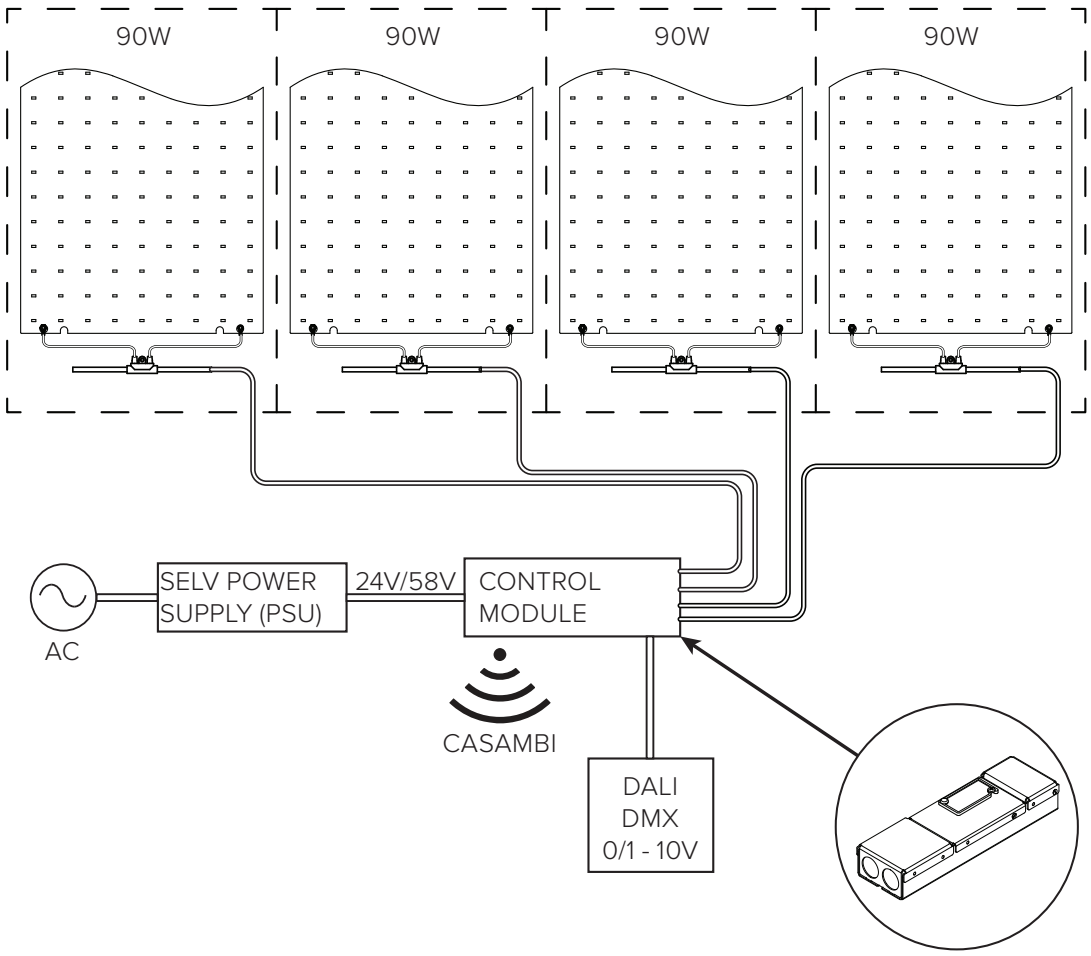
COOLEDGE™

# COOLEDGE LIGHTING CONTROL MODULE USER GUIDE (24V / 58V)




Suitable for use in dry locations only - IP20

CONTROL MODULE should be installed by a qualified electrician.

All devices should always be disconneced from mains power supply and verify its absence prior to installation/maintenance.

Damage to CONTROL MODULE and/or light sheets may occur if wired incorrectly.

**FCC STATEMENT:**
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

CE

c UL us LISTED

RoHS

**5 Year Limited Warranty:**
Parts and workmanship

Cooledge Lighting Inc.
110-13551 Commerce Parkway
Richmond, BC V6V 2L1 Canada

O +1 604 273 2665
F +1 604 273 2660
T +1 844 455 4448
W cooledgelighting.com

## CONTENTS

## 1.0 IMPORTANT INSTALLATION NOTES

**Please read instructions prior to installation**

Installation must be completed by a qualified electrician in accordance with all national and local electrical and construction codes.

Ensure power is off prior to installation.

Cooledge Control Modules are IP20 rated. For a higher degree of ingress protection, they must be mounted ina suitably rated enclosures.

Cooledge Control Modules must be powered by a Cooledge approved constant voltage SELV power supply.

Using a non-approved power source could damage the system and will void the warranty.

## 2.0 COOLEDGE CONTROL MODULE MODEL NUMBER LEGEND

CTR-□□□-□□□-□□V

| Mode | |
|---|---|
| SCT | Static Color Temperature |
| TNW | Tunable White |
| DTW | Dim-To-Warm |

| Control Protocol | |
|---|---|
| DAL* | DALI Control |
| CAS | Wireless (Cassambi) |
| DMX | DMX Control |

* Includes 0/1-10V

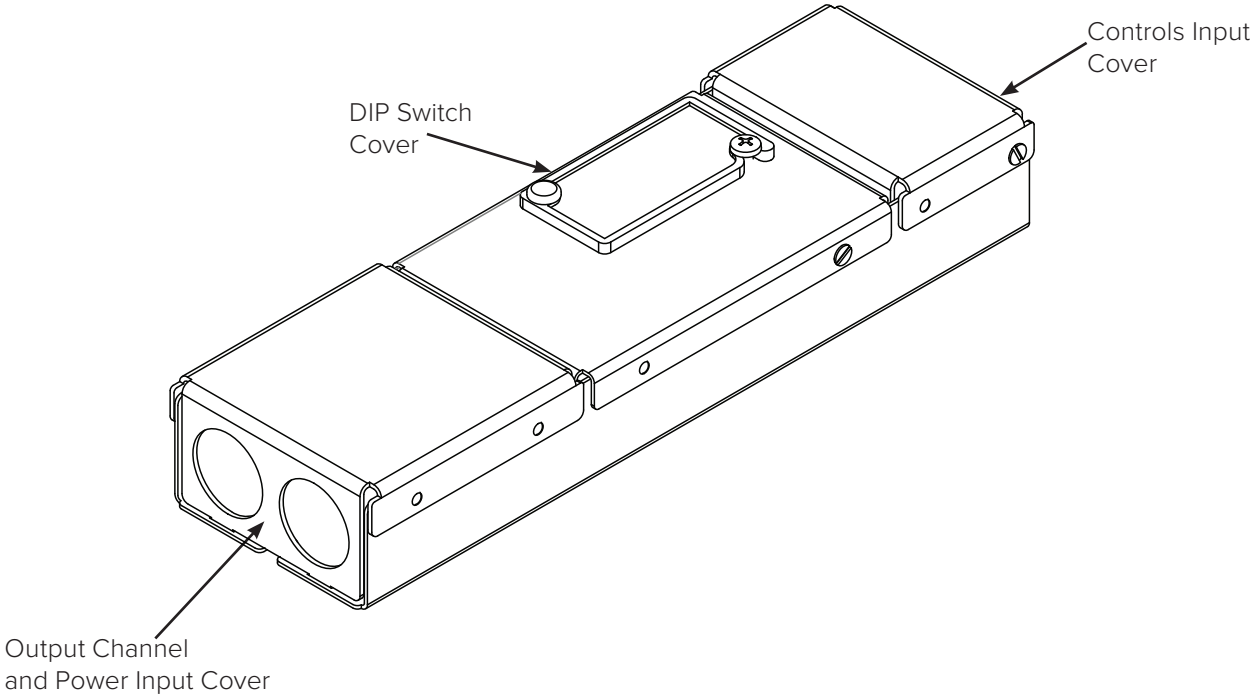
| Input Voltage | |
|---|---|
| 24 | 24 Volts |
| 58 | 58 Volts |
| | |

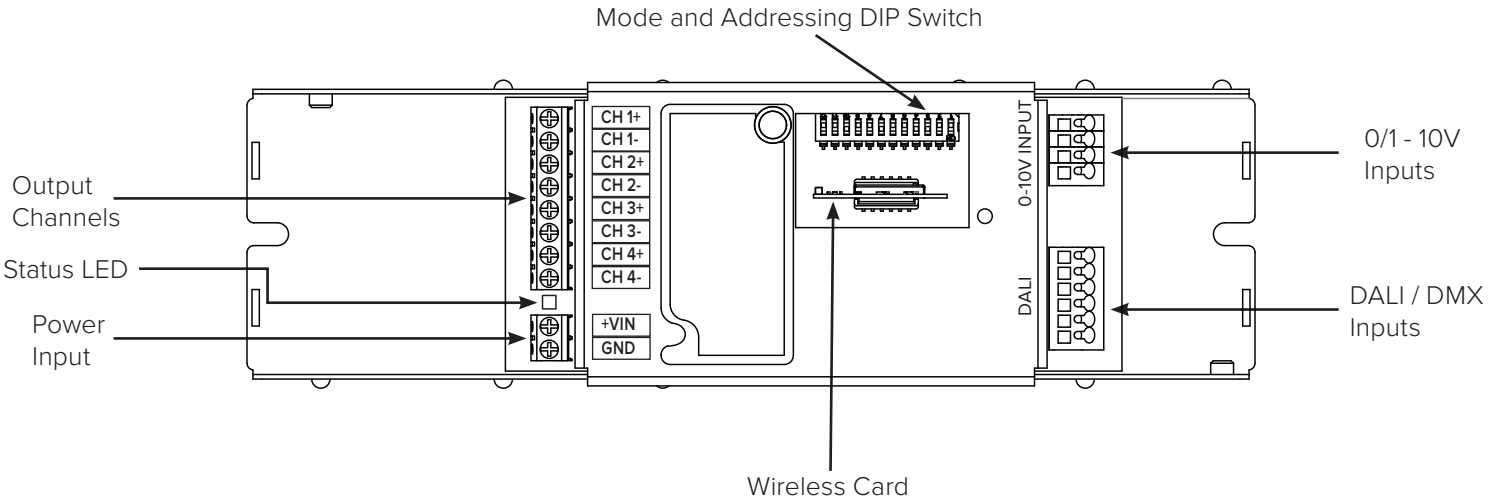
List of Product Part Numbers:

CTR-SCT-DAL-24V
CTR-SCT-CAS-24V
CTR-SCT-DMX-24V
CTR-SCT-DAL-58V
CTR-SCT-CAS-58V
CTR-SCT-DMX-58V
CTR-TNW-DAL-58V
CTR-TNW-CAS-58V
CTR-TNW-DMX-58V
CTR-DTW-DAL-58V
CTR-DTW-CAS-58V
CTR-DTW-DMX-58V

## 3.0 INTRODUCTION TO COOLEDGE CONTROL MODULE

The Cooledge Control Module receives a single DC power input from a constant voltage power supply (24V or 58V) and converts it into up to 4 controlled output channels of max. 90W each. Input signals from 3rd party controllers are used to control dimming and CCT tuning (if applicable). The control protocol required to interface with the controller determines which Control Module product model is required: DALI (0/1-10V), DMX, or Wireless (Casambi).



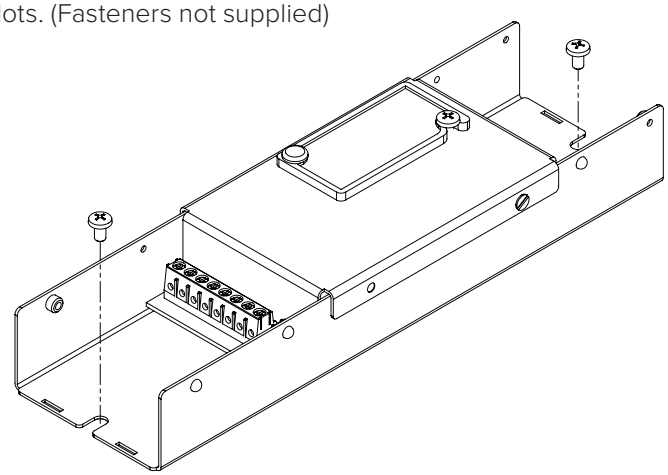

## 4.0 CARE AND HANDLING GUIDELINES

As with all electronics, Cooledge Control Modules are susceptible to damage from Electrostatic Discharge (ESD). Where possible avoid situations that are conducive to creating static.

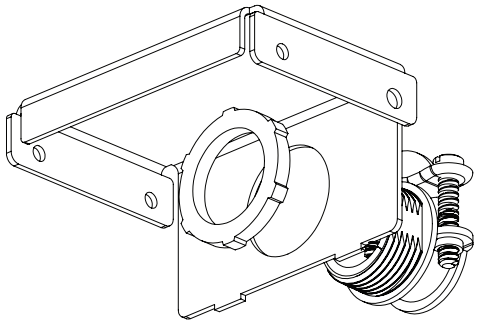
Avoid dropping the Control Modules.

## 5.0 MOUNTING

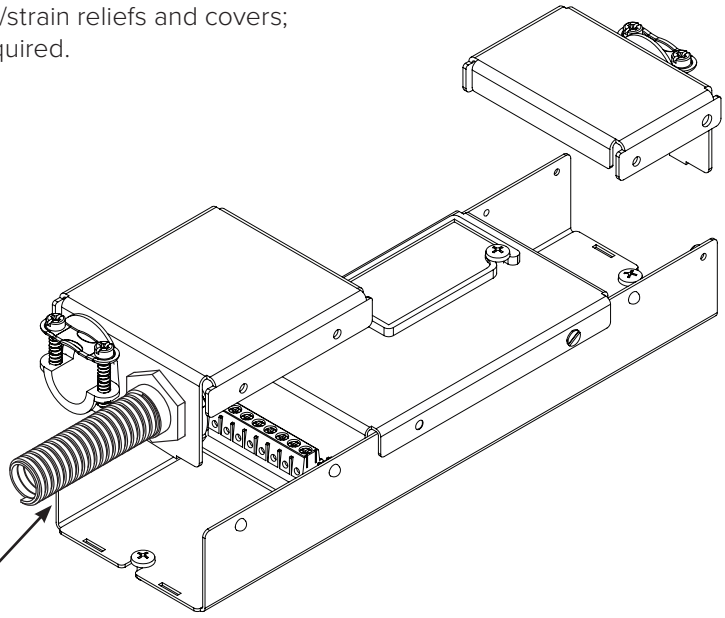
Fasten module in position by using the two mounting slots. (Fasteners not supplied)



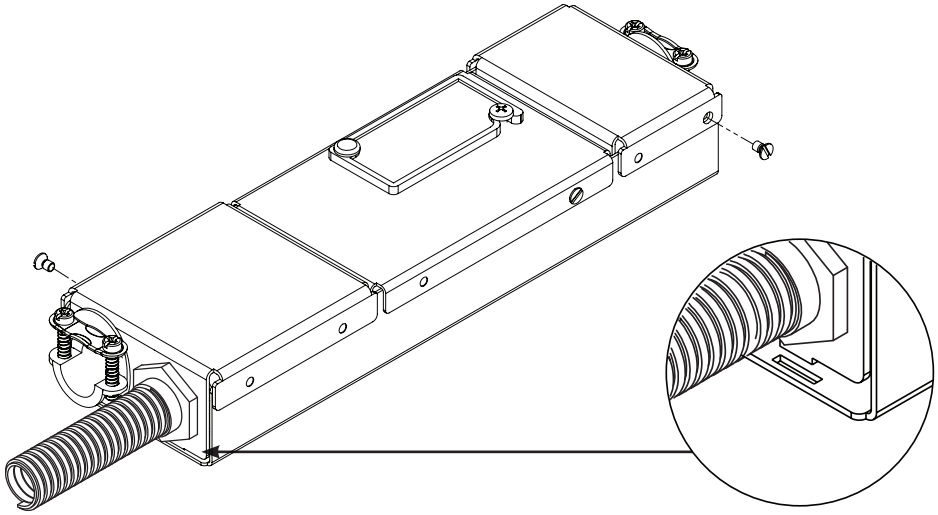
Terminal covers support 1/2” (13mm) strain relief or conduit.



Guide cables through conduit/strain reliefs and covers; then make connections as required.



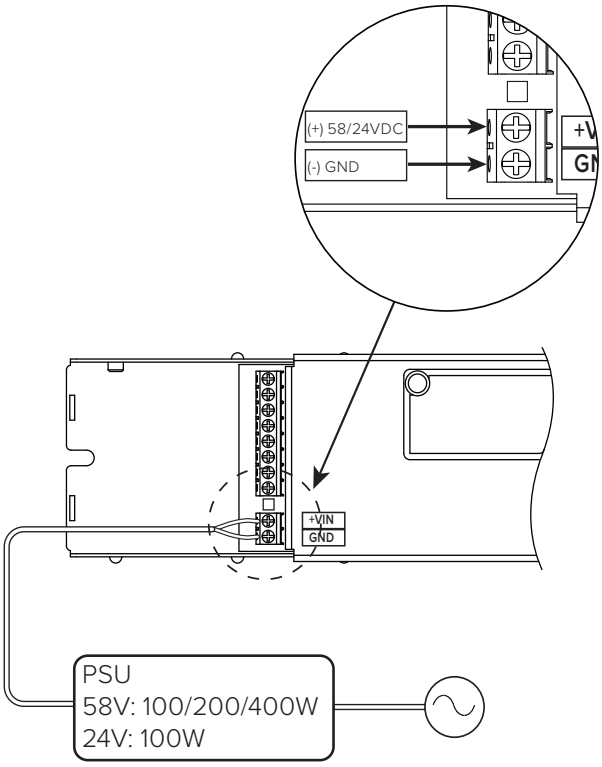
To meet UL requirements conduit or armoured cable must be used for power input cables.



Snap terminal cover onto module ensuring tabs locate into base. Then secure using screws provided.

