Introduction

This training program covers the fundamentals of the Ambiance® Lighting Systems by Sea Gull Lighting Products, LLC. The goal is for you to understand the nuances of each system yourself so you may comfortably and knowledgeably convey the aspects of design, selling features, application, installation and important technical aspects of the systems to others.

Our Product Development, Technical Support and Sales and Marketing Departments have compiled the material contained in this training program over many years. Additionally, we have listened and reacted to numerous distributors’ and end users’ input. It contains the most current product and technical information through the date of publication. Sea Gull Lighting Products, LLC reserves the right to make changes at any time without notice to the construction and design of the products covered in this publication. The changes may be necessary for product quality improvements, by law or due to the availability of supplies.

The Ambiance® Lighting Systems are best taught and learned when the systems are "broken down" to their simplest theories and components. We have provided an in depth analysis and description of each system in this syllabus. However, due to the depth of each product line, learning to put the systems to work for you and your customers may take more than the time allocated for a complete and lengthy seminar. Therefore, the syllabus is divided into modules and you may choose to cover all or part of the course as is applicable to each situation. With a little planning, the program is easy to use.

We invite you to contact us anytime with your questions, comments and suggestions to help educate you and others, and enhance your knowledge of these exciting products by Sea Gull Lighting….The Ambiance® Lighting Systems.
Miniature Lamps

General Lamp Information

As with any lighting system, knowledge of lamps and light sources is an integral part of understanding the system's function and performance. Understanding the variety of lamps available with the Ambiance® Lighting Systems, will allow you to use different lamps to achieve specific lighting design and performance criteria.

The performance of a lamp or type of lamp can be measured according to many different characteristics. For the purpose of selecting the lamp best suited for an application using the Ambiance® Lighting Systems, we are going to explore just a few characteristics.
Color Appearance / Temperature

The actual color of the light emitted from a light source is referred to as color appearance, color temperature or chromaticity. Color temperatures, also referred to as Correlated Color Temperatures (CCT) can establish moods of warmth or coolness, as well as affect behavior or work performance. Additionally, the color temperature of a lamp can affect the appearance of an object.

A common comparison to the varying degrees of color temperatures expressed in degrees Kelvin would be the infamous "iron" comparison. Imagine a piece of iron firstly becoming "red hot." At this time, the reddish-yellow light emitted by the iron at this temperature is warm in appearance. An incandescent lamp at 2700 Kelvin is a good example of this. While the metal continues to heat, it then becomes "white hot" increasing the degrees Kelvin of the iron. Similar to cool white fluorescent, the temperature might reach 4100 Kelvin.

Please see the Correlated Color Temperature Chart which best illustrates the degree of warmth or coolness of white light radiated by a lamp and measured in degrees Kelvin or "K".
Color Rendering (CRI)

A lamp's ability to represent colors in objects is called its Color Rendering Index or CRI. The higher the CRI, the more vibrant or closer to natural the colors appear. The scale of 0 to 100 is based on a relative measurement which rates light sources. Lamps that have CRI ratings of 70-80 are considered good, while those lamps, which have a CRI of 80 or above are considered excellent and are also considered to have a high quality of light. The higher the CRI, the better perceptions of appeal objects and people have.

Efficacy / Lumens Per Watt (LPW)

Simply put, the light output of a lamp is measured in Lumens. The higher the lumen rating of a particular lamp, the brighter the lamp's light output will be. A lamp's efficacy is the relationship of which a lamp is able to convert power (Watts) into light (Lumens) as expressed in lumens per watt (LPW). LPW can be best compared to "miles per gallon." The more efficiently a car engine operates, it increases the mileage obtained for each gallon of gasoline. The same efficiency rules apply here. The more efficiently the conversion of power (Watts) is into usable light (Lumens), the higher the efficacy of the lamp.
Lamp Selection

The Ambiance® Lighting Systems utilize a variety of lamp types depending upon the specific effects desired. In order to attain optimal performance for general, task or accent lighting, all systems use bi-pin halogen lamps and the Ambiance® Lx Lighting System also uses wedge base lamps, xenon festoon cartridge lamps operating at 12 volts and/or 24 volts. Ambiance Transitions kits and components and some 120 volt pendants, use a 40 G9 base line voltage halogen lamp. Additionally, some Ambiance® Transitions fixtures use a self-ballasted compact fluorescent lamp (CFL). The following represents a synopsis of the features and benefits of xenon and halogen lamps.

