

# Guarantee a Safe Low Voltage Lighting Installation and a Happy Customer

## What you must determine before running your wire

People assume low voltage(LV) is safe. LV reduces shock hazards, but increases fire hazards if installed improperly. The location of the lighting and how it's wired are the greatest factors in determining if an installation is safe. LV creates high amperages (heat) and all components must be properly sized for safe, reliable, long term performance. In addition, because of the higher amperages, voltage drop accumulates quickly, leading to poor performance if not accounted for ahead of time. LV lighting is very sensitive to voltage drop and losing just 2 volts (on a 12 volt system) will drop maximum light output 50% and produce yellow light instead of the crisp white light that LV lighting should provide.

### Questions to Answer Before Running Wire

- 1) **Transformer size:** Determined by Total Lighting Load - One XR required for every switch/dimmer zone – De-rating NOT required.
- 2) **Circuit Protection:** Determined by rating of lighting, load on wire run, and size of Wire AWG used
- 3) **Enclosure:** Recessed or Surface Mount, Single or Multiple XRs in a single Enclosure, Above Grade or Direct Burial
- 4) **Transformer Location:** Using a dimmer? Locate transformers out of living spaces to guarantee quiet.
- 5) **Dimmers:** All transformers & chokes are magnetic, not electronic. De-Rate dimmers; refer to electrical labels.
- 6) **12 vs. 24 Volts:** Which to use and When to use? MR-16 lamps are commonly used with cable, track, rail, and down lights. It is best to use 12 volt MR-16s until the 24 volt MR-16 becomes more reliable and readily available. Strip lighting or other linear products are best used at 24 volts because of the reduced voltage drop and amperage. 24 volts also allows more watts per foot and per wire run since 25 amps x 24 volts = 600 watts, but 12 volts x 25 amps only equals 300 watts.
- 7) **Wire Size:** Determined by Load, Circuit Protection and Wire Run distances.  
NOTE: Article 411 of the NEC limits secondary runs to 25 amps. 12 volts x 25 amps = 300 watts, BUT 24V x 25A = 600W  
10 AWG is rated to carry 25 amps, but 8 AWG or 6 AWG will increase Wire run distances or reduce Voltage drop. For example, using 10 AWG instead of 12 AWG decreases voltage drop (or increases wire run distance) by approximately 40%.

### Electricity savings is ongoing. The additional wire cost is a one-time expense.

**14 AWG (.00297 Ohms/Ft) = 15 amp Max**  
**10 AWG (.00118 Ohms/Ft) = 25 amp Max**

**12 AWG (.00187 Ohms/Ft) = 20 amp Max**  
**8 AWG (.00074 Ohms/Ft) = 25 amp Max**

- 18) **Voltage Drop Calculation:**  $V_{Drop} = (Amps) \times (Wire\ run\ distance \times 2) \times (AWG\ Resistance/ft)$  - Don't exceed 2 volts for best results.
- 19) **Wiring Strategies: Layout and estimate VDrop ahead of time.** Do NOT Daisy Chain. Daisy chaining lamps quickly escalates amperage and VDrop and prevents each load from being adjusted independently. When multiple lamps are fed by a single wire run, it is imperative that the Total Voltage Drop be kept as low as possible to avoid the POPCORN Effect. Run separate Feeds to each load because:
  - a) May be required by UL and code to have separate feeds from the transformer.
  - b) It wastes electricity. Compare running three 12-volt 50 watt lamps 50 feet away from the transformer. If each lamp is fed with separate runs of 14 AWG wire, total of 6 leads (2 per lamp) back to the transformer, the voltage drop would be 1.2 volts and the total watts lost from the wire runs would be about 15 watts (or 5 watts per run). If the 3 lamps (150 watts) are daisy chained with a single #12 AWG wire run instead, the voltage drop would be 2.3 volts and the total watts lost would be 29 watts instead of 15 watts (93% more loss and heat generated when daisy chained).
  - c) Voltage drop INCREASES when a smaller AWG wire is used, wire run distances increase, or the load on a wire run is increased.
  - d) Lose control of voltage regulation; If daisy chained, the voltage jumps at the remaining lamps when a lamp blows. Use the example above. If a lamp blows and they are run on separate feeds, the jump in voltage is minimal because the lamps are fed independent of one another. If daisy chained, the voltage will increase 0.8 volts because the decreased load on the wire run lowers the total voltage drop which Spikes the voltage received at the remaining lamps.
  - e) Safety could be compromised if the load exceeds the capabilities of the wire. In addition, time and temperature can break down materials that are pushed to their limits. Separate runs create a safer, cooler, longer lasting installation.
  - f) Running separate feeds pays for themselves through electricity savings and improved performance. Money continues to be saved over time.
  - g) If the same "neutral" feeds multiple loads, it must be correctly sized (10 AWG minimum required for 25 amps – maximum allowed)