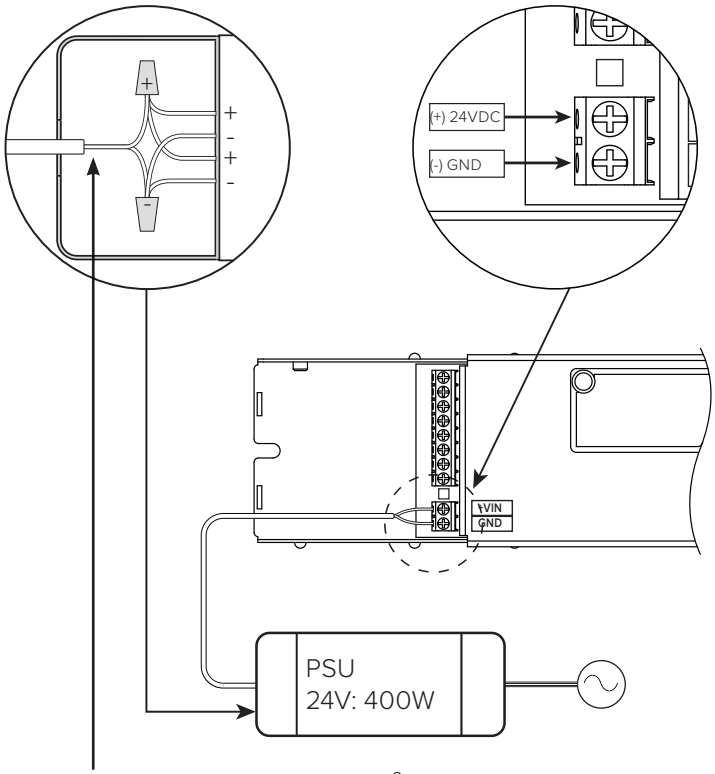
## 6.0 INPUT POWER

58V - 100/200/400W - SELV
24V - 100W - SELV



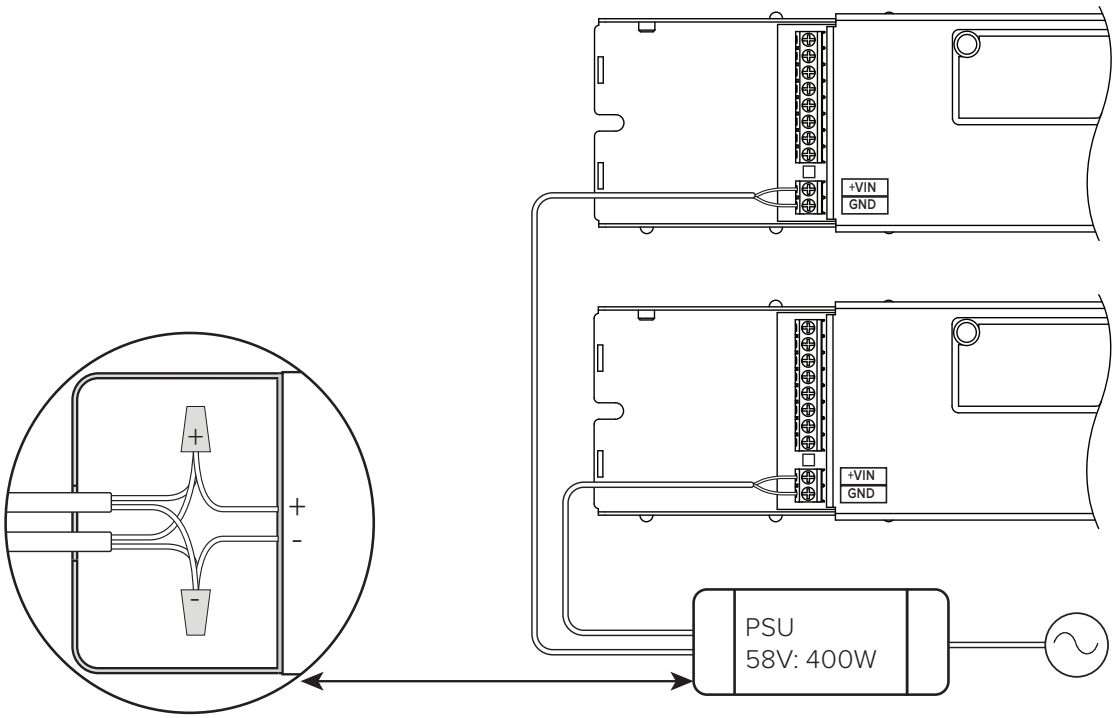

The 100W PSU (58V) cUL version is not compatible with Cooledge Control Modules.

24V - 400W - SELV




Minimum wire size: 12AWG (3.3mm$^2$)

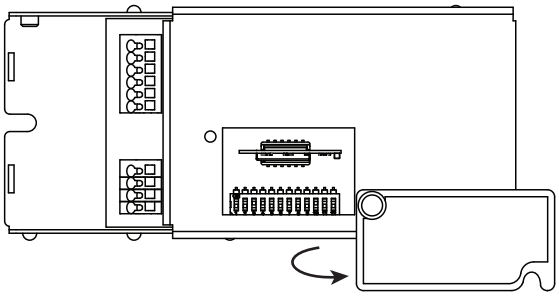
Optional wiring method for TNW and DTW installations using the 400W 58V PSU.

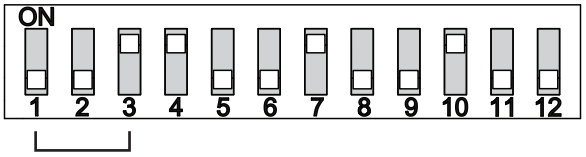


## 7.0 OPERATIONAL MODES

The Cooledge Control Module has three (3) standard operational modes that are preset at the factory and ordered by product model type:
1) Static Color Temperature (”SCT”): used with TILE Interior, TILE Exterior, and LINE to control dimming, where a single CCT is available.
2) Tunable White (”TNW”): used with TILE Tunable White to control dimming and CCT tuning.
3) Dim-to-Warm (”DTW”): used with TILE Tunable White > Dim-to-Warm option to control dimming which then sets the CCT.

In addition to the preset operational modes, there are two additional modes that may be enabled by changing DIP switch settings on the module:
- Standalone: may be used to access preset dim levels or CCTs where there is no 3rd party controller
- Dynamic Test: may be used for on-site troubleshooting to diagnose system problems without the use of a 3rd party controller. The operational mode is set using DIP switches 1-3 as indicated in Sections 7.2 - 7.7. In general, there should not be a need to adjust the switches unless accessing one of the two additional operational modes.






- Switches 1 - 3: Control Module MODE

- To access the DIP switches for selecting the operational mode, unfasten the cover screw and rotate cover out of the way.
- Each switch from 1-3 is used to identify the controller mode, see charts below. For example to set the controller to Tunable white (TNW) mode, set switch 2 in the ON (=1) position and the rest in the OFF (=0) positions, 0-1-0.

## 7.1 CONTROL PRIORITY

Each module has the capability of being controlled via external control signals or on-board settings. The control priority is as follows:

DALI (0/1 - 10V): If the control module receives a DALI input, it will operate according to the DALI commands it receives in priority to 0/1 - 10V signals that may be received. Eg. if both protocols are connected, the module will execute DALI commands. If one of the additional operational modes (Standalone or Dynamic Test) is selected, the module will ignore external controller commands and operate according to the settings of the operational mode selected.

DMX: If one of the additional operational modes (Standalone or Dynamic Test) is selected, the module will ignore external controller commands and operate according to the settings of the operational mode selected.

Wireless (Casambi): When the wireless chip is installed in the Control Module all other inputs are ignored. If one of the additional operational modes (Standalone or Dynamic Test) is selected, the module will ignore Casambi enabled device commands and operate according to the settings of the operational mode selected.

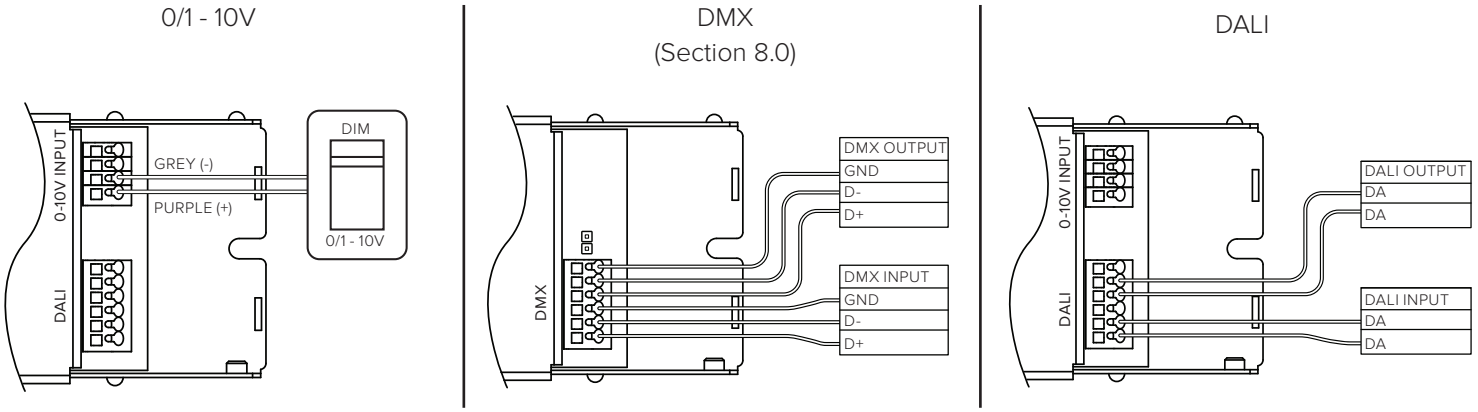
### 7.2 STATIC COLOR TEMPERATURE (SCT)

Static color temperature is a mode in the Control Module used for controlling the dimming features of Cooledge products: TILE Interior, TILE Exterior, and LINE. There are 4 output channels, each channel is able to handle up to a 90W load.

| Dimming Protocol | Mode Switches 1-3 (Log)* | Mode Switches 1-3 (Linear) |
|---|---|---|
| 0/1 - 10V SCT | 0-0-0 | 0-0-1 |
| DALI SCT | 0-0-0 | 0-0-1 |
| DMX SCT | 0-0-0 | 0-0-1 |
| Wireless SCT | 0-0-0 | 0-0-1 |

*Factory set. If the Linear dimming curve is required, the DIP switch settings must be adjusted as shown. See Section 7.6 for details of the two dimming curves.

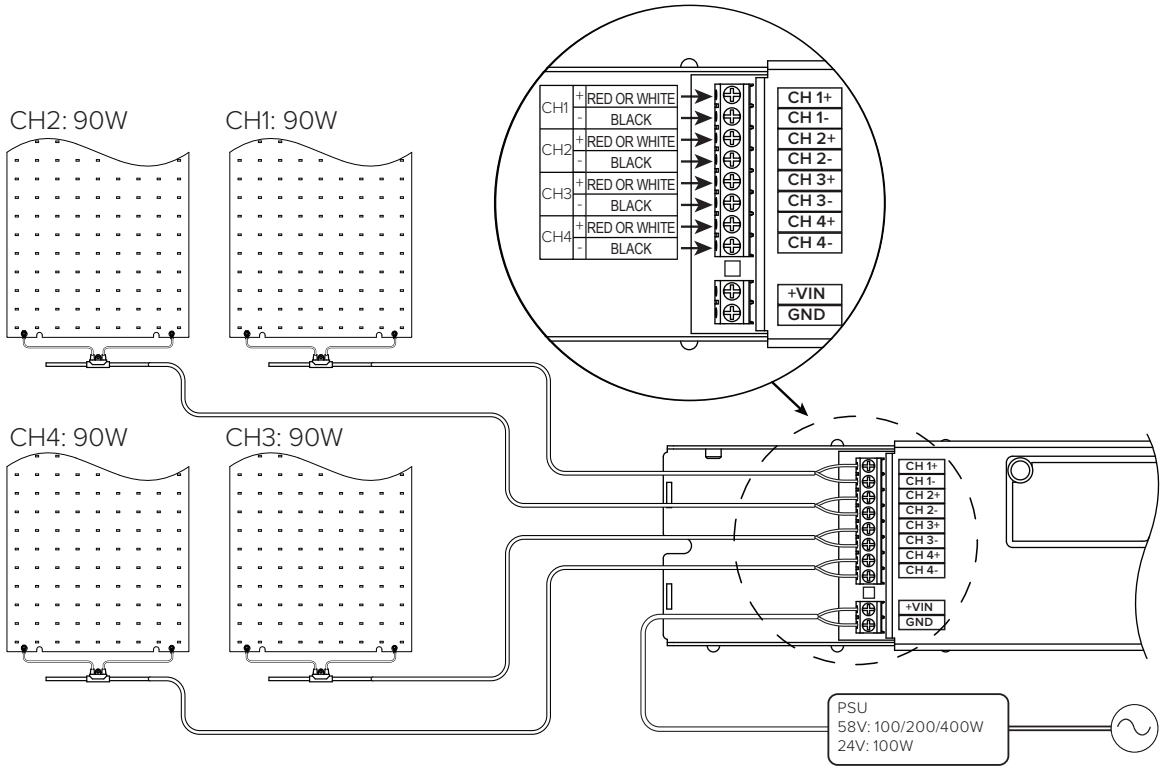
### INPUTS




Note:
A single 0-10V input dimming command will be applied to all output channels.

### OUTPUTS

Refer to section 7.5 for wireless

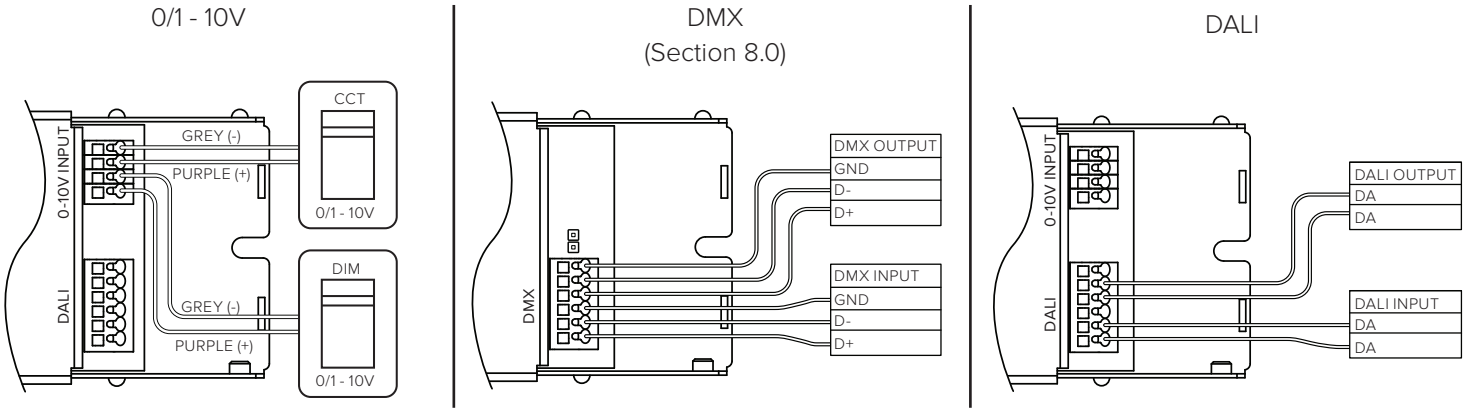


### 7.3 TUNABLE WHITE (TNW)

Tunable White is a mode in the Control Module to be used in conjunction with TILE Tunable White. Powering the controller in this mode can be done with 58V *100W/200W/400W drivers. A 400W driver can power up to 2 Control Modules, refer to section 6.0..

| Dimming Protocol | Mode Switches 1-3 |
|---|---|
| 0/1 - 10V TNW | 0-1-0 |
| DALI TNW | 0-1-0 |
| DMX TNW | 0-1-0 |
| Wireless TNW | 0-1-0 |

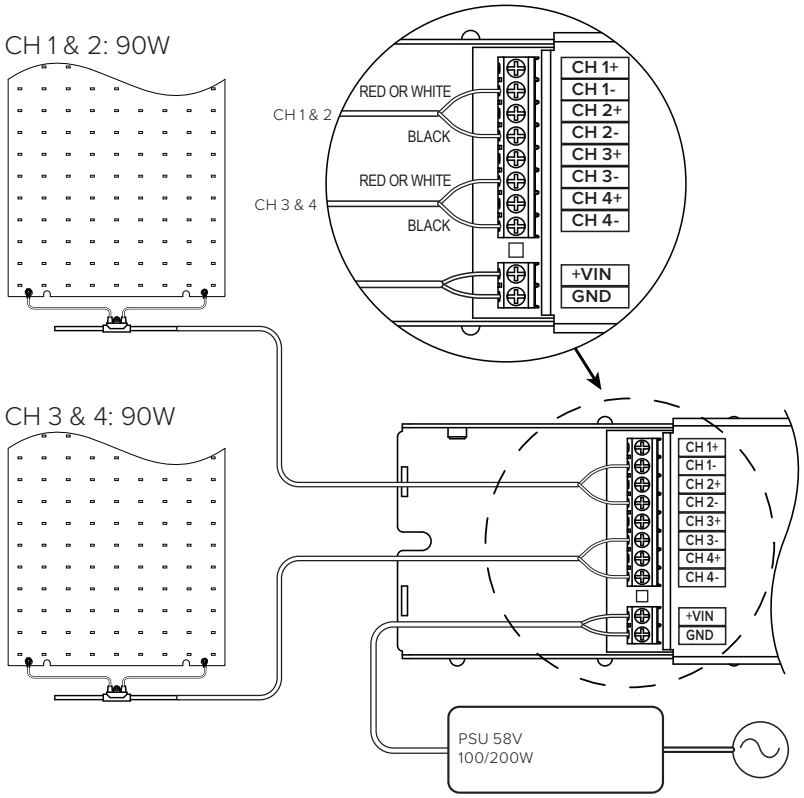
### INPUTS




DIM 10V = 100% Brightness
CCT 10V = Cool (5700K)

### OUTPUTS

Refer to section 7.5 for wireless

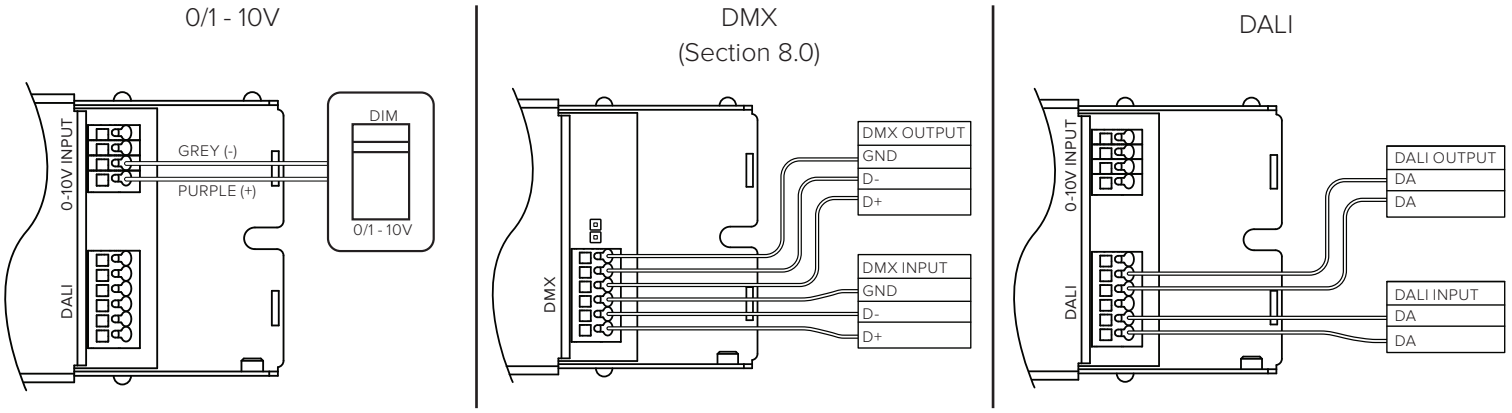


### 7.4 DIM-TO-WARM (DTW)

Dim-to-Warm is a mode in the Control Module to be used in conjunction with the Dim-to-Warm option of TILE Tunable White. In this mode the CCT will adjust from 2200K at lowest dim setting to 3500K at the highest dim setting. This mode can be used with 58V *100/200/400W systems. A 400W driver can power up to 2 Control Modules, refer to section 6.0

| Dimming Protocol | Mode Switches 1-3 |
|---|---|
| 0/1 - 10V DTW | 0-1-1 |
| DALI DTW | 0-1-1 |
| DMX DTW | 0-1-1 |
| Wireless DTW | 0-1-1 |

