

Tape Light Advanced Applications Guide

1.0 Overview

Purpose:

This app note is designed to help provide recommendations for installers who are planning a Lutron tape light project with a non-standard application that may not be covered by the product installation instructions.

Applicability:

The instructions in this application note apply to installations using any Lutron LED tape lights and wireless controllers covered in the **Tape Light Solution** specification submittal. Please see Lutron [P/N 3691301](#) for Lumaris and P/N 3663141 for Rania at www.lutron.com for further details.

Considerations:

The limitations of wire length must be carefully followed to ensure that LEDs are consistently illuminated from the beginning of the run to the end of the run. Light output quality outcomes may vary depending on specific installation implementations.

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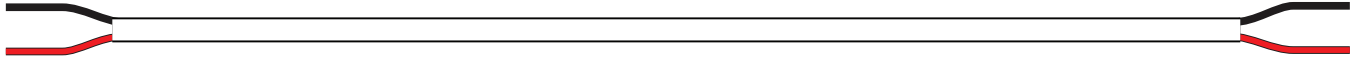
2.0 Definitions

Throughout the system design process, it is important to understand the role each component plays in the design. A few keywords are used throughout this document, and are defined below:

2.1 Wire Types

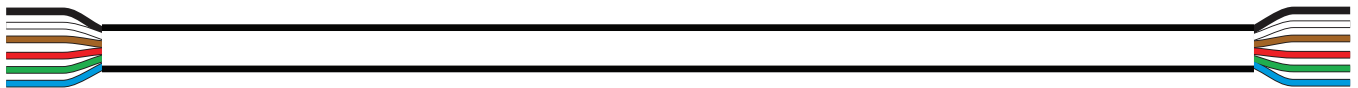
Power Wire

The **power wire** or **power cable** is a 2-conductor cable which connects the wireless controller to the power interface.



Control Wire

The **control wire** or **control cable** is a 3-conductor (tunable white wireless controller) or 6-conductor (multi-channel wireless controller) cable that runs between the controller and the LED tape, or between two sections of tape.

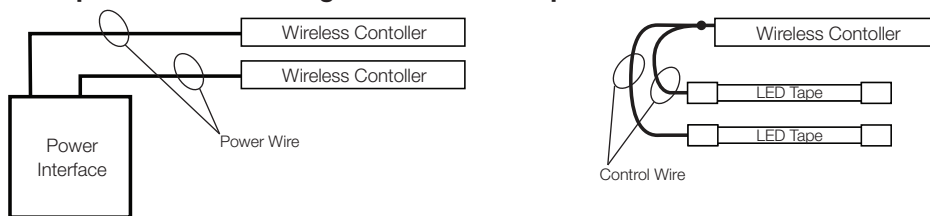


2.2 Wire Configurations

Homerun

Homerun refers to a wiring configuration where two or more devices are wired to a single power source and each device has an independent wire run back to the source. This is the recommended wiring configuration.

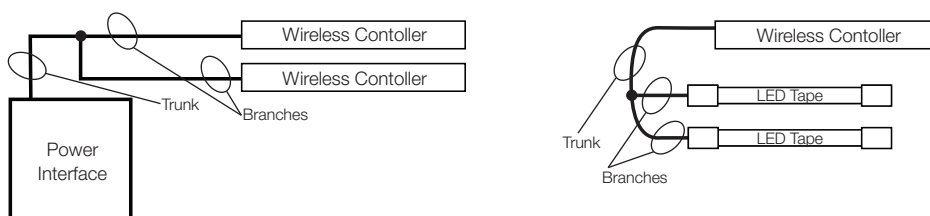
Example: Homerun configuration between power device and controller or controller and LED tape



T-tap

T-tap (sometimes known as “Y-tap”) refers to a wiring configuration where two or more devices are wired to a single power source and the devices share all or part of the wire run back to the source.

Example: T-tap configuration between power device and controller or controller and LED tape



Trunk

Trunk refers to a section of power wire or control wire that is shared between multiple devices. In a homerun configuration, the trunk length is zero.

Branch

Branch refers to a section of power wire or control wire that runs between a trunk and a single device. In a homerun configuration, the branch is the entire wire run. For **control wire**, the wire between segments of tape should be included in the total branch length.