Xenon Lamps

Xenon lamps were developed to take advantage of some of the characteristics of a halogen lamp without some of the costs. A premium fill gas, xenon, is still in the bulb without the addition of a halogen. This results in a slightly less efficient lamp but one with a longer life. The gas pressure is not as great as in the halogen lamp, consequently the glass is not as thick and the bulb runs cooler than the halogen. Since the bulb pressure is not as high and the fill gas does not contain halogen, some filament deposits occur on the bulb causing slight degradation of the lamp brightness over time. All in all, a Xenon lamp is 50% less expensive than a halogen bulb but also loses some efficiency. Xenon has the following benefits when compared to halogen:

- Xenon can be installed with bare hands without affecting lamp life.
- Xenon does not emit potentially harmful UV rays.
- Xenon has long life. (E.g., 20 watt halogen = 2000 hours, 18 watt xenon = 12,000 hours)
- Xenon is a low pressure lamp. No shielding is required and no "non-passive end of life."
- Xenon produces less heat.

Wedge Base Lamps

A wedge base lamp is a miniature, all glass wedge base lamp designed for long life and severe operating conditions including shock, vibration, heat, cold, and moisture. With no metal base or soldered connections to loosen, break, or corrode, these lamps will operate in high ambient temperatures.

The wedge base lamps used with the Ambiance® LX Lighting System are available in a variety of sizes and wattages in both standard incandescent and/or those filled with Xenon gas. Xenon lamps, also included in the incandescent family, offer long life, high intensity, and white color similar to halogen (A more detailed explanation is contained in the next section).

Wedge base xenon lamps wattages are available from 3-18 watts depending upon the selected lamp holder specified for a particular application. Wedge base lamps come in T-3/4 and T-5 dimensions and are available in 12 volts only. The only exception to this rule is the T-5 Xenon wedge base lamp (9774). This lamp is available in either 12 or 24 volt versions. Consult the Lamp Selection Guide, provided by Sea Gull Lighting for lamp characteristics and performance data.
Festoon Lamps

A festoon lamp is also a miniature, glass cartridge lamp, which is designed for long life and severe operating conditions including shock, vibration, heat, cold, and moisture. These lamps will operate in high ambient temperatures. Festoon xenon lamps offer long life (up to 20,000 hours), high intensity, and white color similar to halogen. Festoon xenon lamps provide other benefits versus halogen lamps, which make them a preferred choice for linear lighting.

Festoon/cartridge lamps are available in either 12 or 24 volts with wattages ranging from 5-10 watts. These xenon lamps are available clear or frosted. Performance characteristics differ than those of wedge base lamps, but are very similar to that of rigid loop lamps. Festoon lamps are ideal for use under and/or inside cabinets, cove lighting and other specialty applications. Festoon lamps fit very securely in the specially designed linear lampholder.

Xenon festoon lamps may have higher efficacy then their wedge base counterparts. For example, a single, ten-watt (97119-32) festoon lamp can produce almost 33% more light (lumens) than two, five-watt (9732) xenon wedge base lamps (see the lamp selection chart for verification). Additionally, if maintenance is an issue and an extremely long life lamp is required, the 97122-33, L3 festoon lamp has a life expectancy of up to 150,000 hours to solve this lighting issue. It's an excellent commercial/high end residential solution.
Halogen Lamps

A halogen lamp is an ordinary incandescent lamp with a few modifications. The fill gas includes traces of a halogen as well as an inert gas. Halogens are a group of gas molecules. The purpose of the halogen is to return evaporated tungsten to the filament.

As tungsten evaporates from the filament, it usually condenses on the inner surface of the bulb. The halogen is chemically reactive, and combines with the tungsten deposit on the glass to produce tungsten halides which then evaporate easily. When tungsten halide reaches the filament, the intense heat of the filament causes the halide to break down, releasing tungsten back to the filament. The halogen cycle keeps the inner surface of the bulb clean. This lets halogen lamps stay close to full brightness as they age.