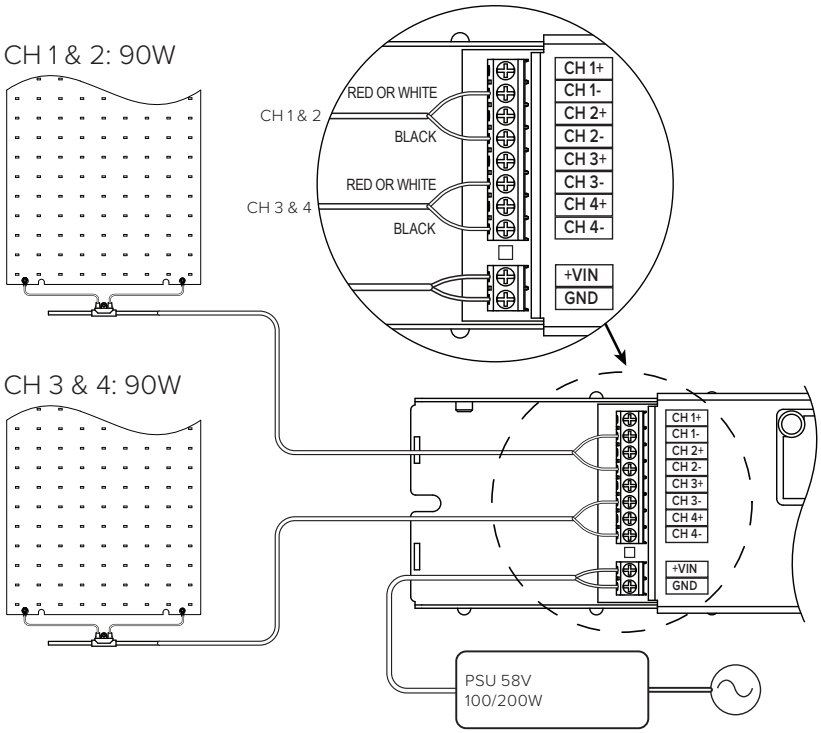
### INPUTS




DIM 10V = 100% Brightness 3500K

### OUTPUTS

Refer to section 7.5 for wireless



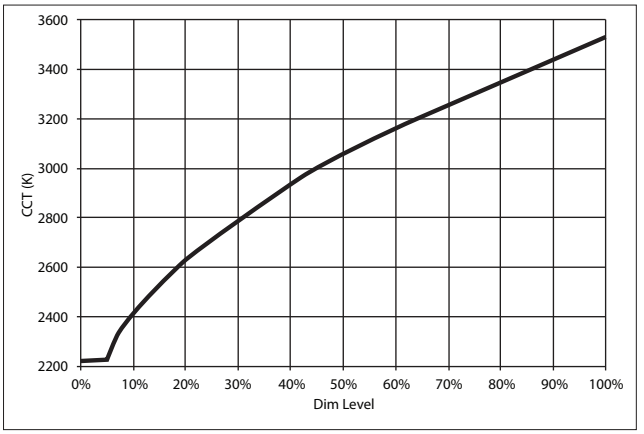
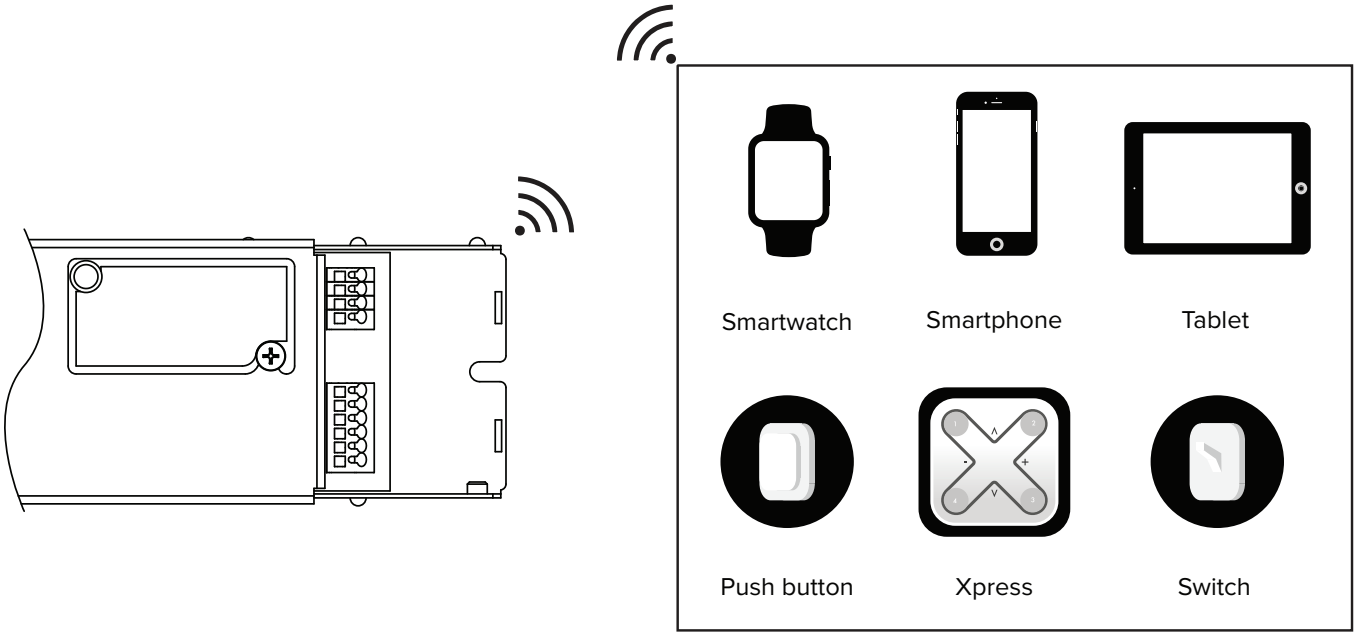



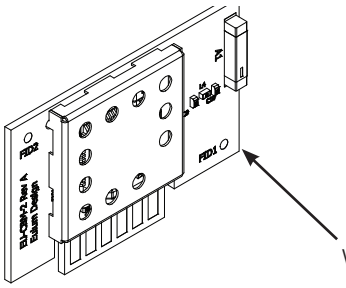

Figure 1: Dim Inputs vs CCT Output

## 7.5 WIRELESS

The Cooledge Control Module is capable of wireless control through the Casambi app (free on IOS and Android Devices). To download the Casambi App and access other relevant documentation please visit www.casambi.com/downloads.html.

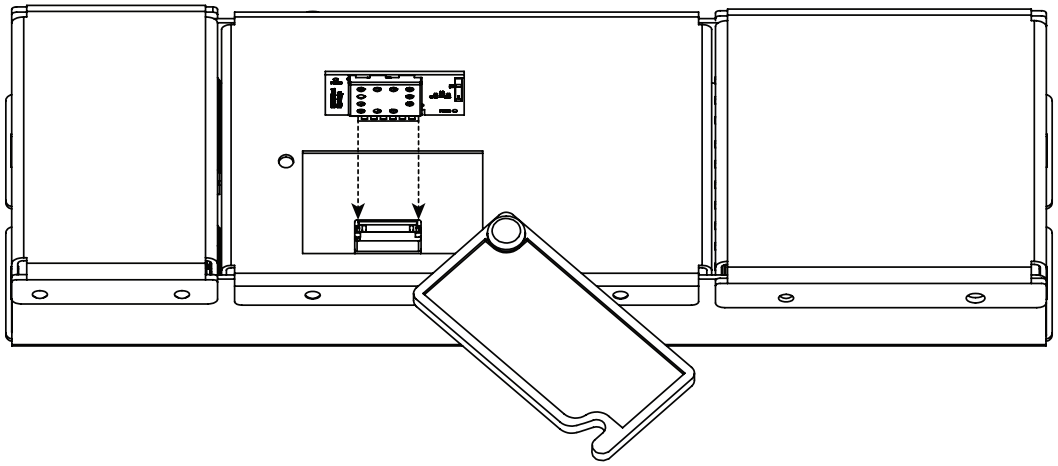



The Cooledge Control Module enables the use of Casambi enabled devices such as smartphones, tablets, or wireless switches to program and/or control dimming and CCT tuning of Cooledge products. This functionality allows the user to set scenes or dynamically control the lighting without the use of a third party controller.



Wireless card found under Cooledge Cover

Wireless models of Cooledge Control Module are shipped with a factory-installed card that enables the Casambi functionality. It is possible to convert a DALI model to a wireless model by installing this card. Conversely, it is possible to convert a wireless model to a DALI or 0/1-10V model by removing the card found in the location indicated in the illustration below. When inserting the wireless card do so with the component side towards the DIP switch.



Consult the “Short User Guide to the Casambi App” at https://casambi.com/static/datasheets/short-user-guide.pdf” for additional information related to setting up and using Casambi.

## 7.5 WIRELESS

The Cooledge control module has custom profiles which are used when in Tunable White mode and Dim-to-Warm mode. When accessing the controller using the Casambi app the main screen will look similar to Figure 2 for a single control module connected to a network.


Figure 2: Network home window

To precisely control the lighting elements press and hold the control module image, this will show up to 4 sliders to adjust output values. Pressing the numeric value will allow the operator to type in a specific value. Alternatively for quick dimming adjustment, select the controller and pan left or right on the screen to adjust the dimming level across all systems connected.

In static color temperature mode (SCT), it is possible to control up to 4 systems Independently on Control Module.
The image below shows the adjustment sliders for SCT set Controllers.

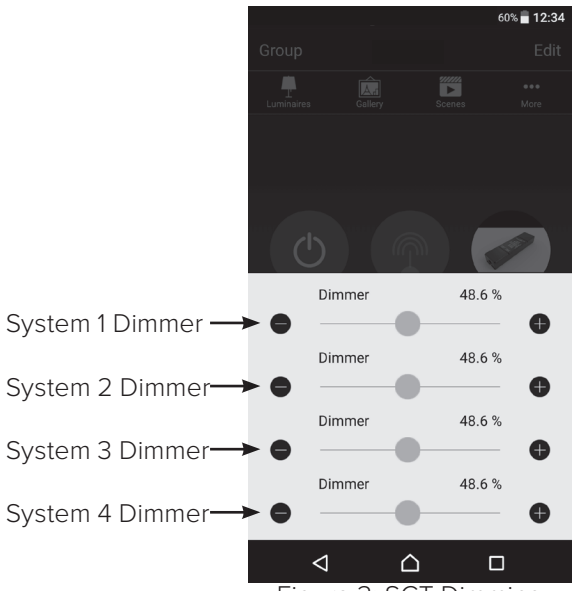



Figure 3: SCT Dimming

## 7.5 WIRELESS

In Tunable White (TW) and Dim-to-Warm (DTW) mode it is possible to control up to two systems from a single Control Module
The images below shows the adjustment sliders for TW (Left) and DTW (Right).

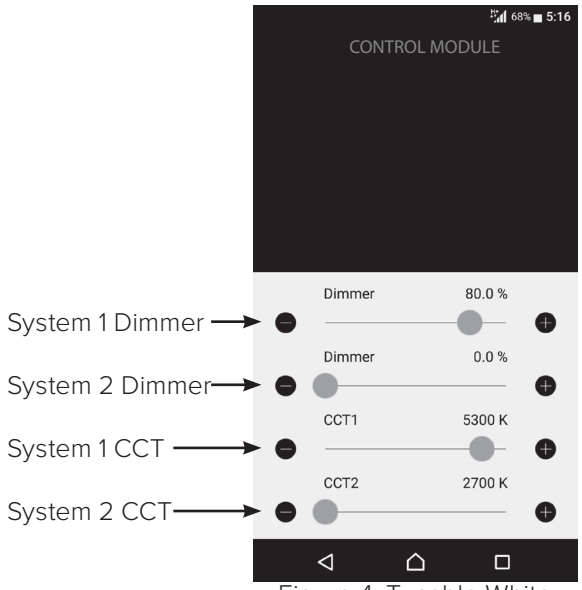


Figure 4: Tunable White

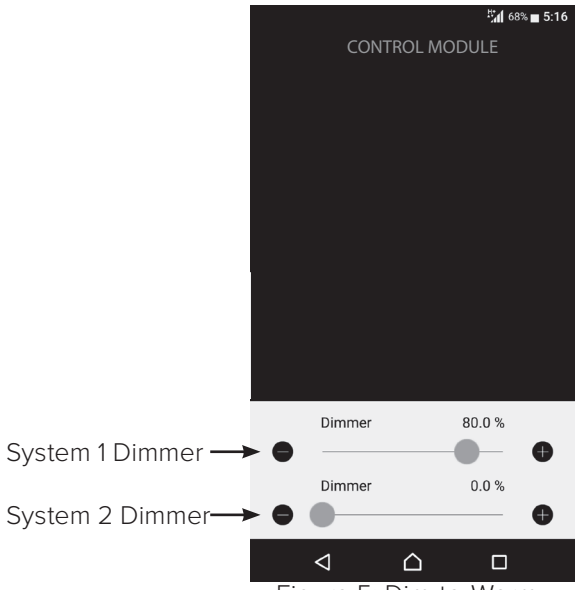


Figure 5: Dim-to-Warm

## 7.6 STANDALONE MODE

Standalone mode gives a pre-defined user-selectable fixed dimming and/or color output. No external control input is required for SCT models. There are two different Dimming curves available; log and linear. Refer to appendix A for log intensity values, and appendix B for linear intensity values.

| Standalone SCT | Mode Switches 1-3 | Switches 4-12 (Intensity) |
|---|---|---|
| Fixed Dimming Level - LOG | 1-0-0 | X-X-X-X-X-X-X-X-0 |
| Fixed Dimming Level - LINEAR | 1-0-0 | X-X-X-X-X-X-X-X-1 |

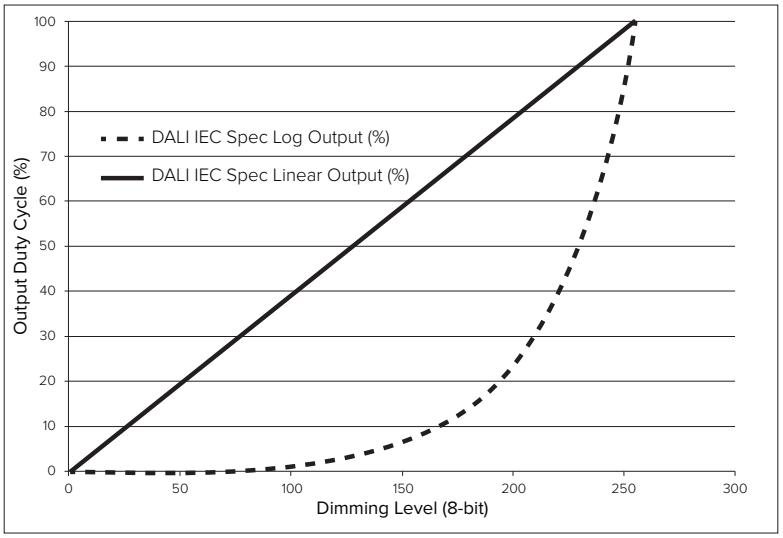



Figure 6: Dimming vs Output duty cycle, logarithmic and linear

| Standalone TNW/DTW Chart | Mode Switch 1-3 | Switches 4-7 (Intensity) | Switches 8-12 (CCT) |
|---|---|---|---|
| Fixed Output - TNW | 1-1-0 | X-X-X-X | X-X-X-X-0 |
| Fixed Output - DTW | 1-1-0 | X-X-X-X | X-X-X-X-1 |

Use the following charts for selecting the fixed output levels for TNW and DTW. Minimum dimming level for TNW is 1%, levels 0-5* will result in 1% intensity for TNW. When using DTW in Standalone mode switches 8-11 are ignored as CCT is not independently adjustable in DTW, the selected intensity will determine the CCT according to Figure 7.

| INTENSITY | | | CCT | | |
|---|---|---|---|---|---|
| Level | Dip Setting | Output (%) | Level | Dip Setting | Color Temp (K) |
| 0 | 0000 | 0.05* | 0 | 0000 | 2700 |
| 1 | 0001 | 0.16* | 1 | 0001 | 2850 |
| 2 | 0010 | 0.25* | 2 | 0010 | 3000 |
| 3 | 0011 | 0.39* | 3 | 0011 | 3200 |
| 4 | 0100 | 0.62* | 4 | 0100 | 3400 |
| 5 | 0101 | 0.99* | 5 | 0101 | 3600 |
| 6 | 0110 | 1.58 | 6 | 0110 | 3800 |
| 7 | 0111 | 2.51 | 7 | 0111 | 4000 |
| 8 | 1000 | 3.99 | 8 | 1000 | 4200 |
| 9 | 1001 | 6.34 | 9 | 1001 | 4400 |
| 10 | 1010 | 10.09 | 10 | 1010 | 4600 |
| 11 | 1011 | 16.05 | 11 | 1011 | 4800 |
| 12 | 1100 | 25.53 | 12 | 1100 | 5000 |
| 13 | 1101 | 40.62 | 13 | 1101 | 5200 |
| 14 | 1110 | 64.61 | 14 | 1110 | 5400 |
| 15 | 1111 | 100.0 | 15 | 1111 | 5700 |

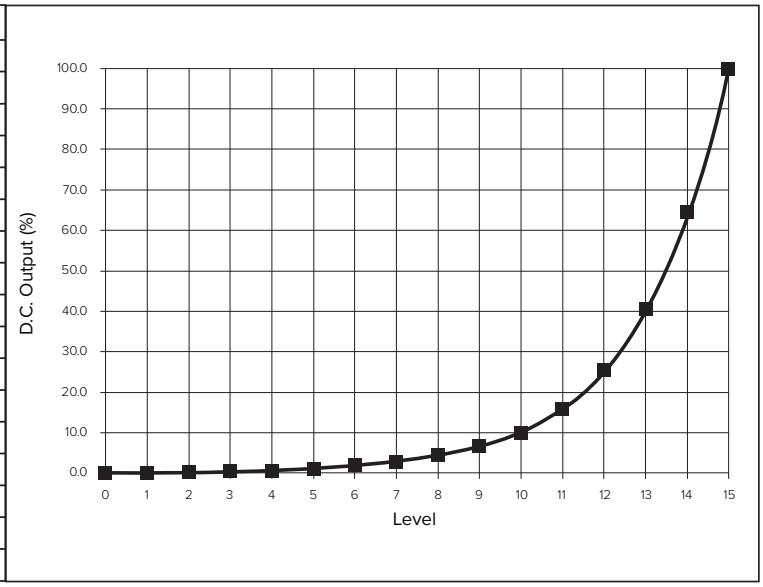



Figure 7: Intensity and CCT selection chart (LEFT), level and output chart (RIGHT)

## 7.7 DYNAMIC TEST MODE

Dynamic test mode is used to check the system functionality. This mode will ignore control inputs and cycle through the output range.

| Standalone SCT | Mode Switches 1-3 | Switches 4-12 |
|---|---|---|
| Dynamic Dimming Level Test (SCT) | 1-0-1 | IGNORED |
| Dynamic Color Tune Test (TNW) | 1-1-1 | IGNORED |
| Dynamic Dim-to-Warm Test (DTW) | 1-1-1 | IGNORED |

* On = 1, Off = 0

Dynamic test SCT mode:
Outputs operate in standard configuration with the output duty cycle of all 4 channels matching. Output duty cycle starts from 0% and ramps linearly up to 100% output, then ramps back down to 0% and repeats indefinitely with a period of 5 seconds.