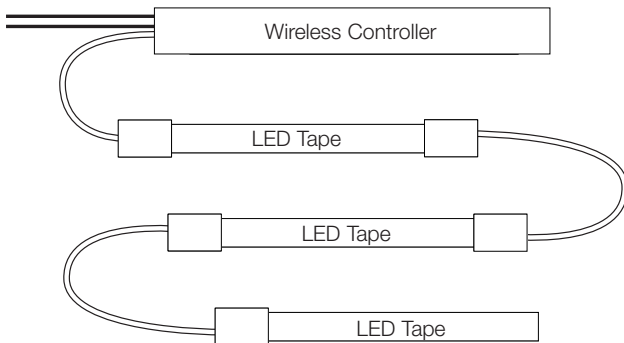
3.0 Wiring Topology for Lutron Tape Light

Three basic options exist for wiring the tape light strips: series, parallel, and series-parallel. A dual-ended wiring option is also available for applications that require a continuous run exceeding the 16.4 ft (5 m) limit¹ or are sensitive to brightness imbalances between ends of the tape light. Each installation should be carefully considered to determine the most effective wiring option for that application. Examples are demonstrated below.

Series

Any installation where tape segments are connected to each other and only one segment is directly connected to the controller.

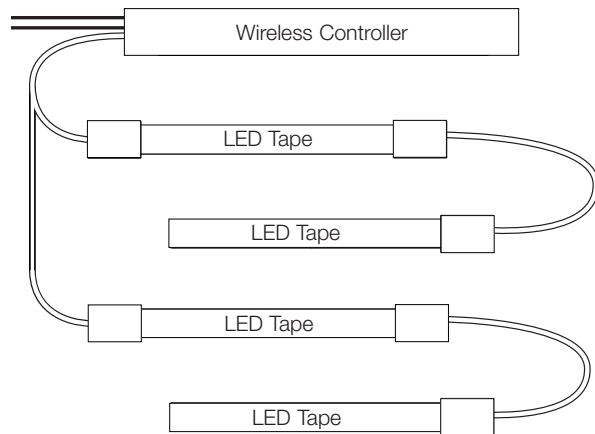
Example: Segments of LED tape installed for under-cabinet lighting



Series-Parallel

Any installation where series and parallel wiring is combined.

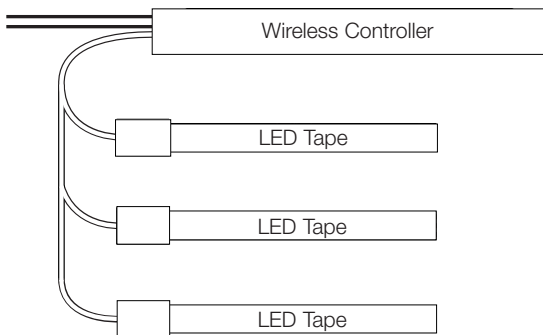
Example: Controller installed in the middle with tape extending in both directions from the controller



Parallel

Any installation where all tape segments connect directly to the controller.

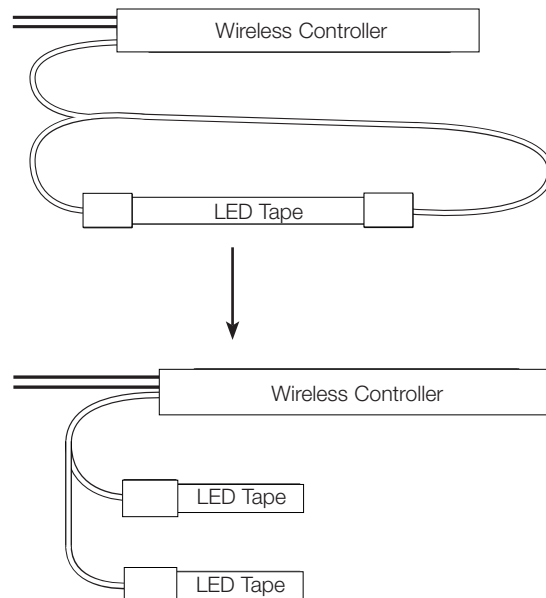
Example: Segments of LED tape installed for bookshelf lighting



Dual-Ended Option

An installation where the control wire connects to both ends of a single tape run. This is effectively identical to a parallel installation with two tape segments of half the total length.

Example: a 16.4 ft to 32.8 ft (5 m to 10 m) continuous cove lighting run



¹ This application is only applicable to Lumaris tape lights. It is recommended that Rania High Output tape lights do not exceed 16.4 ft (5 m) per controller.