**Article 90-1(b) states that " hazards often occur because of overloading of wiring systems by methods or usage not in conformity with the N.E.C. This occurs because initial wiring did not provide for increases in the use of electricity. An initial adequate installation and reasonable provisions for systems changes will provide for future increases in the use of electricity**

### Sample Installations on Back Page

- 1) Running 24 volt Cove Lighting
- 2) Powering 12 volt Cable or track Lighting
- 3) Powering 12 volt Down Lighting

**Eliminate voltage drop, compensate for voltage drop, or live with the results.**

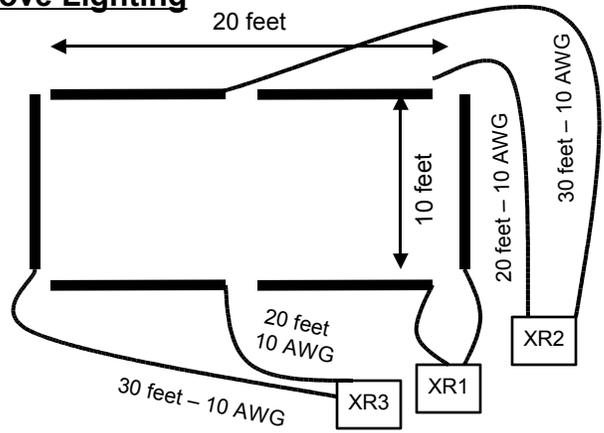
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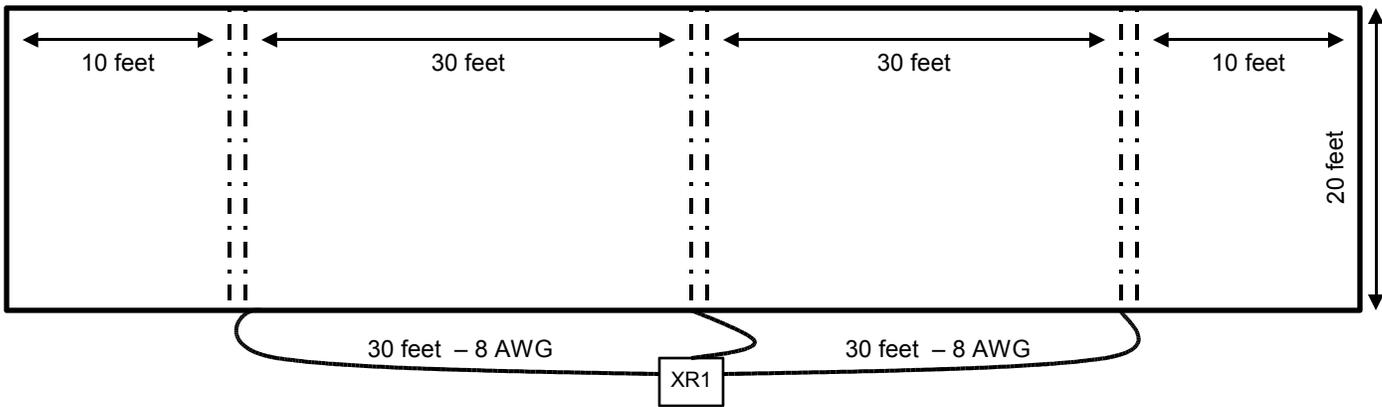
### 1) Running 24 volt Cove Lighting