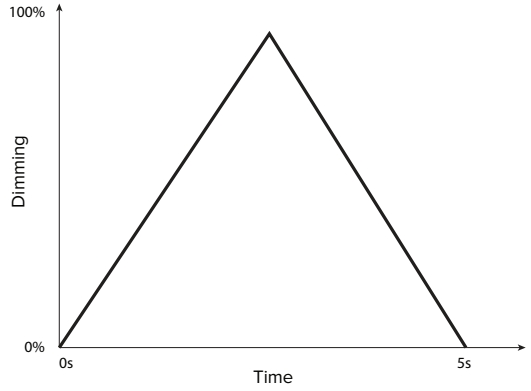



Figure 8: SCT Dynamic test mode output range

Dynamic test TNW/DTW mode:
This test mode is only applicable for TNW and DTW TILEs. Output duty cycle starts with the WARM LEDs (TNW=2700K, DTW=2200K) raising their intensity from 0% to 100% then decreasing to 0%. Next the COOL LEDs (TNW=5700K, DTW =3500K) raise intensity from 0% to 100% then decrease to 0%. This cycle repeats indefinitely with a period of 10 seconds.

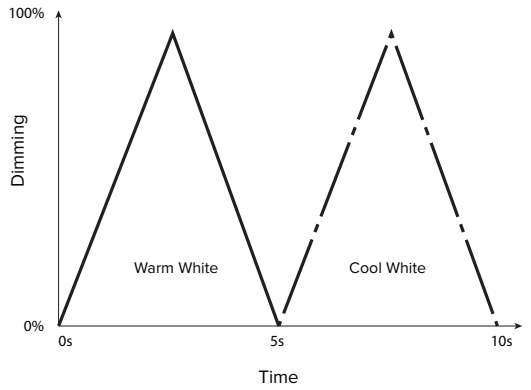
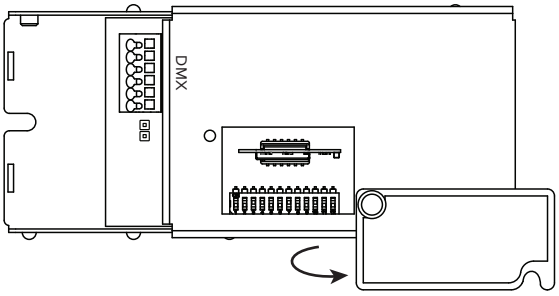
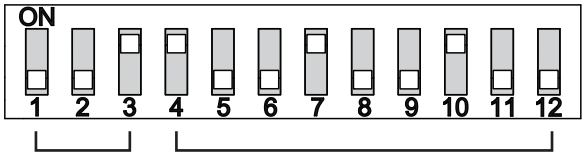



Figure 9: TNW/DTW Dynamic test mode output graph

## 8.0 SELECTING DMX ADDRESSES




1 = On, 0 = Off

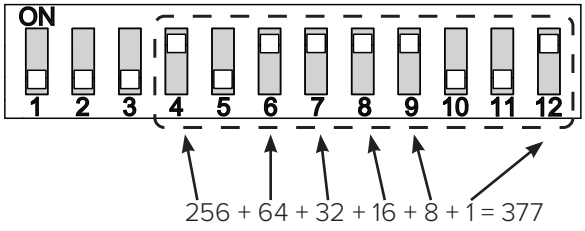


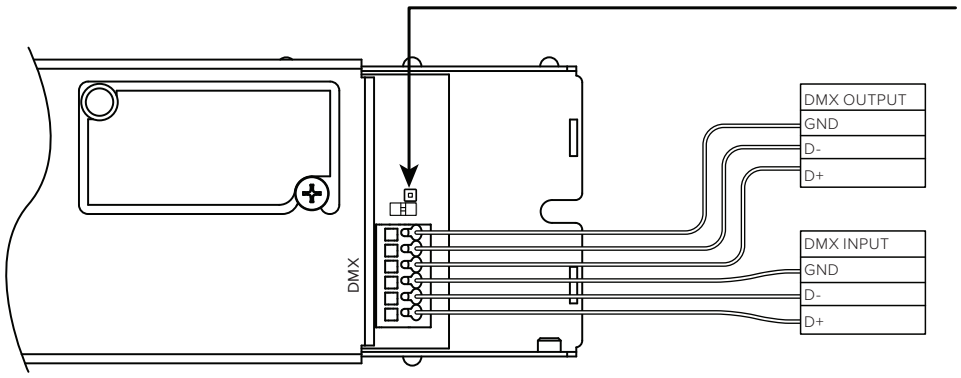

- Switch 1 - 3: Control Module MODE, refer to Mode Section 6.0
- Switches 4 - 12: Addressing switches.

-To access the DIP switch for selecting addresses for DMX controls, unfasten the cover screw and rotate the cover out of the way.
- Each of the 9 switches (4-12) represent a bit in binary representation for the address. See example below.
- Each Control Module can occupy up to 8 addresses depending on the mode selected, refer to appendix C for more details. Addresses 1 through 511 are possible.

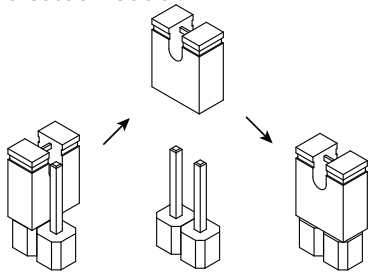
| Switch: | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|
| Binary Value: | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

Example: Address 377

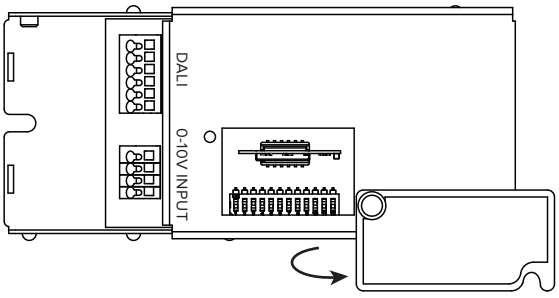


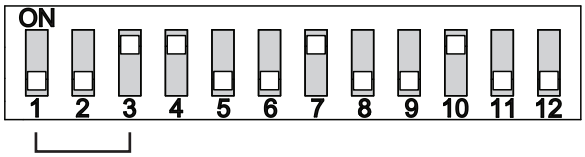

When installing the final controller (termination point) in a DMX network use the provided jumper on the indicated header.



## 9.0 DALI ADDRESSING




1 = On, 0 = Off




- Switch 1 - 3: Control Module MODE, refer to Mode Section 6.0

- On DALI bus, when commissioned, each Control Module unit will occupy 4 subsequent DALI addresses.
- A total of 64 DALI addresses are allowed on a DALI bus, for a maximum of 16 Control Modules.
- The 64 DALI addresses are numbered from “0” to “63”.
- When using the DALI control inputs to the Control Module the DALI bus must be powered before the Control Module. If the bus is not powered before the Control Module the controller will default to 0-10V input and not register DALI inputs.

Static Color Temperature (SCT) DALI Addressing

| Channel | Function | Address |
|---|---|---|
| 1 | DIM Channel 1 | N |
| 2 | DIM Channel 2 | N+1 |
| 3 | DIM Channel 3 | N+2 |
| 4 | DIM Channel 4 | N+3 |

Tunable White (TNW) DALI Addressing

| System | Function | Address |
|---|---|---|
| 1 | DIM System 1 | N |
| 1 | CCT System 1 | N+1 |
| 2 | DIM System 2 | N+2 |
| 2 | CCT System 2 | N+3 |

Dim-To-Warm (DTW) DALI Addressing

| Channel | Function | Address |
|---|---|---|
| 1 | DTW System 1 | N |
| 2 | DTW System 2 | N+1 |
| - | Not Used | N+2 |
| - | Not Used | N+3 |

Example:

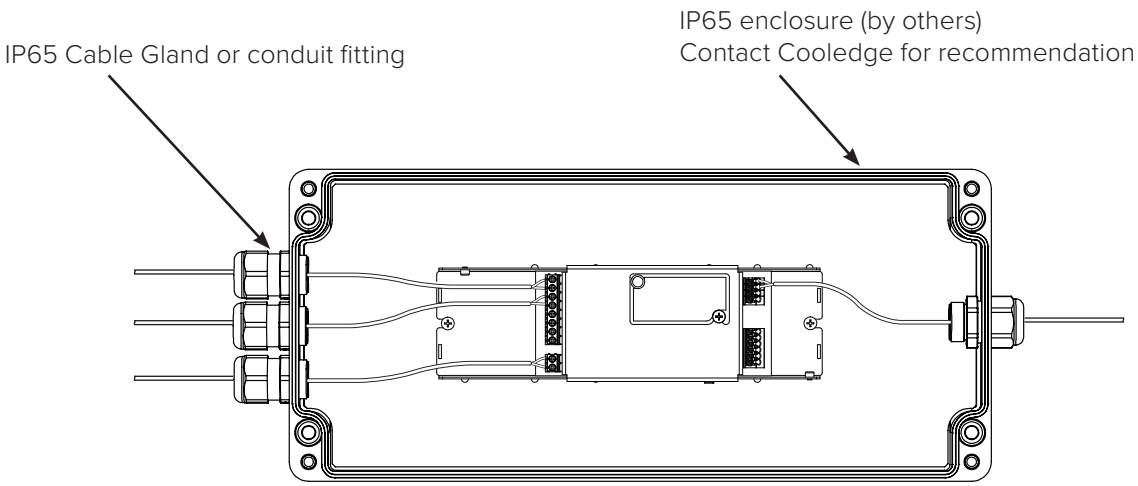
A Control Module in DTW mode commissioned with the addresses 24, 25, 26, and 27.

24 - DIM TW1 Channel
25 - DIM TW2 Channel
26 - Not Used
27 - Not Used

## 10.0 EXTERIOR APPLICATIONS

For exterior applications, Cooledge Control Module must be enclosed in an IP65 minimum rated enclosure prior to installation. When installing in an exterior location be sure to conform to all local electrical codes

Example: Enclosed Control Module




It is the customer's responsibility to cut the necessary holes in the enclosure, and to use an IP rated cable gland or conduit fitting. The wires to and from the Control Module need to be strain relieved. This can be done at either the IP rated enclosure or at the Control Module itself. If strain reliefs are not used on the control module, edge protectors should be installed to protect wires from sharp edges, or remove the terminal block covers.

## DALI/0-10V AND CASAMBI MODULE

| Load Behavior | Controller Status | LED State |
|---|---|---|
| Loads OFF | OFF (No Input Power) | OFF |
| Responsive to Dali commands | DALI Input Recognized | Green Flashing Slow (1Hz) |
| Responsive to Casambi commands | Casambi Input Recognized | Green Flashing Fast (8Hz) |
| Responsive to 0-10V commands | 0-10V Control Input Recognized | Green On Steady State |
| Responsive only to DIP switch setting | Standalone Recognized | Alternate Amber/Green Slow (1Hz) |
| Full ON | No Control Input | Amber On Steady State |
| Loads OFF | Input Over Voltage/<br>0-10V input set at 10V | Amber Flashing Slow (1Hz) |
| Loads OFF | Input Under Voltage | Amber Flashing Fast (8Hz) |
| A load from a control unit is off and the rest are flashing. Rest of units remain responsive to DALI commands. | Shorting between V- to V+ of the off channel. | N/A |
| SCT or Standalone mode, two channels are dim and flashing, other channels unaffected. | Shorting of channels, V- to V- of dim and flashing channels | N/A |
| SCT of Standalone mode, 24V Unit. All channels flashing, one channel flashing at a dimmed level. | Shorting of channels V- to V+, check dim flashing channel. | N/A |
| The load is OFF on one TW/DTW channel. All the other channels of the unit are flashing. The rest of the units remain responsive to DALI/0-10V/Casambi commands. | Shorting of channels to V+, check the off channel. | N/A |
| A channel fully dimmed and flashing a 1Hz. The rest of the loads remain responsive to DALI/0-10V/Casambi commands. | Output Overload | N/A |
| DALI commands unresponsive. | Control Module powered before DALI bus. | N/A |

**DMX MODULE**

| Load Behavior | Controller Status | LED State |
|---|---|---|
| Loads OFF | OFF (No Input Power) | OFF |
| Responsive to DMX commands | DMX Input Recognized | Green On Steady State |
| Full ON, not responsive to DMX commands | DMX Input Missing | Amber On Steady State |
| Responsive only to DIP switch Setting | Standalone Mode Recognized | Alternate Amber/Green Slow (1Hz) |
| Loads OFF | Input Over Voltage | Amber Flashing Slow (1Hz) |
| Loads OFF | Input Under Voltage | Amber Flashing Fast (8Hz) |
| A load from a control unit is off and the rest are flashing. Rest of units remain responsive to DMX commands. | Shorting between V- to V+ of the off channel. | N/A |
| SCT or Standalone mode, two channels are dim and flashing, other channels unaffected. | Shorting of channels, V- to V-, check dim and flashing channels | N/A |
| SCT or Standalone mode, 24V Unit. All channels flashing, one channel flashing at a dimmed level. | Shorting of channels, V- to V+, check dim and flashing channel. | N/A |
| Load is OFF on one TW/DTW channel. All loads of the unit, except the shorted one, are flashing. The rest of the units remain Responsive to DMX commands. | Shorting of channels to V+, check the off channel. | N/A |
| Channel fully dimmed and flashing at 1Hz. Rest of the loads remain responsive to DMX commands. | Output Overload | N/A |

For additional troubleshooting guidance regarding Casambi app visit the web page:
http://support.casambi.com/support/home

## APPENDIX A: LOGARITHMIC DIMMING LEVELS SCT

| Level | DIP SETTING | Output(%) | Level | DIP SETTING | Output(%) | Level | DIP SETTING | Output(%) | Level | DIP SETTING | Output(%) | Level | DIP SETTING | Output(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 00000000 | 0 | 51 | 00110011 | 0.392 | 102 | 01100110 | 1.576 | 153 | 10011001 | 6.344 | 204 | 11001100 | 25.534 |
| 1 | 00000001 | 0.100 | 52 | 00110100 | 0.402 | 103 | 01100111 | 1.620 | 154 | 10011010 | 6.520 | 205 | 11001101 | 26.241 |
| 2 | 00000010 | 0.103 | 53 | 00110101 | 0.414 | 104 | 01101000 | 1.665 | 155 | 10011011 | 6.700 | 206 | 11001110 | 26.967 |
| 3 | 00000011 | 0.106 | 54 | 00110110 | 0.425 | 105 | 01101001 | 1.711 | 156 | 10011100 | 6.886 | 207 | 11001111 | 27.713 |
| 4 | 00000100 | 0.109 | 55 | 00110111 | 0.437 | 106 | 01101010 | 1.758 | 157 | 10011101 | 7.076 | 208 | 11010000 | 28.480 |
| 5 | 00000101 | 0.112 | 56 | 00111000 | 0.449 | 107 | 01101011 | 1.807 | 158 | 10011110 | 7.272 | 209 | 11010001 | 29.269 |
| 6 | 00000110 | 0.115 | 57 | 00111001 | 0.461 | 108 | 01101100 | 1.857 | 159 | 10011111 | 7.473 | 210 | 11010010 | 30.079 |
| 7 | 00000111 | 0.118 | 58 | 00111010 | 0.474 | 109 | 01101101 | 1.908 | 160 | 10100000 | 7.680 | 211 | 11010011 | 30.911 |
| 8 | 00001000 | 0.121 | 59 | 00111011 | 0.487 | 110 | 01101110 | 1.961 | 161 | 10100001 | 7.893 | 212 | 11010100 | 31.767 |
| 9 | 00001001 | 0.124 | 60 | 00111100 | 0.501 | 111 | 01101111 | 2.015 | 162 | 10100010 | 8.111 | 213 | 11010101 | 32.646 |
| 10 | 00001010 | 0.128 | 61 | 00111101 | 0.515 | 112 | 01110000 | 2.071 | 163 | 10100011 | 8.336 | 214 | 11010110 | 33.550 |
| 11 | 00001011 | 0.131 | 62 | 00111110 | 0.529 | 113 | 01110001 | 2.128 | 164 | 10100100 | 8.567 | 215 | 11010111 | 34.479 |
| 12 | 00001100 | 0.135 | 63 | 00111111 | 0.543 | 114 | 01110010 | 2.187 | 165 | 10100101 | 8.804 | 216 | 11011000 | 35.433 |
| 13 | 00001101 | 0.139 | 64 | 01000000 | 0.559 | 115 | 01110011 | 2.248 | 166 | 10100110 | 9.047 | 217 | 11011001 | 36.414 |
| 14 | 00001110 | 0.143 | 65 | 01000001 | 0.574 | 116 | 01110100 | 2.310 | 167 | 10100111 | 9.298 | 218 | 11011010 | 37.422 |
| 15 | 00001111 | 0.147 | 66 | 01000010 | 0.590 | 117 | 01110101 | 2.374 | 168 | 10101000 | 9.555 | 219 | 11011011 | 38.457 |
| 16 | 00010000 | 0.151 | 67 | 01000011 | 0.606 | 118 | 01110110 | 2.440 | 169 | 10101001 | 9.820 | 220 | 11011100 | 39.522 |
| 17 | 00010001 | 0.155 | 68 | 01000100 | 0.623 | 119 | 01110111 | 2.507 | 170 | 10101010 | 10.091 | 221 | 11011101 | 40.616 |
| 18 | 00010010 | 0.159 | 69 | 01000101 | 0.640 | 120 | 01111000 | 2.577 | 171 | 10101011 | 10.371 | 222 | 11011110 | 41.740 |
| 19 | 00010011 | 0.163 | 70 | 01000110 | 0.658 | 121 | 01111001 | 2.648 | 172 | 10101100 | 10.658 | 223 | 11011111 | 42.895 |
| 20 | 00010100 | 0.168 | 71 | 01000111 | 0.676 | 122 | 01111010 | 2.721 | 173 | 10101101 | 10.953 | 224 | 11100000 | 44.083 |
| 21 | 00010101 | 0.173 | 72 | 01001000 | 0.695 | 123 | 01111011 | 2.797 | 174 | 10101110 | 11.256 | 225 | 11100001 | 45.303 |
| 22 | 00010110 | 0.177 | 73 | 01001001 | 0.714 | 124 | 01111100 | 2.874 | 175 | 10101111 | 11.568 | 226 | 11100010 | 46.557 |
| 23 | 00010111 | 0.182 | 74 | 01001010 | 0.734 | 125 | 01111101 | 2.954 | 176 | 10110000 | 11.888 | 227 | 11100011 | 47.846 |
| 24 | 00011000 | 0.187 | 75 | 01001011 | 0.754 | 126 | 01111110 | 3.035 | 177 | 10110001 | 12.217 | 228 | 11100100 | 49.170 |
| 25 | 00011001 | 0.193 | 76 | 01001100 | 0.775 | 127 | 01111111 | 3.119 | 178 | 10110010 | 12.555 | 229 | 11100101 | 50.531 |
| 26 | 00011010 | 0.198 | 77 | 01001101 | 0.796 | 128 | 10000000 | 3.206 | 179 | 10110011 | 12.902 | 230 | 11100110 | 51.930 |
| 27 | 00011011 | 0.203 | 78 | 01001110 | 0.819 | 129 | 10000001 | 3.294 | 180 | 10110100 | 13.260 | 231 | 11100111 | 53.367 |
| 28 | 00011100 | 0.209 | 79 | 01001111 | 0.841 | 130 | 10000010 | 3.386 | 181 | 10110101 | 13.627 | 232 | 11101000 | 54.844 |
| 29 | 00011101 | 0.215 | 80 | 01010000 | 0.864 | 131 | 10000011 | 3.479 | 182 | 10110110 | 14.004 | 233 | 11101001 | 56.362 |
| 30 | 00011110 | 0.221 | 81 | 01010001 | 0.888 | 132 | 10000100 | 3.576 | 183 | 10110111 | 14.391 | 234 | 11101010 | 57.922 |
| 31 | 00011111 | 0.227 | 82 | 01010010 | 0.913 | 133 | 10000101 | 3.675 | 184 | 10111000 | 14.790 | 235 | 11101011 | 59.526 |
| 32 | 00100000 | 0.233 | 83 | 01010011 | 0.938 | 134 | 10000110 | 3.776 | 185 | 10111001 | 15.199 | 236 | 11101100 | 61.173 |
| 33 | 00100001 | 0.240 | 84 | 01010100 | 0.964 | 135 | 10000111 | 3.881 | 186 | 10111010 | 15.620 | 237 | 11101101 | 62.866 |
| 34 | 00100010 | 0.246 | 85 | 01010101 | 0.991 | 136 | 10001000 | 3.988 | 187 | 10111011 | 16.052 | 238 | 11101110 | 64.607 |
| 35 | 00100011 | 0.253 | 86 | 01010110 | 1.018 | 137 | 10001001 | 4.099 | 188 | 10111100 | 16.496 | 239 | 11101111 | 66.395 |
| 36 | 00100100 | 0.260 | 87 | 01010111 | 1.047 | 138 | 10001010 | 4.212 | 189 | 10111101 | 16.953 | 240 | 11110000 | 68.233 |
| 37 | 00100101 | 0.267 | 88 | 01011000 | 1.076 | 139 | 10001011 | 4.329 | 190 | 10111110 | 17.422 | 241 | 11110001 | 70.121 |
| 38 | 00100110 | 0.275 | 89 | 01011001 | 1.105 | 140 | 10001100 | 4.449 | 191 | 10111111 | 17.905 | 242 | 11110010 | 72.062 |
| 39 | 00100111 | 0.282 | 90 | 01011010 | 1.136 | 141 | 10001101 | 4.572 | 192 | 11000000 | 18.400 | 243 | 11110011 | 74.057 |
| 40 | 00101000 | 0.290 | 91 | 01011011 | 1.167 | 142 | 10001110 | 4.698 | 193 | 11000001 | 18.909 | 244 | 11110100 | 76.107 |
| 41 | 00101001 | 0.298 | 92 | 01011100 | 1.200 | 143 | 10001111 | 4.828 | 194 | 11000010 | 19.433 | 245 | 11110101 | 78.213 |
| 42 | 00101010 | 0.306 | 93 | 01011101 | 1.233 | 144 | 10010000 | 4.962 | 195 | 11000011 | 19.971 | 246 | 11110110 | 80.378 |
| 43 | 00101011 | 0.315 | 94 | 01011110 | 1.267 | 145 | 10010001 | 5.099 | 196 | 11000100 | 20.524 | 247 | 11110111 | 82.603 |
| 44 | 00101100 | 0.324 | 95 | 01011111 | 1.302 | 146 | 10010010 | 5.240 | 197 | 11000101 | 21.092 | 248 | 11111000 | 84.889 |
| 45 | 00101101 | 0.332 | 96 | 01100000 | 1.338 | 147 | 10010011 | 5.385 | 198 | 11000110 | 21.675 | 249 | 11111001 | 87.239 |
| 46 | 00101110 | 0.342 | 97 | 01100001 | 1.375 | 148 | 10010100 | 5.535 | 199 | 11000111 | 22.275 | 250 | 11111010 | 89.654 |
| 47 | 00101111 | 0.351 | 98 | 01100010 | 1.413 | 149 | 10010101 | 5.688 | 200 | 11001000 | 22.892 | 251 | 11111011 | 92.135 |
| 48 | 00110000 | 0.361 | 99 | 01100011 | 1.452 | 150 | 10010110 | 5.845 | 201 | 11001001 | 23.526 | 252 | 11111100 | 94.686 |
| 49 | 00110001 | 0.371 | 100 | 01100100 | 1.492 | 151 | 10010111 | 6.007 | 202 | 11001010 | 24.177 | 253 | 11111101 | 97.307 |
| 50 | 00110010 | 0.381 | 101 | 01100101 | 1.534 | 152 | 10011000 | 6.173 | 203 | 11001011 | 24.846 | 254 | 11111110 | 100.000 |