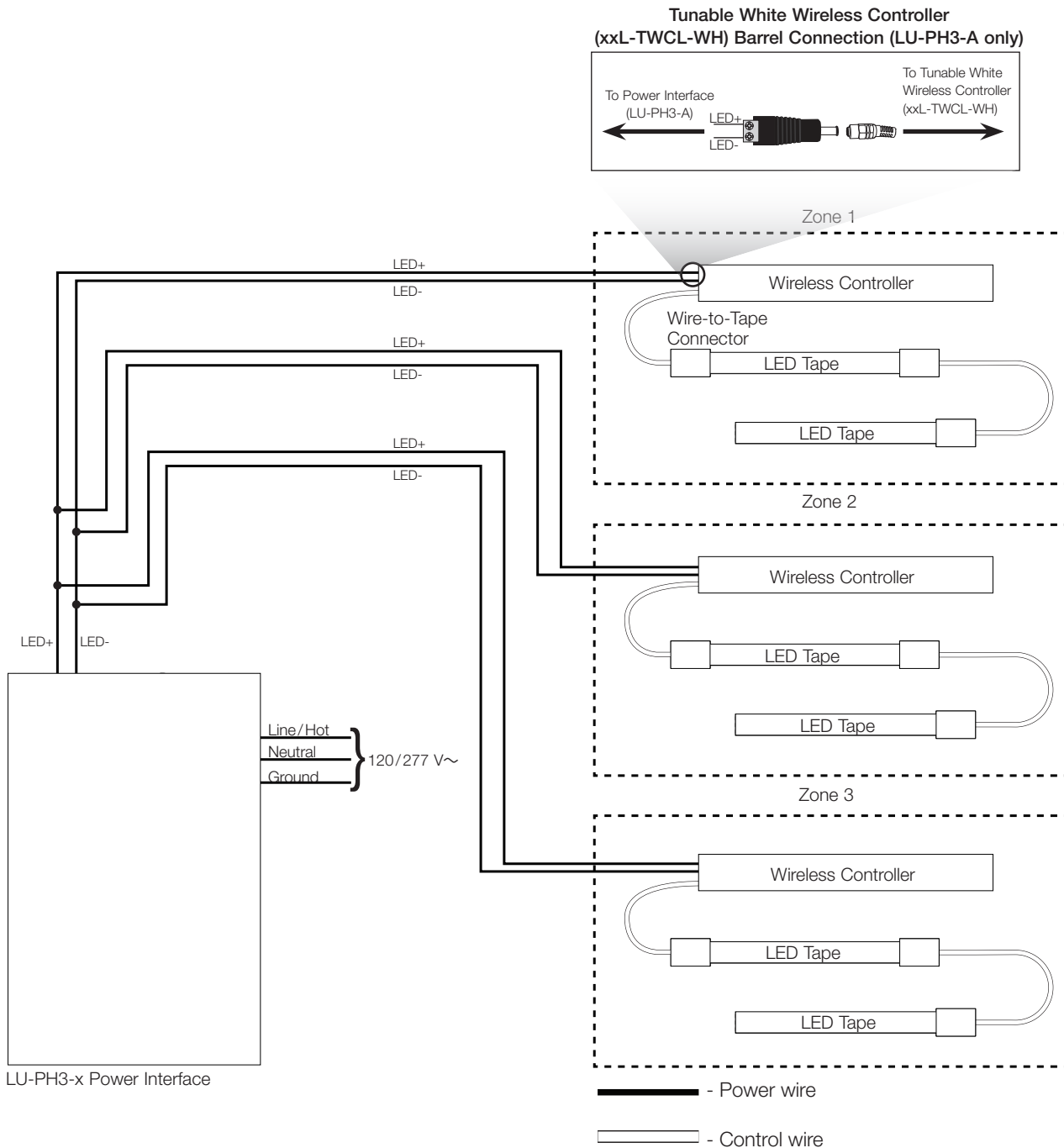
4.0 Multi-Zone Wiring

When wiring multiple Lutron wireless controllers to a power interface, consider whether the controllers will be programmed together in a single zone, or in separate zones.

For wireless controllers programmed in separate zones, wiring LED+ and LED- in a **homerun** configuration (shown in the schematic example below) will minimize interactions between controllers. Wiring in a **T-tap** configuration may result in subtle interactions between controllers.

