 1 Hr / Turn On 1 Minute: Set this to the time you want the relay to turn on. When the system time reaches this time setpoint, the relay will turn on. Range: 0-23 hours, 0-59 minutes.
   b. Turn Off 1 Hr / Turn Off 1 Minute: Set this to the time you want the relay to turn off. When the system time reaches this time setpoint, the relay will turn off. Range: 0-23 hours, 0-59 minutes.

   The a and b settings above work together to create one window of time to turn on the relay.
   
   c. Turn On 2 Hr / Turn On 2 Minute: Set this to the time you want the relay to turn on. When the system time reaches this time setpoint, the relay will turn on. Range: 0-23 hours, 0-59 minutes.
   d. Turn Off 2 Hr / Turn Off 2 Minute: Set this to the time you want the relay to turn off. When the system time reaches this time setpoint, the relay will turn off. Range: 0-23 hours, 0-59 minutes.

   The c and d settings above work together to create a second window of time to turn on the relay.

   Setting both values of a group to the same time setpoint will disable that group. Relays activate and deactivate with the time setpoint and current system time are the same.

8. **RH-STAT G.T.**: This control mode is used for humidistat control. Anytime you want to keep the RH (relative humidity) greater than a setpoint by controlling a humidifier source.
   a. RH Setpoint: This parameter is set to the desired RH reading for the humidistat. Range: 1-99 RH
   b. Hysteresis: Use this to control how much hysteresis RH. When set to a value > 0, this will keep the humidifying on past the setpoint by the hysteresis value. Can be used to reduce short cycling. As an example if setpoint is 50 and hysteresis is 10, controller will turn on at 49 and turn off at 60. Range: 0-99 RH.
   c. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes
d. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes

9. RH-STAT L.T.: This control mode is used for humidistat control. Anytime you want to keep the RH (relative humidity) less than than a setpoint by controlling a dehumidifier source.
   a. RH Setpoint: This parameter is set to the desired RH reading for the humidistat. Range: 1-99 RH
   b. Hysteresis: Use this to control how much hysteresis RH. When set to a value > 0, this will keep dehumidifying on past the setpoint by the hysteresis value. Can be used to reduce short cycling. As an example if setpoint is 50 and hysteresis is 10, controller will turn on at 51 and turn off at 40. Range: 0-99 RH.
   c. MinOn Time: Use this to set a minimum pump run time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum on time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay on for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes
   d. MinOff Time: Use this to set a minimum pump off time in minutes if needed by your pump manufacturer. To disable, set to 0. Some pumps require a minimum off time of 10-20 minutes. This parameter can be used to enforce that. When set to values > 0, this parameter will keep the relay off for min on minutes regardless if the setpoint is met earlier. Range: 0-60 minutes

10. Force On: This control mode is used keep the relay on all the time.
Application Example Diagram

Differential Temperature Control + Heat Thermostat Example

In this example relay 1 is configured for DeltaT Heating and controls a pump for a solar hot water heating system. Relay 2 is configured for a simple Heat Thermostat for controlling a pump to move hot water thru a radiant floor.
INSTALLATION

Always connect the power to the unit last. Always disconnect power to the unit first before servicing or changing wiring. It is important to remember that power from external power supplies may be present on the output contact even when the device is not powered since they are generated external to the device. **Ensure output wiring is powered down before working on!!!**

**First, Connect Sensor Wiring:**

Input Sensors: Connect temperature sensors to any available T1-T4 input first. If you need to extend the temperature sensor wiring, use a twisted pair type wire like telephone line or Ethernet cable if available. Generally extending sensor wiring up to 100 ft is ok and will not result in appreciable error. Passive sensors have no polarity and can be connected in any orientation to a single input pair. All inputs can be assigned to any control mode input desired. T1 and T2 share a common center pin on the connector as well as T3 and T4 share a common center pin. Picture shows two leads going into the middle screw terminal for the T1 and T2 input sensors.

Do not bridge sensor inputs to multiple devices. Sensors should only be tied to one controller at a time.