## APPENDIX B: LINEAR DIMMING LEVELS SCT

| Level | DIP SETTING | Output (%) | Level | DIP SETTING | Output (%) | Level | DIP SETTING | Output (%) | Level | DIP SETTING | Output (%) | Level | DIP SETTING | Output (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 00000000 | 0 | 51 | 00110011 | 20.1 | 102 | 01100110 | 40.2 | 153 | 10011001 | 60.2 | 204 | 11001100 | 80.3 |
| 1 | 00000001 | 0.4 | 52 | 00110100 | 20.5 | 103 | 01100111 | 40.6 | 154 | 10011010 | 60.6 | 205 | 11001101 | 80.7 |
| 2 | 00000010 | 0.8 | 53 | 00110101 | 20.9 | 104 | 01101000 | 40.9 | 155 | 10011011 | 61.0 | 206 | 11001110 | 81.1 |
| 3 | 00000011 | 1.2 | 54 | 00110110 | 21.3 | 105 | 01101001 | 41.3 | 156 | 10011100 | 61.4 | 207 | 11001111 | 81.5 |
| 4 | 00000100 | 1.6 | 55 | 00110111 | 21.7 | 106 | 01101010 | 41.7 | 157 | 10011101 | 61.8 | 208 | 11010000 | 81.9 |
| 5 | 00000101 | 2.0 | 56 | 00111000 | 22.0 | 107 | 01101011 | 42.1 | 158 | 10011110 | 62.2 | 209 | 11010001 | 82.3 |
| 6 | 00000110 | 2.4 | 57 | 00111001 | 22.4 | 108 | 01101100 | 42.5 | 159 | 10011111 | 62.6 | 210 | 11010010 | 82.7 |
| 7 | 00000111 | 2.8 | 58 | 00111010 | 22.8 | 109 | 01101101 | 42.9 | 160 | 10100000 | 63.0 | 211 | 11010011 | 83.1 |
| 8 | 00001000 | 3.1 | 59 | 00111011 | 23.2 | 110 | 01101110 | 43.3 | 161 | 10100001 | 63.4 | 212 | 11010100 | 83.5 |
| 9 | 00001001 | 3.5 | 60 | 00111100 | 23.6 | 111 | 01101111 | 43.7 | 162 | 10100010 | 63.8 | 213 | 11010101 | 83.9 |
| 10 | 00001010 | 3.9 | 61 | 00111101 | 24.0 | 112 | 01110000 | 44.1 | 163 | 10100011 | 64.2 | 214 | 11010110 | 84.3 |
| 11 | 00001011 | 4.3 | 62 | 00111110 | 24.4 | 113 | 01110001 | 44.5 | 164 | 10100100 | 64.6 | 215 | 11010111 | 84.6 |
| 12 | 00001100 | 4.7 | 63 | 00111111 | 24.8 | 114 | 01110010 | 44.9 | 165 | 10100101 | 65.0 | 216 | 11011000 | 85.0 |
| 13 | 00001101 | 5.1 | 64 | 01000000 | 25.2 | 115 | 01110011 | 45.3 | 166 | 10100110 | 65.4 | 217 | 11011001 | 85.4 |
| 14 | 00001110 | 5.5 | 65 | 01000001 | 25.6 | 116 | 01110100 | 45.7 | 167 | 10100111 | 65.7 | 218 | 11011010 | 85.8 |
| 15 | 00001111 | 5.9 | 66 | 01000010 | 26.0 | 117 | 01110101 | 46.1 | 168 | 10101000 | 66.1 | 219 | 11011011 | 86.2 |
| 16 | 00010000 | 6.3 | 67 | 01000011 | 26.4 | 118 | 01110110 | 46.5 | 169 | 10101001 | 66.5 | 220 | 11011100 | 86.6 |
| 17 | 00010001 | 6.7 | 68 | 01000100 | 26.8 | 119 | 01110111 | 46.9 | 170 | 10101010 | 66.9 | 221 | 11011101 | 87.0 |
| 18 | 00010010 | 7.1 | 69 | 01000101 | 27.2 | 120 | 01111000 | 47.2 | 171 | 10101011 | 67.3 | 222 | 11011110 | 87.4 |
| 19 | 00010011 | 7.5 | 70 | 01000110 | 27.6 | 121 | 01111001 | 47.6 | 172 | 10101100 | 67.7 | 223 | 11011111 | 87.8 |
| 20 | 00010100 | 7.9 | 71 | 01000111 | 28.0 | 122 | 01111010 | 48.0 | 173 | 10101101 | 68.1 | 224 | 11100000 | 88.2 |
| 21 | 00010101 | 8.3 | 72 | 01001000 | 28.3 | 123 | 01111011 | 48.4 | 174 | 10101110 | 68.5 | 225 | 11100001 | 88.6 |
| 22 | 00010110 | 8.7 | 73 | 01001001 | 28.7 | 124 | 01111100 | 48.8 | 175 | 10101111 | 68.9 | 226 | 11100010 | 89.0 |
| 23 | 00010111 | 9.1 | 74 | 01001010 | 29.1 | 125 | 01111101 | 49.2 | 176 | 10110000 | 69.3 | 227 | 11100011 | 89.4 |
| 24 | 00011000 | 9.4 | 75 | 01001011 | 29.5 | 126 | 01111110 | 49.6 | 177 | 10110001 | 69.7 | 228 | 11100100 | 89.8 |
| 25 | 00011001 | 9.8 | 76 | 01001100 | 29.9 | 127 | 01111111 | 50.0 | 178 | 10110010 | 70.1 | 229 | 11100101 | 90.2 |
| 26 | 00011010 | 10.2 | 77 | 01001101 | 30.3 | 128 | 10000000 | 50.4 | 179 | 10110011 | 70.5 | 230 | 11100110 | 90.6 |
| 27 | 00011011 | 10.6 | 78 | 01001110 | 30.7 | 129 | 10000001 | 50.8 | 180 | 10110100 | 70.9 | 231 | 11100111 | 90.9 |
| 28 | 00011100 | 11.0 | 79 | 01001111 | 31.1 | 130 | 10000010 | 51.2 | 181 | 10110101 | 71.3 | 232 | 11101000 | 91.3 |
| 29 | 00011101 | 11.4 | 80 | 01010000 | 31.5 | 131 | 10000011 | 51.6 | 182 | 10110110 | 71.7 | 233 | 11101001 | 91.7 |
| 30 | 00011110 | 11.8 | 81 | 01010001 | 31.9 | 132 | 10000100 | 52.0 | 183 | 10110111 | 72.0 | 234 | 11101010 | 92.1 |
| 31 | 00011111 | 12.2 | 82 | 01010010 | 32.3 | 133 | 10000101 | 52.4 | 184 | 10111000 | 72.4 | 235 | 11101011 | 92.5 |
| 32 | 00100000 | 12.6 | 83 | 01010011 | 32.7 | 134 | 10000110 | 52.8 | 185 | 10111001 | 72.8 | 236 | 11101100 | 92.9 |
| 33 | 00100001 | 13.0 | 84 | 01010100 | 33.1 | 135 | 10000111 | 53.1 | 186 | 10111010 | 73.2 | 237 | 11101101 | 93.3 |
| 34 | 00100010 | 13.4 | 85 | 01010101 | 33.5 | 136 | 10001000 | 53.5 | 187 | 10111011 | 73.6 | 238 | 11101110 | 93.7 |
| 35 | 00100011 | 13.8 | 86 | 01010110 | 33.9 | 137 | 10001001 | 53.9 | 188 | 10111100 | 74.0 | 239 | 11101111 | 94.1 |
| 36 | 00100100 | 14.2 | 87 | 01010111 | 34.3 | 138 | 10001010 | 54.3 | 189 | 10111101 | 74.4 | 240 | 11110000 | 94.5 |
| 37 | 00100101 | 14.6 | 88 | 01011000 | 34.6 | 139 | 10001011 | 54.7 | 190 | 10111110 | 74.8 | 241 | 11110001 | 94.9 |
| 38 | 00100110 | 15.0 | 89 | 01011001 | 35.0 | 140 | 10001100 | 55.1 | 191 | 10111111 | 75.2 | 242 | 11110010 | 95.3 |
| 39 | 00100111 | 15.4 | 90 | 01011010 | 35.4 | 141 | 10001101 | 55.5 | 192 | 11000000 | 75.6 | 243 | 11110011 | 95.7 |
| 40 | 00101000 | 15.7 | 91 | 01011011 | 35.8 | 142 | 10001110 | 55.9 | 193 | 11000001 | 76.0 | 244 | 11110100 | 96.1 |
| 41 | 00101001 | 16.1 | 92 | 01011100 | 36.2 | 143 | 10001111 | 56.3 | 194 | 11000010 | 76.4 | 245 | 11110101 | 96.5 |
| 42 | 00101010 | 16.5 | 93 | 01011101 | 36.6 | 144 | 10010000 | 56.7 | 195 | 11000011 | 76.8 | 246 | 11110110 | 96.9 |
| 43 | 00101011 | 16.9 | 94 | 01011110 | 37.0 | 145 | 10010001 | 57.1 | 196 | 11000100 | 77.2 | 247 | 11110111 | 97.2 |
| 44 | 00101100 | 17.3 | 95 | 01011111 | 37.4 | 146 | 10010010 | 57.5 | 197 | 11000101 | 77.6 | 248 | 11111000 | 97.6 |
| 45 | 00101101 | 17.7 | 96 | 01100000 | 37.8 | 147 | 10010011 | 57.9 | 198 | 11000110 | 78.0 | 249 | 11111001 | 98.0 |
| 46 | 00101110 | 18.1 | 97 | 01100001 | 38.2 | 148 | 10010100 | 58.3 | 199 | 11000111 | 78.3 | 250 | 11111010 | 98.4 |
| 47 | 00101111 | 18.5 | 98 | 01100010 | 38.6 | 149 | 10010101 | 58.7 | 200 | 11001000 | 78.7 | 251 | 11111011 | 98.8 |
| 48 | 00110000 | 18.9 | 99 | 01100011 | 39.0 | 150 | 10010110 | 59.1 | 201 | 11001001 | 79.1 | 252 | 11111100 | 99.2 |
| 49 | 00110001 | 19.3 | 100 | 01100100 | 39.4 | 151 | 10010111 | 59.4 | 202 | 11001010 | 79.5 | 253 | 11111101 | 99.6 |
| 50 | 00110010 | 19.7 | 101 | 01100101 | 39.8 | 152 | 10011000 | 59.8 | 203 | 11001011 | 79.9 | 254 | 11111110 | 100.0 |

## APPENDIX C: DMX ADDRESSES

The Controller DMX address is set using DIP switches 4 - 12, with the “ON” position = 1, and “OFF” position = 0. Each Control Module will occupy 3 - 7 subsequent DMX addresses, depending on the type of mode the controller is in. SCT will have a total of 8 addresses, TNW will have a total of 8 addresses, and DTW will have a total of 4 addresses. Addresses 1 - 511 are avaliable. Address “0” is not a valid address.

Static Color Temperature (SCT) DMX Addressing

| Channel | Dimming Resolution | Address |
|---|---|---|
| 1 | DIM Coarse | N |
| 1 | DIM Fine | N+1 |
| 2 | DIM Coarse | N+2 |
| 2 | DIM Fine | N+3 |
| 3 | DIM Coarse | N+4 |
| 3 | DIM Fine | N+5 |
| 4 | DIM Coarse | N+6 |
| 4 | DIM Fine | N+7 |

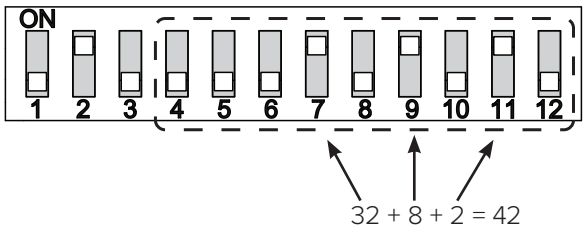
Tunable White (TNW) DMX Addressing

| Channel | Dimming Resolution | Address |
|---|---|---|
| 1 | DIM Coarse | N |
| 1 | DIM Fine | N+1 |
| 1 | CCT Coarse | N+2 |
| 1 | CCT Fine | N+3 |
| 2 | DIM Coarse | N+4 |
| 2 | DIM Fine | N+5 |
| 2 | CCT Coarse | N+6 |
| 2 | CCT Fine | N+7 |

Dim-to-Warm (DTW) DMX Addressing

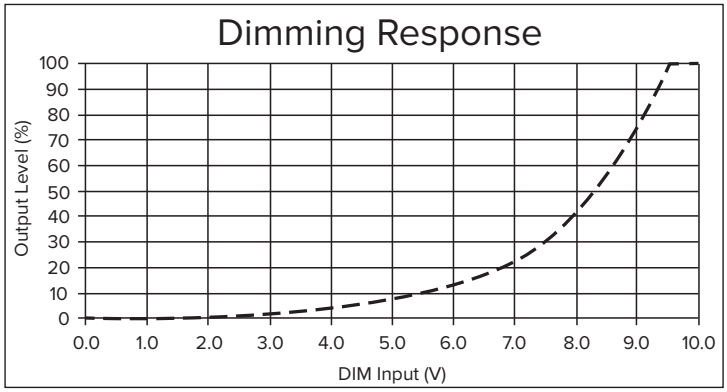
| Channel | Dimming Resolution | Address |
|---|---|---|
| 1 | DIM Coarse | N |
| 1 | DIM Fine | N+1 |
| 2 | DIM Coarse | N+2 |
| 2 | DIM Fine | N+3 |

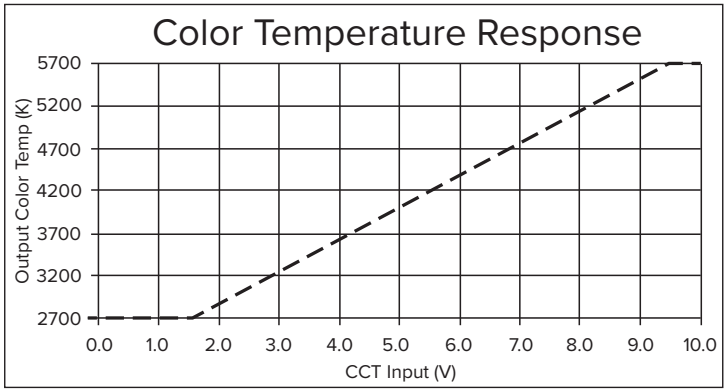
Example:
A TNW Control Module with one 90W load, with address of 42. Looking at the Tunable White DMX addressing table with N = 42 and only 1 system being controlled, the Control Module would also occupy addresses 43, 44, 45, 46, 47, 48, and 49.