Please note that xxL-TWCL-WH is compatible only with LU-PH3-A (Lumaris power interface). xxL-MWCL-WH may be used with either LU-PH3-A or LU-PH3-B.

For LU-PH3-A, only one wire is allowed per terminal block connection.



5.0 Wire Length Recommendations (Power Interface LU-PH3-x Only)

When using the power interface (LU-PH3-x) with Lutron tape light, there may be times when it would be advantageous to use greater than 10 ft (3 m) of **control wire** on the output of a wireless controller. To maintain consistent light output, the length of the 24 V \equiv **power wire** must be considered when extending the wire length on the controller's output. Maximum wire length between the power interface and wireless controller for different sizes is listed below.

Controller Type	Maximum Wire Length from Power Interface to the Wireless Controller: ft (m)				
	12 AWG (4.0 mm ²)	14 AWG (2.5 mm ²)	16 AWG (1.5 mm ²)	18 AWG (1.0 mm ²)	20 AWG (0.75 mm ²)
Tunable White	75 (22.9)	50 (15.2)	30 (9.1)	20 (6.1)	10 (3.0)
Multi-channel	60 (18.3)	38 (11.6)	25 (7.6)	15 (4.5)	9 (2.7)

The tables below demonstrate how **power wire** and **control wire** lengths can be varied to increase installation flexibility and maintain optimum performance. Note that 20 AWG (0.75 mm²) **power wire** and 22 AWG (0.50 mm²) **control wire** are supplied in Lutron kits and used in the tables. These revised wire length rules **ONLY** apply when using a power interface (LU-PH3-x), and when controllers are **homerun** to the power interface.

If more wire is needed, other gauges of wire may be required. Refer to the multiplier tables and examples below for guidance on changing wire gauge. For Lutron Designer – Canvas View users, refer also to the Tape Light Assistant to validate desired installation configuration.

Case 1: Permissible 22 AWG (0.50 mm²) Control Wire Length for RGB + Tunable White Tape: ft (m)^{a,b}

Controller's Total Tape Load: ft (m)	20 AWG (0.75 mm ²) Power Wire Length: ft (m)			
	5 (1.50)	10 (3.0)	20 (6.0)	40 (12.0)
8.2 (2.50)	83 (25.30)	80 (24.40)	74 (22.50)	60 (18.30)
16.4 (5.00)	22 (6.70)	19 (5.60)	12 (3.70)	-
24.6 (7.50)	14 (4.27)	10 (3.0)	4 (1.22)	-
32.8 (10.00)	9 (2.75)	6 (1.83)	-	-

Case 2: Permissible 22 AWG (0.50 mm²) Control Wire Length for Tunable White Tape: ft (m)^{a,b}

Controller's Total Tape Load: ft (m)	20 AWG (0.75 mm ²) Power Wire Length: ft (m)			
	5 (1.50)	10 (3.0)	20 (6.0)	40 (12.0)
4.1 (1.25)	157 (48.00)	155 (47.25)	148 (45.10)	134 (40.80)
8.2 (2.50)	69 (21.00)	65 (19.80)	59 (18.00)	45 (13.70)
16.4 (5.00)	15 (4.57)	12 (3.65)	5 (1.52)	-

^a Tables assume one series run of tape, except for Case 1 – 24.6 ft (7.50 m) and 32.8 ft (10.0 m) of tape, which assumes two or more **t-tapped** runs where at least one run is 16.4 ft (5.00 m). When **homerunning** tape to the controller, the allowable length of **control wire** to each run may be doubled on each **branch**, only if each **branch** is similar load length.

^b If using more than six connectors on any individual series-wired LED tape run, each additional connector reduces the maximum length of the **control wire** allowed by 6 in (152.4 mm), regardless of gauge.

Continued on the next page...