**Second, Connect Output Wiring:**

Always disconnect and unplug all power wiring to load device before connecting!!! Use output fuses in-line with each output load to protect end equipment and controller for shorts at the load. Verify all wiring connections to load devices before powering any circuits. Consult local code requirements and wiring requirements. The N.C. pin is normally closed with no power connected, the N.O. pin is normally open with no power connected. When the controller turns on a relay, the N.O. will be connected to the C pin (Common). For switching power to loads, connect external power to the center C pin. Connect the N.O. pin to the load device power input pin. When the relay is turned on, the relay will close and power will go to the load device (pump, fan, etc) and turn it on.
Third, Connect Power to Power Input:

The AE2 required a well regulated 10-15VDC power supply for operation. The unit is low power, requiring less than 120 mA to operate. The power input is on the left two screw terminals. Positive voltage is on the left and is marked with a (+) sign on the board. Negative / Ground is on the right and marked with a (-) on the board.

Note: If you using the same power supply for DC load devices, do not use the power ground connection wire for the load return wire. Always use separate wires for output load grounds and input power.

Verify your power supply meets the requirements with a meter before connecting to controller input. It’s good practice to use a switch and fuse to connect power to unit.

After applying power to the unit, it will initialize and go thru a diagnostic commissioning phase before it begins operating and controlling the outputs.
AE2 Board Physical Drawing

The AE2 Dual Temperature Controller is approx. 3.875 x 3.5 x 1.75 (Drawing not to scale)

Side view of controller showing DIN clip connected to DIN rail.
# HARDWARE SPECIFICATIONS

## Power Input:

<table>
<thead>
<tr>
<th>Power Input (DC)</th>
<th>10-15.0 VDC, 0.12 Amps Max,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td>1.2W max with all RELAY Outputs engaged</td>
</tr>
</tbody>
</table>

## Inputs - Temperature Inputs (T1-T4)

<table>
<thead>
<tr>
<th>Temperature Inputs (T1-T4) Types Supported</th>
<th>10K NTC Type2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Sensor Range</td>
<td>-30F – 257F, -34C – 125C</td>
</tr>
</tbody>
</table>

## Outputs - Dry Relay CONTACTS, 3 Contacts (N.O,COM,N.C.) (R1-R2)

<table>
<thead>
<tr>
<th>Dry RELAY Contact Output (R1-R2)</th>
<th>8 Amp Continuous, 30VDC Max DC Voltage, 120VAC Max AC Voltage</th>
</tr>
</thead>
</table>

## Relative Humidity (RH) Sensor (Optional)

<table>
<thead>
<tr>
<th>Relative Humidity (RH) Sensor (optional)</th>
<th>RH: 1-99% - +/- 3% RH typical</th>
</tr>
</thead>
</table>

## HMI LCD Display and Pushbuttons

<table>
<thead>
<tr>
<th>Display Type</th>
<th>4x20 Backlit LCD Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrast Adjust</td>
<td>On back of display there is potentiometer adjust</td>
</tr>
</tbody>
</table>

## RTC:

<table>
<thead>
<tr>
<th>Real Time Clock</th>
<th>YES, with limited backup time recovery</th>
</tr>
</thead>
</table>

## Environmental Specifications:

<table>
<thead>
<tr>
<th>Operating Temperature</th>
<th>-30C – 65C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-40C – 85C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>1 – 99%, non-condensing</td>
</tr>
</tbody>
</table>

[www.mydtcstore.com](http://www.mydtcstore.com)  Revision 1.0
Screw Terminal Specifications:

<table>
<thead>
<tr>
<th>Wire Gauge</th>
<th>14-26 AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>10A</td>
</tr>
<tr>
<td>Voltage</td>
<td>300V</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION

See [www.mydtcstore.com](http://www.mydtcstore.com) for ordering information and pricing.

WARRANTY

The AE2 controller comes with a 1 year warranty.

Contact mydtcstore by email for warranty service.

Warranty is null and void if the unit has been modified in any way.
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