## APPENDIX D: 0 -10V CONTROL PROTOCOL

| Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.00 | 0.0 | 2700 | 3.4 | 2.98 | 3.4 | 3419 | 6.8 | 20.90 | 6.8 | 4699 |
| 0.1 | 0.00 | 0.1 | 2700 | 3.5 | 3.15 | 3.5 | 3457 | 6.9 | 22.07 | 6.9 | 4737 |
| 0.2 | 0.00 | 0.2 | 2700 | 3.6 | 3.32 | 3.6 | 3495 | 7.0 | 23.31 | 7.0 | 4774 |
| 0.3 | 0.00 | 0.3 | 2700 | 3.7 | 3.51 | 3.7 | 3532 | 7.1 | 25.07 | 7.1 | 4812 |
| 0.4 | 0.00 | 0.4 | 2700 | 3.8 | 3.71 | 3.8 | 3570 | 7.2 | 26.48 | 7.2 | 4850 |
| 0.5 | 0.00 | 0.5 | 2700 | 3.9 | 3.92 | 3.9 | 3607 | 7.3 | 27.97 | 7.3 | 4887 |
| 0.6 | 0.00 | 0.6 | 2700 | 4.0 | 4.21 | 4.0 | 3645 | 7.4 | 29.54 | 7.4 | 4925 |
| 0.7 | 0.00 | 0.7 | 2700 | 4.1 | 4.45 | 4.1 | 3683 | 7.5 | 31.19 | 7.5 | 4963 |
| 0.8 | 0.00 | 0.8 | 2700 | 4.2 | 4.70 | 4.2 | 3720 | 7.6 | 32.94 | 7.6 | 5000 |
| 0.9 | 0.00 | 0.9 | 2700 | 4.3 | 4.96 | 4.3 | 3758 | 7.7 | 35.43 | 7.7 | 5038 |
| 1.0 | 0.00 | 1.0 | 2700 | 4.4 | 5.24 | 4.4 | 3796 | 7.8 | 37.42 | 7.8 | 5076 |
| 1.1 | 0.00 | 1.1 | 2700 | 4.5 | 5.53 | 4.5 | 3833 | 7.9 | 39.52 | 7.9 | 5113 |
| 1.2 | 0.00 | 1.2 | 2700 | 4.6 | 5.95 | 4.6 | 3871 | 8.0 | 41.74 | 8.0 | 5151 |
| 1.3 | 0.00 | 1.3 | 2700 | 4.7 | 6.29 | 4.7 | 3909 | 8.1 | 44.08 | 8.1 | 5189 |
| 1.4 | 0.00 | 1.4 | 2700 | 4.8 | 6.64 | 4.8 | 3946 | 8.2 | 46.56 | 8.2 | 5226 |
| 1.5 | 1.00 | 1.5 | 2700 | 4.9 | 7.01 | 4.9 | 3984 | 8.3 | 50.07 | 8.3 | 5264 |
| 1.6 | 1.06 | 1.6 | 2742 | 5.0 | 7.41 | 5.0 | 4022 | 8.4 | 52.88 | 8.4 | 5301 |
| 1.7 | 1.12 | 1.7 | 2779 | 5.1 | 7.82 | 5.1 | 4059 | 8.5 | 55.85 | 8.5 | 5339 |
| 1.8 | 1.18 | 1.8 | 2817 | 5.2 | 8.41 | 5.2 | 4097 | 8.6 | 58.99 | 8.6 | 5377 |
| 1.9 | 1.24 | 1.9 | 2855 | 5.3 | 8.88 | 5.3 | 4134 | 8.7 | 62.30 | 8.7 | 5414 |
| 2.0 | 1.31 | 2.0 | 2892 | 5.4 | 9.38 | 5.4 | 4172 | 8.8 | 65.79 | 8.8 | 5452 |
| 2.1 | 1.39 | 2.1 | 2930 | 5.5 | 9.91 | 5.5 | 4210 | 8.9 | 70.76 | 8.9 | 5490 |
| 2.2 | 1.49 | 2.2 | 2967 | 5.6 | 10.47 | 5.6 | 4247 | 9.0 | 74.73 | 9.0 | 5527 |
| 2.3 | 1.58 | 2.3 | 3005 | 5.7 | 11.05 | 5.7 | 4285 | 9.1 | 78.93 | 9.1 | 5565 |
| 2.4 | 1.66 | 2.4 | 3043 | 5.8 | 11.67 | 5.8 | 4323 | 9.2 | 83.36 | 9.2 | 5603 |
| 2.5 | 1.76 | 2.5 | 3080 | 5.9 | 12.55 | 5.9 | 4360 | 9.3 | 88.04 | 9.3 | 5640 |
| 2.6 | 1.86 | 2.6 | 3118 | 6.0 | 13.26 | 6.0 | 4398 | 9.4 | 92.98 | 9.4 | 5678 |
| 2.7 | 1.96 | 2.7 | 3156 | 6.1 | 14.00 | 6.1 | 4436 | 9.5 | 100.00 | 9.5 | 5700 |
| 2.8 | 2.11 | 2.8 | 3193 | 6.2 | 14.79 | 6.2 | 4473 | 9.6 | 100.00 | 9.6 | 5700 |
| 2.9 | 2.23 | 2.9 | 3231 | 6.3 | 15.62 | 6.3 | 4511 | 9.7 | 100.00 | 9.7 | 5700 |
| 3.0 | 2.35 | 3.0 | 3269 | 6.4 | 16.50 | 6.3 | 4549 | 9.8 | 100.00 | 9.8 | 5700 |
| 3.1 | 2.48 | 3.1 | 3306 | 6.5 | 17.74 | 6.4 | 4586 | 9.9 | 100.00 | 9.9 | 5700 |
| 3.2 | 2.62 | 3.2 | 3344 | 6.6 | 18.74 | 6.5 | 4624 | 10.0 | 100.00 | 10.0 | 5700 |
| 3.3 | 2.77 | 3.3 | 3382 | 6.7 | 19.79 | 6.6 | 4662 | | | | |



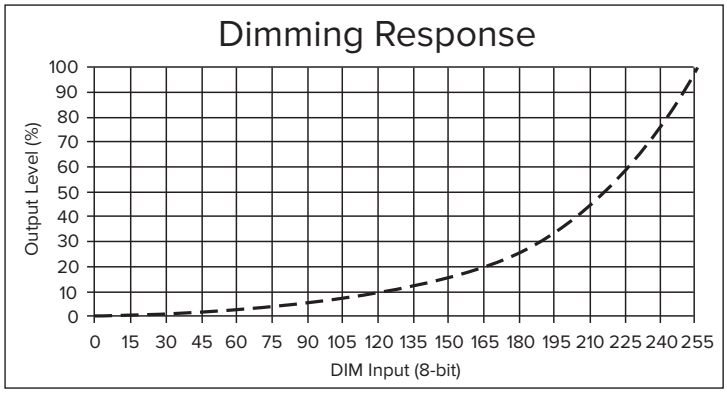



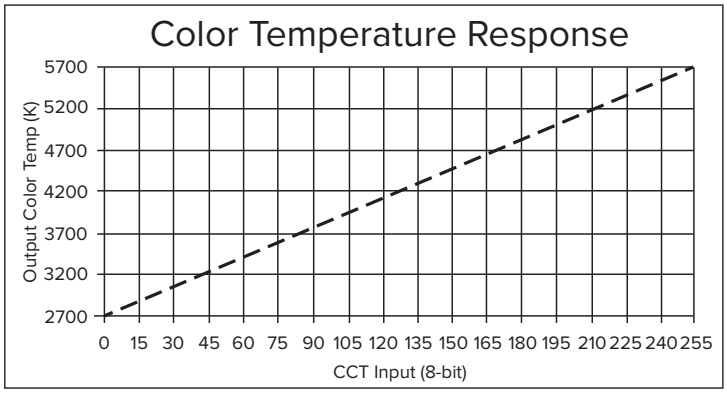
## APPENDIX E: DALI CONTROL PROTOCOL

| Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0 | 2700 | 57 | 2.77 | 57 | 3373 | 114 | 7.82 | 114 | 4046 |
| 1 | 1.00 | 1 | 2712 | 58 | 2.82 | 58 | 3385 | 115 | 7.96 | 115 | 4058 |
| 2 | 1.02 | 2 | 2724 | 59 | 2.87 | 59 | 3397 | 116 | 8.11 | 116 | 4070 |
| 3 | 1.04 | 3 | 2735 | 60 | 2.93 | 60 | 3409 | 117 | 8.26 | 117 | 4082 |
| 4 | 1.06 | 4 | 2747 | 61 | 2.98 | 61 | 3420 | 118 | 8.41 | 118 | 4094 |
| 5 | 1.08 | 5 | 2759 | 62 | 3.04 | 62 | 3432 | 119 | 8.57 | 119 | 4106 |
| 6 | 1.10 | 6 | 2771 | 63 | 3.09 | 63 | 3444 | 120 | 8.72 | 120 | 4117 |
| 7 | 1.12 | 7 | 2783 | 64 | 3.15 | 64 | 3456 | 121 | 8.88 | 121 | 4129 |
| 8 | 1.14 | 8 | 2794 | 65 | 3.21 | 65 | 3468 | 122 | 9.05 | 122 | 4141 |
| 9 | 1.16 | 9 | 2806 | 66 | 3.26 | 66 | 3480 | 123 | 9.21 | 123 | 4153 |
| 10 | 1.18 | 10 | 2818 | 67 | 3.32 | 67 | 3491 | 124 | 9.38 | 124 | 4165 |
| 11 | 1.20 | 11 | 2830 | 68 | 3.39 | 68 | 3503 | 125 | 9.56 | 125 | 4176 |
| 12 | 1.22 | 12 | 2842 | 69 | 3.45 | 69 | 3515 | 126 | 9.73 | 126 | 4188 |
| 13 | 1.24 | 13 | 2854 | 70 | 3.51 | 70 | 3527 | 127 | 9.91 | 127 | 4200 |
| 14 | 1.27 | 14 | 2865 | 71 | 3.58 | 71 | 3539 | 128 | 10.09 | 128 | 4212 |
| 15 | 1.29 | 15 | 2877 | 72 | 3.64 | 72 | 3550 | 129 | 10.28 | 129 | 4224 |
| 16 | 1.31 | 16 | 2889 | 73 | 3.71 | 73 | 3562 | 130 | 10.47 | 130 | 4235 |
| 17 | 1.34 | 17 | 2901 | 74 | 3.78 | 74 | 3574 | 131 | 10.66 | 131 | 4247 |
| 18 | 1.36 | 18 | 2913 | 75 | 3.85 | 75 | 3586 | 132 | 10.85 | 132 | 4259 |
| 19 | 1.39 | 19 | 2924 | 76 | 3.92 | 76 | 3598 | 133 | 11.05 | 133 | 4271 |
| 20 | 1.41 | 20 | 2936 | 77 | 3.99 | 77 | 3609 | 134 | 11.26 | 134 | 4283 |
| 21 | 1.44 | 21 | 2948 | 78 | 4.06 | 78 | 3621 | 135 | 11.46 | 135 | 4294 |
| 22 | 1.47 | 22 | 2960 | 79 | 4.14 | 79 | 3633 | 136 | 11.67 | 136 | 4306 |
| 23 | 1.49 | 23 | 2972 | 80 | 4.21 | 80 | 3645 | 137 | 11.89 | 137 | 4318 |
| 24 | 1.52 | 24 | 2983 | 81 | 4.29 | 81 | 3657 | 138 | 12.11 | 138 | 4330 |
| 25 | 1.55 | 25 | 2995 | 82 | 4.37 | 82 | 3669 | 139 | 12.33 | 139 | 4342 |
| 26 | 1.58 | 26 | 3007 | 83 | 4.45 | 83 | 3680 | 140 | 12.55 | 140 | 4354 |
| 27 | 1.61 | 27 | 3019 | 84 | 4.53 | 84 | 3692 | 141 | 12.79 | 141 | 4365 |
| 28 | 1.63 | 28 | 3031 | 85 | 4.61 | 85 | 3704 | 142 | 13.02 | 142 | 4377 |
| 29 | 1.66 | 29 | 3043 | 86 | 4.70 | 86 | 3716 | 143 | 13.26 | 143 | 4389 |
| 30 | 1.70 | 30 | 3054 | 87 | 4.78 | 87 | 3728 | 144 | 13.50 | 144 | 4401 |
| 31 | 1.73 | 31 | 3066 | 88 | 4.87 | 88 | 3739 | 145 | 13.75 | 145 | 4413 |
| 32 | 1.76 | 32 | 3078 | 89 | 4.96 | 89 | 3751 | 146 | 14.00 | 146 | 4424 |
| 33 | 1.79 | 33 | 3090 | 90 | 5.05 | 90 | 3763 | 147 | 14.26 | 147 | 4436 |
| 34 | 1.82 | 34 | 3102 | 91 | 5.15 | 91 | 3775 | 148 | 14.52 | 148 | 4448 |
| 35 | 1.86 | 35 | 3113 | 92 | 5.24 | 92 | 3787 | 149 | 14.79 | 149 | 4460 |
| 36 | 1.89 | 36 | 3125 | 93 | 5.34 | 93 | 3798 | 150 | 15.06 | 150 | 4472 |
| 37 | 1.93 | 37 | 3137 | 94 | 5.43 | 94 | 3810 | 151 | 15.34 | 151 | 4483 |
| 38 | 1.96 | 38 | 3149 | 95 | 5.53 | 95 | 3822 | 152 | 15.62 | 152 | 4495 |
| 39 | 2.00 | 39 | 3161 | 96 | 5.64 | 96 | 3834 | 153 | 15.91 | 153 | 4507 |
| 40 | 2.03 | 40 | 3172 | 97 | 5.74 | 97 | 3846 | 154 | 16.20 | 154 | 4519 |
| 41 | 2.07 | 41 | 3184 | 98 | 5.85 | 98 | 3857 | 155 | 16.50 | 155 | 4531 |
| 42 | 2.11 | 42 | 3196 | 99 | 5.95 | 99 | 3869 | 156 | 16.80 | 156 | 4543 |
| 43 | 2.15 | 43 | 3208 | 100 | 6.06 | 100 | 3881 | 157 | 17.11 | 157 | 4554 |
| 44 | 2.19 | 44 | 3220 | 101 | 6.17 | 101 | 3893 | 158 | 17.42 | 158 | 4566 |
| 45 | 2.23 | 45 | 3231 | 102 | 6.29 | 102 | 3905 | 159 | 17.74 | 159 | 4578 |
| 46 | 2.27 | 46 | 3243 | 103 | 6.40 | 103 | 3917 | 160 | 18.07 | 160 | 4590 |
| 47 | 2.31 | 47 | 3255 | 104 | 6.52 | 104 | 3928 | 161 | 18.40 | 161 | 4602 |
| 48 | 2.35 | 48 | 3267 | 105 | 6.64 | 105 | 3940 | 162 | 18.74 | 162 | 4613 |
| 49 | 2.40 | 49 | 3279 | 106 | 6.76 | 106 | 3952 | 163 | 19.08 | 163 | 4625 |
| 50 | 2.44 | 50 | 3291 | 107 | 6.89 | 107 | 3964 | 164 | 19.43 | 164 | 4637 |
| 51 | 2.48 | 51 | 3302 | 108 | 7.01 | 108 | 3976 | 165 | 19.79 | 165 | 4649 |
| 52 | 2.53 | 52 | 3314 | 109 | 7.14 | 109 | 3987 | 166 | 20.15 | 166 | 4661 |
| 53 | 2.58 | 53 | 3326 | 110 | 7.27 | 110 | 3999 | 167 | 20.52 | 167 | 4672 |
| 54 | 2.62 | 54 | 3338 | 111 | 7.41 | 111 | 4011 | 168 | 20.90 | 168 | 4684 |
| 55 | 2.67 | 55 | 3350 | 112 | 7.54 | 112 | 4023 | 169 | 21.28 | 169 | 4696 |
| 56 | 2.72 | 56 | 3361 | 113 | 7.68 | 113 | 4035 | 170 | 21.68 | 170 | 4708 |

## APPENDIX E: DALI CONTROL PROTOCOL CONTINUED

| Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 171 | 22.07 | 171 | 4720 | 200 | 37.42 | 200 | 5062 | 229 | 63.44 | 229 | 5405 |
| 172 | 22.48 | 172 | 4731 | 201 | 38.11 | 201 | 5074 | 230 | 64.61 | 230 | 5417 |
| 173 | 22.89 | 173 | 4743 | 202 | 38.81 | 202 | 5086 | 231 | 65.79 | 231 | 5428 |
| 174 | 23.31 | 174 | 4755 | 203 | 39.52 | 203 | 5098 | 232 | 67.00 | 232 | 5440 |
| 175 | 23.74 | 175 | 4767 | 204 | 40.25 | 204 | 5109 | 233 | 68.23 | 233 | 5452 |
| 176 | 24.18 | 176 | 4779 | 205 | 40.99 | 205 | 5121 | 234 | 69.49 | 234 | 5464 |
| 177 | 24.62 | 177 | 4791 | 206 | 41.74 | 206 | 5133 | 235 | 70.76 | 235 | 5476 |
| 178 | 25.07 | 178 | 4802 | 207 | 42.51 | 207 | 5145 | 236 | 72.06 | 236 | 5487 |
| 179 | 25.53 | 179 | 4814 | 208 | 43.29 | 208 | 5157 | 237 | 73.39 | 237 | 5499 |
| 180 | 26.00 | 180 | 4826 | 209 | 44.08 | 209 | 5169 | 238 | 74.73 | 238 | 5511 |
| 181 | 26.48 | 181 | 4838 | 210 | 44.89 | 210 | 5180 | 239 | 76.11 | 239 | 5523 |
| 182 | 26.97 | 182 | 4850 | 211 | 45.72 | 211 | 5192 | 240 | 77.50 | 240 | 5535 |
| 183 | 27.46 | 183 | 4861 | 212 | 46.56 | 212 | 5204 | 241 | 78.93 | 241 | 5546 |
| 184 | 27.97 | 184 | 4873 | 213 | 47.41 | 213 | 5216 | 242 | 80.38 | 242 | 5558 |
| 185 | 28.48 | 185 | 4885 | 214 | 48.28 | 214 | 5228 | 243 | 81.85 | 243 | 5570 |
| 186 | 29.00 | 186 | 4897 | 215 | 49.17 | 215 | 5239 | 244 | 83.36 | 244 | 5582 |
| 187 | 29.54 | 187 | 4909 | 216 | 50.07 | 216 | 5251 | 245 | 84.89 | 245 | 5594 |
| 188 | 30.08 | 188 | 4920 | 217 | 50.99 | 217 | 5263 | 246 | 86.45 | 246 | 5606 |
| 189 | 30.63 | 189 | 4932 | 218 | 51.93 | 218 | 5275 | 247 | 88.04 | 247 | 5617 |
| 190 | 31.19 | 190 | 4944 | 219 | 52.88 | 219 | 5287 | 248 | 89.65 | 248 | 5629 |
| 191 | 31.77 | 191 | 4956 | 220 | 53.85 | 220 | 5298 | 249 | 91.30 | 249 | 5641 |
| 192 | 32.35 | 192 | 4968 | 221 | 54.84 | 221 | 5310 | 250 | 92.98 | 250 | 5653 |
| 193 | 32.94 | 193 | 4980 | 222 | 55.85 | 222 | 5322 | 251 | 94.69 | 251 | 5665 |
| 194 | 33.55 | 194 | 4991 | 223 | 56.88 | 223 | 5334 | 252 | 96.43 | 252 | 5676 |
| 195 | 34.17 | 195 | 5003 | 224 | 57.92 | 224 | 5346 | 253 | 98.20 | 253 | 5688 |
| 196 | 34.79 | 196 | 5015 | 225 | 58.99 | 225 | 5357 | 254 | 100.00 | 254 | 5700 |
| 197 | 35.43 | 197 | 5027 | 226 | 60.07 | 226 | 5369 | 255 | 100.00 | 255 | 5700 |
| 198 | 36.08 | 198 | 5039 | 227 | 61.17 | 227 | 5381 | | | | |
| 199 | 36.75 | 199 | 5050 | 228 | 62.30 | 228 | 5393 | | | | |