5.0 Wire Length Recommendations (Power Interface LU-PH3-x Only) Continued

Case 3: Permissible 22 AWG (0.50 mm²) Control Wire Length for High Output Rania Tape: ft (m)^{a,b}

Controller's Total Tape Load: ft (m)	20 AWG (0.75 mm ²) Power Wire Length: ft (m)			
	5 (1.50)	10 (3.0)	20 (6.0)	40 (12.0)
4.1 (1.25)	74 (22.55)	71 (21.64)	64 (19.50)	51 (15.54)
8.2 (2.50)	28 (8.53)	25 (7.62)	19 (5.79)	5 (1.52)
16.4 (5.00)	1 (0.30)	-	-	-

Control Wire – To use the size...	...Multiply “Permissible 22 AWG (0.50 mm ²) Control Wire Length” by:	Power Wire – To use the size...	...Multiply “Permissible 20 AWG (0.75 mm ²) Power Wire Length” by:
14 AWG (2.50 mm ²) ^c	6	12 AWG (4.00 mm ²) ^c	6
16 AWG (1.50 mm ²) ^c	4	14 AWG (2.50 mm ²) ^c	4
18 AWG (1.00 mm ²) ^c	2	16 AWG (1.50 mm ²) ^c	2
22 AWG (0.50 mm ²)	1	20 AWG (0.75 mm ²)	1

Please note that lengths of wire between tape segment runs can cause noticeably inconsistent light levels between the beginning and the end of the LED tape run. In general, no individual series-wired LED tape run should have more than 10 ft (3 m) of 22 AWG (0.50 mm²) **control wire** from first LED tape segment to the last LED tape segment.

NOTE: Due to the nature of the insulation displacement connectors used for wire-to-tape connections, **ONLY** Lutron provided 22 AWG (0.50 mm²) stranded wire may be used on the inlet of the wire-to-tape connectors, and consistent connection can only be guaranteed using LU-WK1-4W^d, LU-WK1-6W or LU-WK1-TW. Solid wire and other sizes are not supported. If using another gauge, splice a piece of LU-WK1-4W^d, LU-WK1-6W or LU-WK1-TW to the end for insertion into the connector.

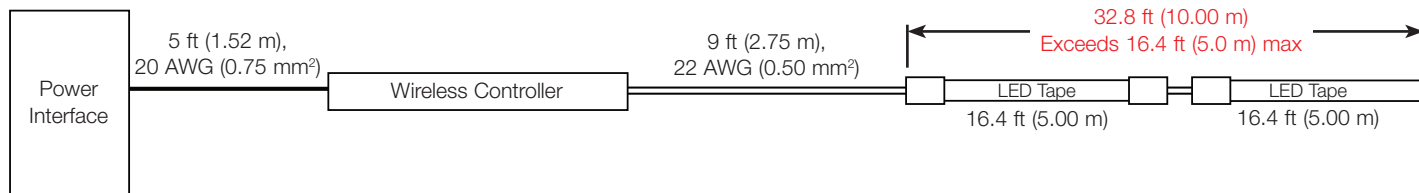
- ^a Tables assume one series run of tape, except for Case 1 – 24.6 ft (7.50 m) and 32.8 ft (10.0 m) of tape, which assumes two or more **t-tapped** runs where at least one run is 16.4 ft (5.00 m). When **homerunning** tape to the controller, the allowable length of **control wire** to each run may be doubled on each **branch**, only if each **branch** is similar load length.
- ^b If using more than six connectors on any individual series-wired LED tape run, each additional connector reduces the maximum length of the **control wire** allowed by 6 in (152.4 mm), regardless of gauge.
- ^c Not available for purchase from Lutron.
- ^d Applicable to Rania tape lights.

6.0 Wiring Examples

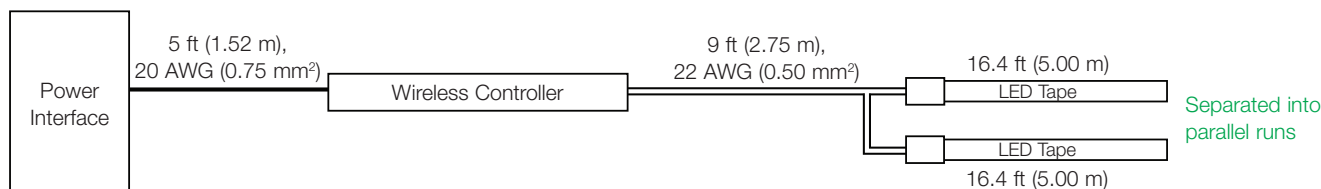
Examples of how to apply the tables in Section 5 are provided below. In all examples, the following hardware is used: LU-PH3-x, xxL-MWCL-WH, LU-Txx-RT-IN.