- 1) (6) SIX 10W/24V Lamps per foot = 60 watts/Foot
  - 2) x 60 feet = 3600 watts
  - 3) /600watts per run = 6 separate runs to the transformer
- Transformers Surface Mounted, Dimmed, 120 volt/60 Hz Primary.  
Controlled by a single dimmer. Transformers Mounted together.  
Quantity: 3 of Model #: S1200-24-2x25+C4  
Each Fed by a separate 20 amp Panel Breaker

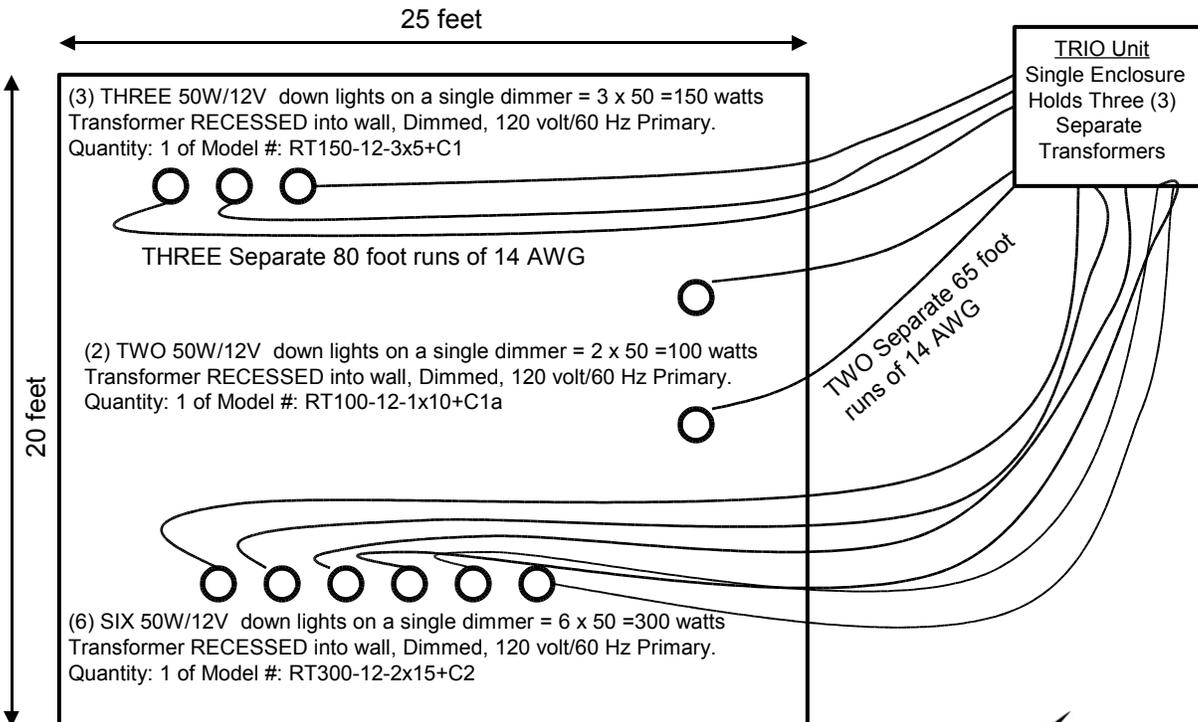


### 2) Powering 12 volt Cable or track Lighting

- (3) THREE 300W/12V cables controlled by a single dimmer = 3 x 300 =900 watts
- Transformer RECESSED into wall, Dimmed, 120 volt/60 Hz Primary.  
Quantity: 1 of Model #: R900-12-3x25+C3b



### 3) Powering 12 volt Down Lighting – Multiple Zones



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