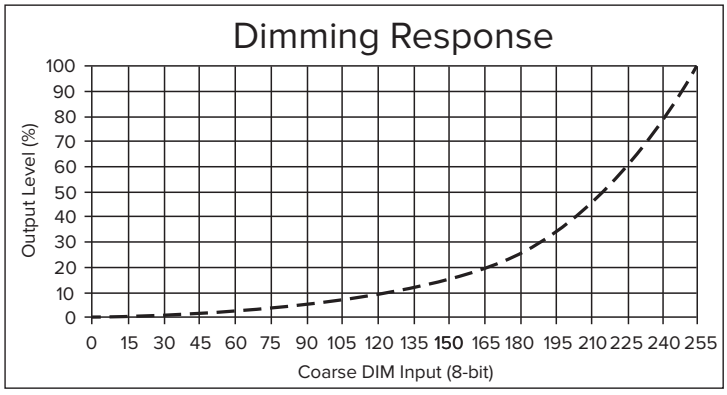



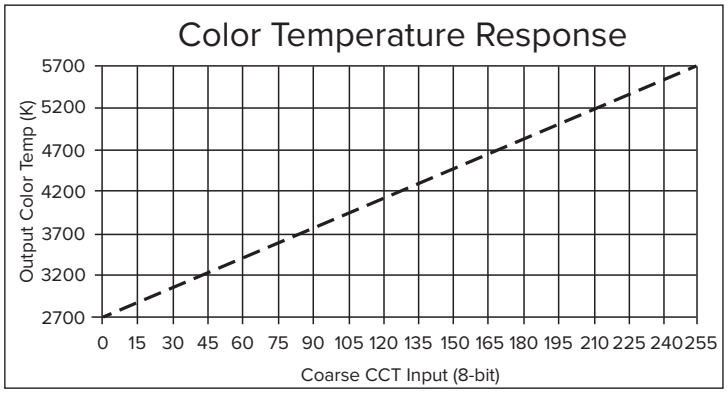
## APPENDIX F: DMX CONTROL PROTOCOL

| Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0 | 2700 | 57 | 2.77 | 57 | 3373 | 114 | 7.82 | 114 | 4046 |
| 1 | 1.00 | 1 | 2712 | 58 | 2.82 | 58 | 3385 | 115 | 7.96 | 115 | 4058 |
| 2 | 1.02 | 2 | 2724 | 59 | 2.87 | 59 | 3397 | 116 | 8.11 | 116 | 4070 |
| 3 | 1.04 | 3 | 2735 | 60 | 2.93 | 60 | 3409 | 117 | 8.26 | 117 | 4082 |
| 4 | 1.06 | 4 | 2747 | 61 | 2.98 | 61 | 3420 | 118 | 8.41 | 118 | 4094 |
| 5 | 1.08 | 5 | 2759 | 62 | 3.04 | 62 | 3432 | 119 | 8.57 | 119 | 4106 |
| 6 | 1.10 | 6 | 2771 | 63 | 3.09 | 63 | 3444 | 120 | 8.72 | 120 | 4117 |
| 7 | 1.12 | 7 | 2783 | 64 | 3.15 | 64 | 3456 | 121 | 8.88 | 121 | 4129 |
| 8 | 1.14 | 8 | 2794 | 65 | 3.21 | 65 | 3468 | 122 | 9.05 | 122 | 4141 |
| 9 | 1.16 | 9 | 2806 | 66 | 3.26 | 66 | 3480 | 123 | 9.21 | 123 | 4153 |
| 10 | 1.18 | 10 | 2818 | 67 | 3.32 | 67 | 3491 | 124 | 9.38 | 124 | 4165 |
| 11 | 1.20 | 11 | 2830 | 68 | 3.39 | 68 | 3503 | 125 | 9.56 | 125 | 4176 |
| 12 | 1.22 | 12 | 2842 | 69 | 3.45 | 69 | 3515 | 126 | 9.73 | 126 | 4188 |
| 13 | 1.24 | 13 | 2854 | 70 | 3.51 | 70 | 3527 | 127 | 9.91 | 127 | 4200 |
| 14 | 1.27 | 14 | 2865 | 71 | 3.58 | 71 | 3539 | 128 | 10.09 | 128 | 4212 |
| 15 | 1.29 | 15 | 2877 | 72 | 3.64 | 72 | 3550 | 129 | 10.28 | 129 | 4224 |
| 16 | 1.31 | 16 | 2889 | 73 | 3.71 | 73 | 3562 | 130 | 10.47 | 130 | 4235 |
| 17 | 1.34 | 17 | 2901 | 74 | 3.78 | 74 | 3574 | 131 | 10.66 | 131 | 4247 |
| 18 | 1.36 | 18 | 2913 | 75 | 3.85 | 75 | 3586 | 132 | 10.85 | 132 | 4259 |
| 19 | 1.39 | 19 | 2924 | 76 | 3.92 | 76 | 3598 | 133 | 11.05 | 133 | 4271 |
| 20 | 1.41 | 20 | 2936 | 77 | 3.99 | 77 | 3609 | 134 | 11.26 | 134 | 4283 |
| 21 | 1.44 | 21 | 2948 | 78 | 4.06 | 78 | 3621 | 135 | 11.46 | 135 | 4294 |
| 22 | 1.47 | 22 | 2960 | 79 | 4.14 | 79 | 3633 | 136 | 11.67 | 136 | 4306 |
| 23 | 1.49 | 23 | 2972 | 80 | 4.21 | 80 | 3645 | 137 | 11.89 | 137 | 4318 |
| 24 | 1.52 | 24 | 2983 | 81 | 4.29 | 81 | 3657 | 138 | 12.11 | 138 | 4330 |
| 25 | 1.55 | 25 | 2995 | 82 | 4.37 | 82 | 3669 | 139 | 12.33 | 139 | 4342 |
| 26 | 1.58 | 26 | 3007 | 83 | 4.45 | 83 | 3680 | 140 | 12.55 | 140 | 4354 |
| 27 | 1.61 | 27 | 3019 | 84 | 4.53 | 84 | 3692 | 141 | 12.79 | 141 | 4365 |
| 28 | 1.63 | 28 | 3031 | 85 | 4.61 | 85 | 3704 | 142 | 13.02 | 142 | 4377 |
| 29 | 1.66 | 29 | 3043 | 86 | 4.70 | 86 | 3716 | 143 | 13.26 | 143 | 4389 |
| 30 | 1.70 | 30 | 3054 | 87 | 4.78 | 87 | 3728 | 144 | 13.50 | 144 | 4401 |
| 31 | 1.73 | 31 | 3066 | 88 | 4.87 | 88 | 3739 | 145 | 13.75 | 145 | 4413 |
| 32 | 1.76 | 32 | 3078 | 89 | 4.96 | 89 | 3751 | 146 | 14.00 | 146 | 4424 |
| 33 | 1.79 | 33 | 3090 | 90 | 5.05 | 90 | 3763 | 147 | 14.26 | 147 | 4436 |
| 34 | 1.82 | 34 | 3102 | 91 | 5.15 | 91 | 3775 | 148 | 14.52 | 148 | 4448 |
| 35 | 1.86 | 35 | 3113 | 92 | 5.24 | 92 | 3787 | 149 | 14.79 | 149 | 4460 |
| 36 | 1.89 | 36 | 3125 | 93 | 5.34 | 93 | 3798 | 150 | 15.06 | 150 | 4472 |
| 37 | 1.93 | 37 | 3137 | 94 | 5.43 | 94 | 3810 | 151 | 15.34 | 151 | 4483 |
| 38 | 1.96 | 38 | 3149 | 95 | 5.53 | 95 | 3822 | 152 | 15.62 | 152 | 4495 |
| 39 | 2.00 | 39 | 3161 | 96 | 5.64 | 96 | 3834 | 153 | 15.91 | 153 | 4507 |
| 40 | 2.03 | 40 | 3172 | 97 | 5.74 | 97 | 3846 | 154 | 16.20 | 154 | 4519 |
| 41 | 2.07 | 41 | 3184 | 98 | 5.85 | 98 | 3857 | 155 | 16.50 | 155 | 4531 |
| 42 | 2.11 | 42 | 3196 | 99 | 5.95 | 99 | 3869 | 156 | 16.80 | 156 | 4543 |
| 43 | 2.15 | 43 | 3208 | 100 | 6.06 | 100 | 3881 | 157 | 17.11 | 157 | 4554 |
| 44 | 2.19 | 44 | 3220 | 101 | 6.17 | 101 | 3893 | 158 | 17.42 | 158 | 4566 |
| 45 | 2.23 | 45 | 3231 | 102 | 6.29 | 102 | 3905 | 159 | 17.74 | 159 | 4578 |
| 46 | 2.27 | 46 | 3243 | 103 | 6.40 | 103 | 3917 | 160 | 18.07 | 160 | 4590 |
| 47 | 2.31 | 47 | 3255 | 104 | 6.52 | 104 | 3928 | 161 | 18.40 | 161 | 4602 |
| 48 | 2.35 | 48 | 3267 | 105 | 6.64 | 105 | 3940 | 162 | 18.74 | 162 | 4613 |
| 49 | 2.40 | 49 | 3279 | 106 | 6.76 | 106 | 3952 | 163 | 19.08 | 163 | 4625 |
| 50 | 2.44 | 50 | 3291 | 107 | 6.89 | 107 | 3964 | 164 | 19.43 | 164 | 4637 |
| 51 | 2.48 | 51 | 3302 | 108 | 7.01 | 108 | 3976 | 165 | 19.79 | 165 | 4649 |
| 52 | 2.53 | 52 | 3314 | 109 | 7.14 | 109 | 3987 | 166 | 20.15 | 166 | 4661 |
| 53 | 2.58 | 53 | 3326 | 110 | 7.27 | 110 | 3999 | 167 | 20.52 | 167 | 4672 |
| 54 | 2.62 | 54 | 3338 | 111 | 7.41 | 111 | 4011 | 168 | 20.90 | 168 | 4684 |
| 55 | 2.67 | 55 | 3350 | 112 | 7.54 | 112 | 4023 | 169 | 21.28 | 169 | 4696 |
| 56 | 2.72 | 56 | 3361 | 113 | 7.68 | 113 | 4035 | 170 | 21.68 | 170 | 4708 |

## APPENDIX F: DMX CONTROL PROTOCOL CONTINUED

| Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) | Input Dim | Output Level (%) | Input CCT | Output Color Temper (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 171 | 22.07 | 171 | 4720 | 200 | 37.42 | 200 | 5062 | 229 | 63.44 | 229 | 5405 |
| 172 | 22.48 | 172 | 4731 | 201 | 38.11 | 201 | 5074 | 230 | 64.61 | 230 | 5417 |
| 173 | 22.89 | 173 | 4743 | 202 | 38.81 | 202 | 5086 | 231 | 65.79 | 231 | 5428 |
| 174 | 23.31 | 174 | 4755 | 203 | 39.52 | 203 | 5098 | 232 | 67.00 | 232 | 5440 |
| 175 | 23.74 | 175 | 4767 | 204 | 40.25 | 204 | 5109 | 233 | 68.23 | 233 | 5452 |
| 176 | 24.18 | 176 | 4779 | 205 | 40.99 | 205 | 5121 | 234 | 69.49 | 234 | 5464 |
| 177 | 24.62 | 177 | 4791 | 206 | 41.74 | 206 | 5133 | 235 | 70.76 | 235 | 5476 |
| 178 | 25.07 | 178 | 4802 | 207 | 42.51 | 207 | 5145 | 236 | 72.06 | 236 | 5487 |
| 179 | 25.53 | 179 | 4814 | 208 | 43.29 | 208 | 5157 | 237 | 73.39 | 237 | 5499 |
| 180 | 26.00 | 180 | 4826 | 209 | 44.08 | 209 | 5169 | 238 | 74.73 | 238 | 5511 |
| 181 | 26.48 | 181 | 4838 | 210 | 44.89 | 210 | 5180 | 239 | 76.11 | 239 | 5523 |
| 182 | 26.97 | 182 | 4850 | 211 | 45.72 | 211 | 5192 | 240 | 77.50 | 240 | 5535 |
| 183 | 27.46 | 183 | 4861 | 212 | 46.56 | 212 | 5204 | 241 | 78.93 | 241 | 5546 |
| 184 | 27.97 | 184 | 4873 | 213 | 47.41 | 213 | 5216 | 242 | 80.38 | 242 | 5558 |
| 185 | 28.48 | 185 | 4885 | 214 | 48.28 | 214 | 5228 | 243 | 81.85 | 243 | 5570 |
| 186 | 29.00 | 186 | 4897 | 215 | 49.17 | 215 | 5239 | 244 | 83.36 | 244 | 5582 |
| 187 | 29.54 | 187 | 4909 | 216 | 50.07 | 216 | 5251 | 245 | 84.89 | 245 | 5594 |
| 188 | 30.08 | 188 | 4920 | 217 | 50.99 | 217 | 5263 | 246 | 86.45 | 246 | 5606 |
| 189 | 30.63 | 189 | 4932 | 218 | 51.93 | 218 | 5275 | 247 | 88.04 | 247 | 5617 |
| 190 | 31.19 | 190 | 4944 | 219 | 52.88 | 219 | 5287 | 248 | 89.65 | 248 | 5629 |
| 191 | 31.77 | 191 | 4956 | 220 | 53.85 | 220 | 5298 | 249 | 91.30 | 249 | 5641 |
| 192 | 32.35 | 192 | 4968 | 221 | 54.84 | 221 | 5310 | 250 | 92.98 | 250 | 5653 |
| 193 | 32.94 | 193 | 4980 | 222 | 55.85 | 222 | 5322 | 251 | 94.69 | 251 | 5665 |
| 194 | 33.55 | 194 | 4991 | 223 | 56.88 | 223 | 5334 | 252 | 96.43 | 252 | 5676 |
| 195 | 34.17 | 195 | 5003 | 224 | 57.92 | 224 | 5346 | 253 | 98.20 | 253 | 5688 |
| 196 | 34.79 | 196 | 5015 | 225 | 58.99 | 225 | 5357 | 254 | 100.00 | 254 | 5700 |
| 197 | 35.43 | 197 | 5027 | 226 | 60.07 | 226 | 5369 | 255 | 100.00 | 255 | 5700 |
| 198 | 36.08 | 198 | 5039 | 227 | 61.17 | 227 | 5381 | | | | |
| 199 | 36.75 | 199 | 5050 | 228 | 62.30 | 228 | 5393 | | | | |