Example 1: Using the lookup table in Case 1 and the 16.4 ft (5.0 m) maximum run rule

Incorrect

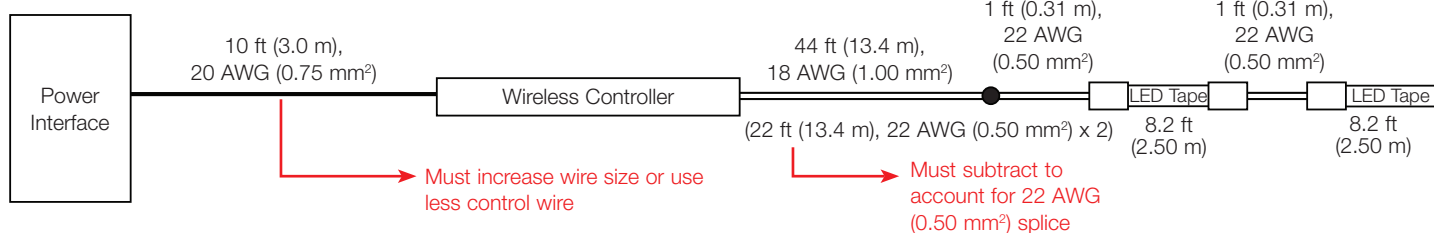


Correct

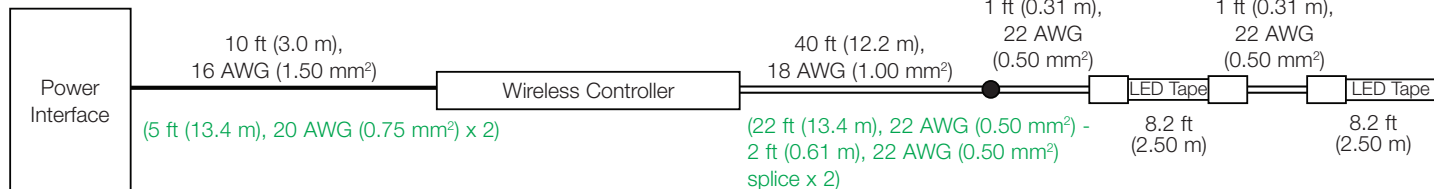


Example 2: Using gauge multiplier tables

Incorrect



Correct

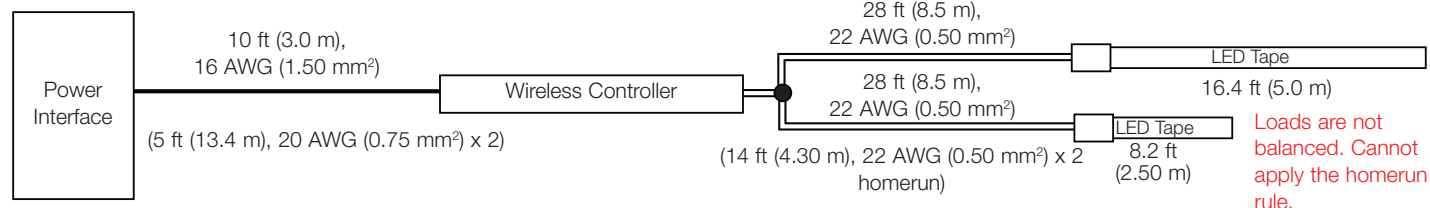


6.0 Wiring Examples (continued)

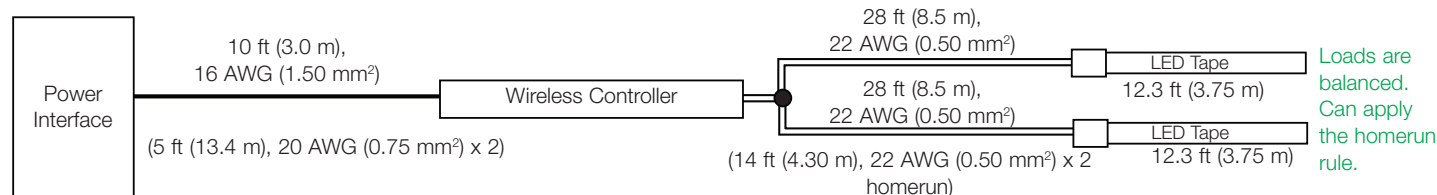
Examples of how to apply the tables in Section 5 are provided below. In all examples, the following hardware is used: LU-PH3-x, xxL-MWCL-WH, LU-Txx-RT-IN.

Example 3: Using the homerun multiplier

Incorrect



Correct



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