In order for the halogen cycle to work, the bulb surface must be very hot, generally over 480 degrees Fahrenheit. The halogen may not adequately vaporize or fail to adequately react with condensed tungsten if the bulb is too cool. This means that the bulb must be small and made of either quartz or a high strength, heat resistant glass.

It is for these reasons that halogen lamps should burn at full brightness. This is not to say that you cannot dim halogen lamps, however if the lamp is dimmed, the halogen cycle is inefficient thus shortening lamp life considerably.

Since the bulb is small and fairly strong, the bulb can be filled with gas to a higher pressure than usual. This slows down the evaporation of the filament. The higher pressure and better fill gases can extend the life of the lamp and/or permit a higher filament temperature that results in higher efficiency.

A halogen lamp is often 10 to 20 percent more efficient than a similar incandescent lamp. Halogen lamps may also have two to three times as long a lifetime as ordinary lamps, sometimes with an improvement in efficiency of up to 10 percent.

The construction and principle of operation of incandescent filament and tungsten-halogen lamps are similar; however, the halogen regenerative cycle enables a tungsten-halogen lamp to provide the following benefits compared to a traditional incandescent lamp:

- Halogen lamps have longer life.
- Halogen lamps have a higher correlated color temperature (CCT) thus makes colors appear rich, vibrant, and natural.
- Halogen lamps have higher efficacy.
- Halogen lamps do not produce bulb blackening.
- Halogen offers crisp white light that allows dramatic accents and is excellent for accenting.

Bi Pin Halogen Lamps

All low voltage Ambiance® Lighting Systems use bi-pin halogen lamps. The T3 G4 Bi-Pin halogen lamp is available from 5-20 watts and the T3 or T4, GY6.35 lamp (available in either 12 volt or 24 volt versions) is available from 20-50 watts. This lamp is used for general and accent lighting providing an efficient source for enhancing color and texture. Some familiar uses of the T3 and T4 bi-pin halogen lamp are seen in recessed lighting and pendants.
Some lamp manufacturers are producing bi-pin halogen lamps with built in reflectors. Also, technology is available to allow halogen, bi-pin lamps to be used without shielding.

**Mirror Reflector Lamps (MR)**

For over two decades, the MR16 (Mirror Reflector) lamp has revolutionized low voltage lighting. With the onset of this lamp, which had been used extensively in Europe, it allowed domestic manufacturers to design smaller fixtures for residential and commercial use. The popularity grew as the technology expanded to allow lighting designers more latitude in their designs for recessed and track lighting. Today, the MR16 and related lamps is an integral, if not essential, part of most lighting designs. The Ambiance® Lighting System uses MR16 lamps in track lampholders as well as in recessed fixtures.

The following represents the features and benefits of the standard MR16 family of lamps:

- Standard Dichroic Reflector
- Superior beam performance
- Cost effective display and accent lighting
- Choice of six beam angles and consequential CBCP (Center Beam Candlepower)
- 4000-hour lamp life

"Dichroic" is defined as the property of having more than one color, especially when viewed from different angles. Dichroic glass is a high-tech spin-off of the space industry. Thin layers of metallic oxides are deposited upon the surface of the glass in a high temperature, vacuum furnace.

Dichroic coatings transmit certain wavelengths of light, while reflecting others, thus creating an interference-effect that is iridescent in nature. Improvements in dichroic technology have often eliminated the iridescent colors once found emanating within and from the dichroic reflectors of MR lamps.

The development of the IR (infrared) MR16 lamps represents the latest innovation and improvement to low voltage halogen technology that increases lamp efficacy (LPW) up to 25% more than standard MR16 lamps. These lamps are coated with an infrared reflective film on a precisely formed halogen capsule that redirects waste heat back to the lamp filament and reducing the energy needed to deliver light. Originally introduced in 37-watt versions that yield the same light output as standard 50-watt MR16 lamps, the IR product family has been expanded to include 50-watt IR versions, which replace up to 71-watt standard MR16s. The new 50-watt lamp is available in a variety of distribution patterns (NSP, SP, FL).

Infrared (IR) lamps also feature a hard-coated, dichroic reflector that delivers consistent, white light throughout their 4000-hour average rated life. All lamps have a UV-control capsule to eliminate UV-B and UV-C radiation.