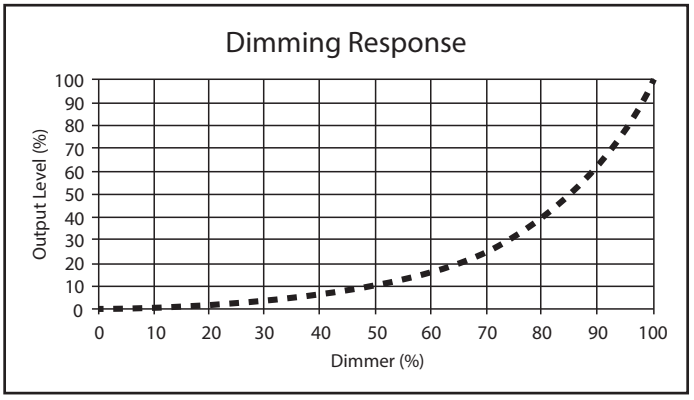



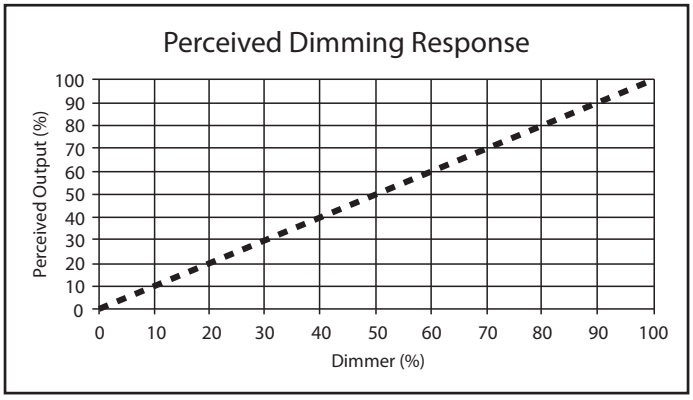
## APPENDIX G: CASAMBI CONTROL PROTOCOL DIMMING OUTPUT

| Input Dim | Output Level (%) | Perceived Output (%) | Input Dim | Output Level (%) | Perceived Output (%) | Input Dim | Output Level (%) | Perceived Output (%) |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.0 | 22.4 | 2.77 | 22.4 | 44.9 | 7.82 | 44.9 |
| 0.4 | 1.00 | 0.4 | 22.8 | 2.82 | 22.8 | 45.3 | 7.96 | 45.3 |
| 0.8 | 1.02 | 0.8 | 23.2 | 2.87 | 23.2 | 45.7 | 8.11 | 45.7 |
| 1.2 | 1.04 | 1.2 | 23.6 | 2.93 | 23.6 | 46.1 | 8.26 | 46.1 |
| 1.6 | 1.06 | 1.6 | 24.0 | 2.98 | 24.0 | 46.5 | 8.41 | 46.5 |
| 2.0 | 1.08 | 2.0 | 24.4 | 3.04 | 24.4 | 46.9 | 8.57 | 46.9 |
| 2.4 | 1.10 | 2.4 | 24.8 | 3.09 | 24.8 | 47.2 | 8.72 | 47.2 |
| 2.8 | 1.12 | 2.8 | 25.2 | 3.15 | 25.2 | 47.6 | 8.88 | 47.6 |
| 3.1 | 1.14 | 3.1 | 25.6 | 3.21 | 25.6 | 48.0 | 9.05 | 48.0 |
| 3.5 | 1.16 | 3.5 | 26.0 | 3.26 | 26.0 | 48.4 | 9.21 | 48.4 |
| 3.9 | 1.18 | 3.9 | 26.4 | 3.32 | 26.4 | 48.8 | 9.38 | 48.8 |
| 4.3 | 1.20 | 4.3 | 26.8 | 3.39 | 26.8 | 49.2 | 9.56 | 49.2 |
| 4.7 | 1.22 | 4.7 | 27.2 | 3.45 | 27.2 | 49.6 | 9.73 | 49.6 |
| 5.1 | 1.24 | 5.1 | 27.6 | 3.51 | 27.6 | 50.0 | 9.91 | 50.0 |
| 5.5 | 1.27 | 5.5 | 28.0 | 3.58 | 28.0 | 50.4 | 10.09 | 50.4 |
| 5.9 | 1.29 | 5.9 | 28.3 | 3.64 | 28.3 | 50.8 | 10.28 | 50.8 |
| 6.3 | 1.31 | 6.3 | 28.7 | 3.71 | 28.7 | 51.2 | 10.47 | 51.2 |
| 6.7 | 1.34 | 6.7 | 29.1 | 3.78 | 29.1 | 51.6 | 10.66 | 51.6 |
| 7.1 | 1.36 | 7.1 | 29.5 | 3.85 | 29.5 | 52.0 | 10.85 | 52.0 |
| 7.5 | 1.39 | 7.5 | 29.9 | 3.92 | 29.9 | 52.4 | 11.05 | 52.4 |
| 7.9 | 1.41 | 7.9 | 30.3 | 3.99 | 30.3 | 52.8 | 11.26 | 52.8 |
| 8.3 | 1.44 | 8.3 | 30.7 | 4.06 | 30.7 | 53.1 | 11.46 | 53.1 |
| 8.7 | 1.47 | 8.7 | 31.1 | 4.14 | 31.1 | 53.5 | 11.67 | 53.5 |
| 9.1 | 1.49 | 9.1 | 31.5 | 4.21 | 31.5 | 53.9 | 11.89 | 53.9 |
| 9.4 | 1.52 | 9.4 | 31.9 | 4.29 | 31.9 | 54.3 | 12.11 | 54.3 |
| 9.8 | 1.55 | 9.8 | 32.3 | 4.37 | 32.3 | 54.7 | 12.33 | 54.7 |
| 10.2 | 1.58 | 10.2 | 32.7 | 4.45 | 32.7 | 55.1 | 12.55 | 55.1 |
| 10.6 | 1.61 | 10.6 | 33.1 | 4.53 | 33.1 | 55.5 | 12.79 | 55.5 |
| 11.0 | 1.63 | 11.0 | 33.5 | 4.61 | 33.5 | 55.9 | 13.02 | 55.9 |
| 11.4 | 1.66 | 11.4 | 33.9 | 4.70 | 33.9 | 56.3 | 13.26 | 56.3 |
| 11.8 | 1.70 | 11.8 | 34.3 | 4.78 | 34.3 | 56.7 | 13.50 | 56.7 |
| 12.2 | 1.73 | 12.2 | 34.6 | 4.87 | 34.6 | 57.1 | 13.75 | 57.1 |
| 12.6 | 1.76 | 12.6 | 35.0 | 4.96 | 35.0 | 57.5 | 14.00 | 57.5 |
| 13.0 | 1.79 | 13.0 | 35.4 | 5.05 | 35.4 | 57.9 | 14.26 | 57.9 |
| 13.4 | 1.82 | 13.4 | 35.8 | 5.15 | 35.8 | 58.3 | 14.52 | 58.3 |
| 13.8 | 1.86 | 13.8 | 36.2 | 5.24 | 36.2 | 58.7 | 14.79 | 58.7 |
| 14.2 | 1.89 | 14.2 | 36.6 | 5.34 | 36.6 | 59.1 | 15.06 | 59.1 |
| 14.6 | 1.93 | 14.6 | 37.0 | 5.43 | 37.0 | 59.4 | 15.34 | 59.4 |
| 15.0 | 1.96 | 15.0 | 37.4 | 5.53 | 37.4 | 59.8 | 15.62 | 59.8 |
| 15.4 | 2.00 | 15.4 | 37.8 | 5.64 | 37.8 | 60.2 | 15.91 | 60.2 |
| 15.7 | 2.03 | 15.7 | 38.2 | 5.74 | 38.2 | 60.6 | 16.20 | 60.6 |
| 16.1 | 2.07 | 16.1 | 38.6 | 5.85 | 38.6 | 61.0 | 16.50 | 61.0 |
| 16.5 | 2.11 | 16.5 | 39.0 | 5.95 | 39.0 | 61.4 | 16.80 | 61.4 |
| 16.9 | 2.15 | 16.9 | 39.4 | 6.06 | 39.4 | 61.8 | 17.11 | 61.8 |
| 17.3 | 2.19 | 17.3 | 39.8 | 6.17 | 39.8 | 62.2 | 17.42 | 62.2 |
| 17.7 | 2.23 | 17.7 | 40.2 | 6.29 | 40.2 | 62.6 | 17.74 | 62.6 |
| 18.1 | 2.27 | 18.1 | 40.6 | 6.40 | 40.6 | 63.0 | 18.07 | 63.0 |
| 18.5 | 2.31 | 18.5 | 40.9 | 6.52 | 40.9 | 63.4 | 18.40 | 63.4 |
| 18.9 | 2.35 | 18.9 | 41.3 | 6.64 | 41.3 | 63.8 | 18.74 | 63.8 |
| 19.3 | 2.40 | 19.3 | 41.7 | 6.76 | 41.7 | 64.2 | 19.08 | 64.2 |
| 19.7 | 2.44 | 19.7 | 42.1 | 6.89 | 42.1 | 64.6 | 19.43 | 64.6 |
| 20.1 | 2.48 | 20.1 | 42.5 | 7.01 | 42.5 | 65.0 | 19.79 | 65.0 |
| 20.5 | 2.53 | 20.5 | 42.9 | 7.14 | 42.9 | 65.4 | 20.15 | 65.4 |
| 20.9 | 2.58 | 20.9 | 43.3 | 7.27 | 43.3 | 65.7 | 20.52 | 65.7 |
| 21.3 | 2.62 | 21.3 | 43.7 | 7.41 | 43.7 | 66.1 | 20.90 | 66.1 |
| 21.7 | 2.67 | 21.7 | 44.1 | 7.54 | 44.1 | 66.5 | 21.28 | 66.5 |
| 22.0 | 2.72 | 22.0 | 44.5 | 7.68 | 44.5 | 66.9 | 21.68 | 66.9 |

## APPENDIX G: CASAMBI CONTROL PROTOCOL DIMMING OUTPUT CONTINUED

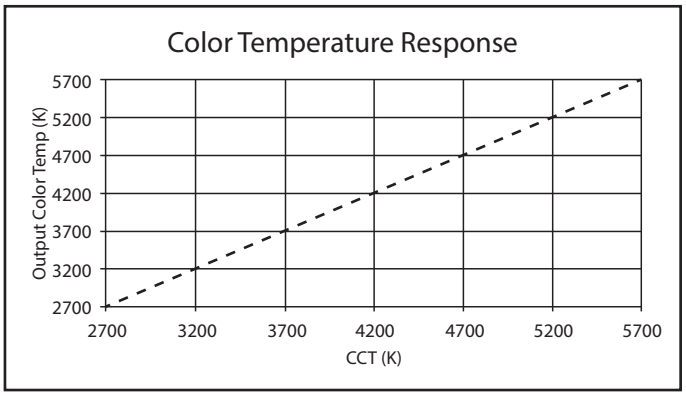
| Input Dim | Output Level (%) | Perceived Output (%) | Input Dim | Output Level (%) | Perceived Output (%) | Input Dim | Output Level (%) | Perceived Output (%) |
|---|---|---|---|---|---|---|---|---|
| 67.3 | 22.07 | 67.3 | 78.7 | 37.42 | 78.7 | 90.2 | 63.44 | 90.2 |
| 67.7 | 22.48 | 67.7 | 79.1 | 38.11 | 79.1 | 90.6 | 64.61 | 90.6 |
| 68.1 | 22.89 | 68.1 | 79.5 | 38.81 | 79.5 | 90.9 | 65.79 | 90.9 |
| 68.5 | 23.31 | 68.5 | 79.9 | 39.52 | 79.9 | 91.3 | 67.00 | 91.3 |
| 68.9 | 23.74 | 68.9 | 80.3 | 40.25 | 80.3 | 91.7 | 68.23 | 91.7 |
| 69.3 | 24.18 | 69.3 | 80.7 | 40.99 | 80.7 | 92.1 | 69.49 | 92.1 |
| 69.7 | 24.62 | 69.7 | 81.1 | 41.74 | 81.1 | 92.5 | 70.76 | 92.5 |
| 70.1 | 25.07 | 70.1 | 81.5 | 42.51 | 81.5 | 92.9 | 72.06 | 92.9 |
| 70.5 | 25.53 | 70.5 | 81.9 | 43.29 | 81.9 | 93.3 | 73.39 | 93.3 |
| 70.9 | 26.00 | 70.9 | 82.3 | 44.08 | 82.3 | 93.7 | 74.73 | 93.7 |
| 71.3 | 26.48 | 71.3 | 82.7 | 44.89 | 82.7 | 94.1 | 76.11 | 94.1 |
| 71.7 | 26.97 | 71.7 | 83.1 | 45.72 | 83.1 | 94.5 | 77.50 | 94.5 |
| 72.0 | 27.46 | 72.0 | 83.5 | 46.56 | 83.5 | 94.9 | 78.93 | 94.9 |
| 72.4 | 27.97 | 72.4 | 83.9 | 47.41 | 83.9 | 95.3 | 80.38 | 95.3 |
| 72.8 | 28.48 | 72.8 | 84.3 | 48.28 | 84.3 | 95.7 | 81.85 | 95.7 |
| 73.2 | 29.00 | 73.2 | 84.6 | 49.17 | 84.6 | 96.1 | 83.36 | 96.1 |
| 73.6 | 29.54 | 73.6 | 85.0 | 50.07 | 85.0 | 96.5 | 84.89 | 96.5 |
| 74.0 | 30.08 | 74.0 | 85.4 | 50.99 | 85.4 | 96.9 | 86.45 | 96.9 |
| 74.4 | 30.63 | 74.4 | 85.8 | 51.93 | 85.8 | 97.2 | 88.04 | 97.2 |
| 74.8 | 31.19 | 74.8 | 86.2 | 52.88 | 86.2 | 97.6 | 89.65 | 97.6 |
| 75.2 | 31.77 | 75.2 | 86.6 | 53.85 | 86.6 | 98.0 | 91.30 | 98.0 |
| 75.6 | 32.35 | 75.6 | 87.0 | 54.84 | 87.0 | 98.4 | 92.98 | 98.4 |
| 76.0 | 32.94 | 76.0 | 87.4 | 55.85 | 87.4 | 98.8 | 94.69 | 98.8 |
| 76.4 | 33.55 | 76.4 | 87.8 | 56.88 | 87.8 | 99.2 | 96.43 | 99.2 |
| 76.8 | 34.17 | 76.8 | 88.2 | 57.92 | 88.2 | 99.6 | 98.20 | 99.6 |
| 77.2 | 34.79 | 77.2 | 88.6 | 58.99 | 88.6 | 100.0 | 100.00 | 100.0 |
| 77.6 | 35.43 | 77.6 | 89.0 | 60.07 | 89.0 | | | |
| 78.0 | 36.08 | 78.0 | 89.4 | 61.17 | 89.4 | | | |
| 78.3 | 36.75 | 78.3 | 89.8 | 62.30 | 89.8 | | | |



## APPENDIX G: CASAMBI CONTROL PROTOCOL CCT OUTPUT

| Input CCT (K) | Output CCT (K) | Input CCT (K) | Output CCT (K) | Input CCT (K) | Output CCT (K) | Input CCT | Output CCT (K) | Input CCT (K) | Output CCT (K) | Input CCT (K) | Output CCT (K) | Input CCT (K) | Output CCT (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2700 | 2700 | 3270 | 3270 | 3840 | 3840 | 4410 | 4410 | 4810 | 4810 | 5210 | 5210 | 5610 | 5610 |
| 2710 | 2710 | 3280 | 3280 | 3850 | 3850 | 4420 | 4420 | 4820 | 4820 | 5220 | 5220 | 5620 | 5620 |
| 2720 | 2720 | 3290 | 3290 | 3860 | 3860 | 4430 | 4430 | 4830 | 4830 | 5230 | 5230 | 5630 | 5630 |
| 2730 | 2730 | 3300 | 3300 | 3870 | 3870 | 4440 | 4440 | 4840 | 4840 | 5240 | 5240 | 5640 | 5640 |
| 2740 | 2740 | 3310 | 3310 | 3880 | 3880 | 4450 | 4450 | 4850 | 4850 | 5250 | 5250 | 5650 | 5650 |
| 2750 | 2750 | 3320 | 3320 | 3890 | 3890 | 4460 | 4460 | 4860 | 4860 | 5260 | 5260 | 5660 | 5660 |
| 2760 | 2760 | 3330 | 3330 | 3900 | 3900 | 4470 | 4470 | 4870 | 4870 | 5270 | 5270 | 5670 | 5670 |
| 2770 | 2770 | 3340 | 3340 | 3910 | 3910 | 4480 | 4480 | 4880 | 4880 | 5280 | 5280 | 5680 | 5680 |
| 2780 | 2780 | 3350 | 3350 | 3920 | 3920 | 4490 | 4490 | 4890 | 4890 | 5290 | 5290 | 5690 | 5690 |
| 2790 | 2790 | 3360 | 3360 | 3930 | 3930 | 4500 | 4500 | 4900 | 4900 | 5300 | 5300 | 5700 | 5700 |
| 2800 | 2800 | 3370 | 3370 | 3940 | 3940 | 4510 | 4510 | 4910 | 4910 | 5310 | 5310 | | |
| 2810 | 2810 | 3380 | 3380 | 3950 | 3950 | 4520 | 4520 | 4920 | 4920 | 5320 | 5320 | | |
| 2820 | 2820 | 3390 | 3390 | 3960 | 3960 | 4530 | 4530 | 4930 | 4930 | 5330 | 5330 | | |
| 2830 | 2830 | 3400 | 3400 | 3970 | 3970 | 4540 | 4540 | 4940 | 4940 | 5340 | 5340 | | |
| 2840 | 2840 | 3410 | 3410 | 3980 | 3980 | 4550 | 4550 | 4950 | 4950 | 5350 | 5350 | | |
| 2850 | 2850 | 3420 | 3420 | 3990 | 3990 | 4560 | 4560 | 4960 | 4960 | 5360 | 5360 | | |
| 2860 | 2860 | 3430 | 3430 | 4000 | 4000 | 4570 | 4570 | 4970 | 4970 | 5370 | 5370 | | |
| 2870 | 2870 | 3440 | 3440 | 4010 | 4010 | 4580 | 4580 | 4980 | 4980 | 5380 | 5380 | | |
| 2880 | 2880 | 3450 | 3450 | 4020 | 4020 | 4590 | 4590 | 4990 | 4990 | 5390 | 5390 | | |
| 2890 | 2890 | 3460 | 3460 | 4030 | 4030 | 4600 | 4600 | 5000 | 5000 | 5400 | 5400 | | |
| 2900 | 2900 | 3470 | 3470 | 4040 | 4040 | 4610 | 4610 | 5010 | 5010 | 5410 | 5410 | | |
| 2910 | 2910 | 3480 | 3480 | 4050 | 4050 | 4620 | 4620 | 5020 | 5020 | 5420 | 5420 | | |
| 2920 | 2920 | 3490 | 3490 | 4060 | 4060 | 4630 | 4630 | 5030 | 5030 | 5430 | 5430 | | |
| 2930 | 2930 | 3500 | 3500 | 4070 | 4070 | 4640 | 4640 | 5040 | 5040 | 5440 | 5440 | | |
| 2940 | 2940 | 3510 | 3510 | 4080 | 4080 | 4650 | 4650 | 5050 | 5050 | 5450 | 5450 | | |
| 2950 | 2950 | 3520 | 3520 | 4090 | 4090 | 4660 | 4660 | 5060 | 5060 | 5460 | 5460 | | |
| 2960 | 2960 | 3530 | 3530 | 4100 | 4100 | 4670 | 4670 | 5070 | 5070 | 5470 | 5470 | | |
| 2970 | 2970 | 3540 | 3540 | 4110 | 4110 | 4680 | 4680 | 5080 | 5080 | 5480 | 5480 | | |
| 2980 | 2980 | 3550 | 3550 | 4120 | 4120 | 4690 | 4690 | 5090 | 5090 | 5490 | 5490 | | |
| 2990 | 2990 | 3560 | 3560 | 4130 | 4130 | 4700 | 4700 | 5100 | 5100 | 5500 | 5500 | | |
| 3000 | 3000 | 3570 | 3570 | 4140 | 4140 | 4710 | 4710 | 5110 | 5110 | 5510 | 5510 | | |
| 3010 | 3010 | 3580 | 3580 | 4150 | 4150 | 4720 | 4720 | 5120 | 5120 | 5520 | 5520 | | |
| 3020 | 3020 | 3590 | 3590 | 4160 | 4160 | 4730 | 4730 | 5130 | 5130 | 5530 | 5530 | | |
| 3030 | 3030 | 3600 | 3600 | 4170 | 4170 | 4740 | 4740 | 5140 | 5140 | 5540 | 5540 | | |
| 3040 | 3040 | 3610 | 3610 | 4180 | 4180 | 4750 | 4750 | 5150 | 5150 | 5550 | 5550 | | |
| 3050 | 3050 | 3620 | 3620 | 4190 | 4190 | 4760 | 4760 | 5160 | 5160 | 5560 | 5560 | | |
| 3060 | 3060 | 3630 | 3630 | 4200 | 4200 | 4770 | 4770 | 5170 | 5170 | 5570 | 5570 | | |
| 3070 | 3070 | 3640 | 3640 | 4210 | 4210 | 4780 | 4780 | 5180 | 5180 | 5580 | 5580 | | |
| 3080 | 3080 | 3650 | 3650 | 4220 | 4220 | 4790 | 4790 | 5190 | 5190 | 5590 | 5590 | | |
| 3090 | 3090 | 3660 | 3660 | 4230 | 4230 | 4800 | 4800 | 5200 | 5200 | 5600 | 5600 | | |
| 3100 | 3100 | 3670 | 3670 | 4240 | 4240 | | | | | | | | |
| 3110 | 3110 | 3680 | 3680 | 4250 | 4250 | | | | | | | | |
| 3120 | 3120 | 3690 | 3690 | 4260 | 4260 | | | | | | | | |
| 3130 | 3130 | 3700 | 3700 | 4270 | 4270 | | | | | | | | |
| 3140 | 3140 | 3710 | 3710 | 4280 | 4280 | | | | | | | | |
| 3150 | 3150 | 3720 | 3720 | 4290 | 4290 | | | | | | | | |
| 3160 | 3160 | 3730 | 3730 | 4300 | 4300 | | | | | | | | |
| 3170 | 3170 | 3740 | 3740 | 4310 | 4310 | | | | | | | | |
| 3180 | 3180 | 3750 | 3750 | 4320 | 4320 | | | | | | | | |
| 3190 | 3190 | 3760 | 3760 | 4330 | 4330 | | | | | | | | |
| 3200 | 3200 | 3770 | 3770 | 4340 | 4340 | | | | | | | | |
| 3210 | 3210 | 3780 | 3780 | 4350 | 4350 | | | | | | | | |
| 3220 | 3220 | 3790 | 3790 | 4360 | 4360 | | | | | | | | |
| 3230 | 3230 | 3800 | 3800 | 4370 | 4370 | | | | | | | | |
| 3240 | 3240 | 3810 | 3810 | 4380 | 4380 | | | | | | | | |
| 3250 | 3250 | 3820 | 3820 | 4390 | 4390 | | | | | | | | |
| 3260 | 3260 | 3830 | 3830 | 4400 | 4400 | | | | | | | | |



## 13.0 PRODUCT SUPPORT

Contact Cooledge Technical Support at:

E: apps.engineering@cooledgelighting.com
O: +1.781.899.0317
T: +1.844.455.4448 (toll free - North America)

## 14.0 WARRANTY

Cooledge warrants that the products manufactured, distributed or sold by it will:

1. Be free of any claim of ownership by third parties
2. Be conforming to the Specifications and free from defects in materials and workmanship under normal use, handling, warehousing and service.

The warranty period specified in the Cooledge Warranty Terms and Conditions for the products will be for a period of five (5) years from the shipment date of any products sold by Cooledge.

CE

c UL us LISTED

RoHS

5 YEAR SYSTEM WARRANTY 5 5 YEAR SYSTEM WARRANTY

**5 Year Limited Warranty:**
Parts and workmanship

Cooledge Lighting Inc.
110-13551 Commerce Parkway
Richmond, BC V6V 2L1 Canada

O +1 604 273 2665
F +1 604 273 2660
T +1 844 455 4448
W cooledgelighting.com