Other earlier improvements to the MR16 family of lamps include "Constant Color" where the consistency of color (no color shift) is important, long life lamps up to aluminized reflector lamps where finish coordination is a consideration, and covered lamps for use in open fixtures. Each manufacturer has their own trade names for the different versions of MR16 lamps on the market today. Gaining some popularity are the 120 volt versions of the MR16 lamp, but the lamp life can be less than the low voltage versions and some color temperature issues might still remain.

The MR11 and MRC11 lamps are part of the bi-pin family of halogen lamps. This series provides precise beam control while also emitting a cool beam to reduce heat while lighting sensitive objects.

Ambiance® Lighting System fixtures using MR11 series lamps accept a maximum of 20 watts each. A variety of beam spreads are available including narrow spot (NSP), spot (SP), and narrow flood (NFL). Use different beam spreads to achieve desired effects to highlight a variety of sizes and objects.

Depending upon the fixture used, MR11 lamps come with an open front (MR11) or a glass cover (MRC11).
Depending upon the fixture used, MR11 lamps come with an open front (MR11) or a glass cover (MRC11). The MR11 is for use in an enclosed fixture while the MRC11 is for use in an open fixture. The glass cover helps to keep the lamp from becoming dirty as well as preventing incidental contact while the lamp is functioning and prevents injury should the lamp experience non-passive end of life.

The following represents some features and benefits of the standard MR11 family of lamps:

- Standard Dichroic Coating
- Maximum light output from ultra compact fixtures
- High CRI in merchandise display case
- A choice of spot or flood versions with good CBCP (Center Beam Candle Power)
- 3000-hour lamp life

MR8 lamps (one inch in diameter) allow for even smaller fixture designs than MR11 and MR16 lamps. Having similar characteristics to other MR lamps, the MR8 is as tiny as they come for any application within the Ambiance® LX Lighting System.

These miniature lamps are perfect for applications requiring task lighting, display lighting or accent lighting where the lamp needs to be as inconspicuous as possible.

The following represents some additional features and benefits of the standard family of MR8 lamps:

- 1 inch diameter
- Standard bi-pin GZ4 base
- 3050° K Color temperature
- 2,000 average life
- Integrated cover glass
- Cool Beam Dichroic Reflector

"Xelogen" lamps

A recent "buzzword" promotes the use of Xelogen lamps in low voltage fixtures. A Xelogen lamp is basically a Xenon lamp either in wedge base or bi-pin form. For further information regarding Xenon lamps, refer back to the xenon section as the characteristics of Xelogen are very similar.

120 volt, G9 Base Halogen Lamps

Ambiance® Transitions kits and component fixtures, and their 120 volt pendants, use a lamp that has been popular in Europe and Canada for years. Similar in operation to the 12 volt versions, these lamps are excellent for general and accent lighting. The innovative G9 pinched quartz lamp structure eliminates arcing sources and creates a self-fusing lamp. It combines a bright, compact source with UV-Filter quartz, which means the G9 allows small, sleek fixtures to be designed without the need for expensive transformers and heavy glass shields.

The "G9" in G9 is the base designation. The new base is a simple snap in / pull out design that is perfect for getting lamps into and out of small fixtures. The long life and energy efficiency of G9 lamps make them ideal for use in residential, commercial and industrial buildings.
Lamp Selection & Reference Guide

Use the chart below to select the lamp which is best suited for your specific lighting application. The lamp data included in this section is based on the lamp manufactures' published information recalculated at approximately 12 volts for 12V systems and 23 volts for 24V systems.

Click to see a larger image
**Watts Rated**
This indicates the industry's rating for the watts of this particular lamp. This is the number used when speaking in generic terms about the "wattage" of each lamp.

**Watts Consumed****
This indicates the approximate watts consumed for each lamp.
PLEASE USE THIS DATA WHEN CALCULATING A SYSTEM'S LOAD FOR MORE PRECISE SPECIFICATIONS.

**Rated Life**
The average expected life span of the lamp.

**Approximate Light (Lumen)**
This lists the approximate quantity of light from each lamp expressed in lumens.

**Approximate Color Temperature (K)**
This is the approximate correlated color temperature (CCT) measured in degrees Kelvin.
Review

1. The actual color of light emitted from a light source is referred to as:
   - Correlated Color Temperature (CCT)
   - Color Coolness
   - Rendered Color Scale

2. A lamp's ability to represent colors in objects is called its
   - Light Spectrum
   - Color Rendering Index (CRI)
   - Color Acuity

3. A lamp's efficacy is expressed as
   - Light per Square Foot
   - Lumens Per Watt (LPW)
   - Total Lumens

4. The three light sources used in the Ambiance® Lighting Systems are:
   - Xenon Festoon Lamps, Wedge Based Lamps, Bi-Pin Halogen Lamps
   - Incandescent lamps, Rigid Loop, Candelabra lamps
   - Xenon Festoon Lamps, Bayonet Base Lamps, Wedge Base Lamps

5. Standard incandescent lamps can be used with the Ambiance® Lx Lighting System.
   - True
   - False

6. Festoon lamps used with the Ambiance® Lighting System are always Xenon lamps.
   - True
   - False

7. All lamps used with the Ambiance® Lighting System are available in 12 v or 24 v.
   - True
   - False

8. The evaporation and recycling of the halogen on a filament is known as the
   - Vibration Cycle
   - Lamp Effectiveness Quotient
   - Halogen Regenerative Cycle
Answer True or false about these attributes of Xenon Lamps:

9. Xenon lamps can be installed with bare hands without affecting lamp life.
   - True
   - False

10. Xenon does not emit potentially harmful UV rays.
   - True
   - False

11. Xenon typically has longer life than a comparable Halogen lamp.
   - True
   - False

12. Xenon is a low pressure lamp.
   - True
   - False

13. With Xenon, shielding is required and lamp expiration may cause "non-passive" end of life.
   - True
   - False

Answer True or false about these attributes of Halogen Lamps:

14. Halogen lamps have a higher correlated color temperature (CCT) than standard incandescent lamps.
   - True
   - False

15. Halogen lamps have higher efficacy than standard incandescent lamps.
   - True
   - False

16. Halogen lamps produce bulb blackening.
   - True
   - False

17. Halogen Lamps may cause "non-passive end of life.
   - True
   - False

18. Always use the watts rated column in the Ambiance® Lighting System lamp selection guide to calculate your specification.
   - True
   - False
Check my answers
Low Voltage Transformers

"To ensure safety and retain the Sea Gull Lighting warranty and U.L. listing of the entire system, always use transformers supplied by Sea Gull Lighting which have been designed specifically for the Ambiance® Lighting Systems."

As the heart of the Ambiance® Lighting Systems, Sea Gull Lighting transformers are designed to operate quietly and efficiently while providing a safe voltage conversion.

A low voltage transformer, or step down transformer, reduces the incoming voltage from 120 volts (or line voltage) to a lower voltage, either 12 volts or 24 volts. The output on all transformers designed for lighting is Alternating Current (AC), not Direct Current (DC), which is similar to a battery. Transformers fall into two major categories, magnetic or electronic.
Magnetic Transformers

Magnetic transformers are isolated transformers of the "core and coil" type. The reason it is described as a "core and coil" transformer is because inside the transformer there is a metal core (that is why magnetic transformers are so heavy) and wrapped around this metal core is a "coil" or copper wire. Voltage is reduced through magnetic fields, thus the name magnetic transformer. To further define all of the available magnetic transformers for the Ambiance® Lighting Systems there are three subdivisions: laminated integral, laminated remote and toroidal.

For optimal operation, we recommend that the load on any Ambiance® Lighting Systems laminated magnetic transformer should be between 50 and 100% of the maximum load. For example, the transformers are designed to have an output of 12 volts when loaded 100%. When the load is only 50% of the maximum, the output is approximately 12.6V. As the load decreases, the voltage increases. As the voltage increases above 12.6 volts, the lamps are being over-driven. When this happens, the lamp's light output increases, thus potentially ending lamp life prematurely. So, over-driving the lamps will significantly shorten their lamp life.

Ambiance® RX Lighting Systems' magnetic toroidal transformers are designed to operate with loads between 0% and 100% of the rated capacity of the transformer. The "50%" rule does not apply to toroidal transformers.

Integral Laminated Magnetic Transformers

Integral magnetic transformers are usually found in low voltage recessed housings, or in some other manufacturer's track fixtures. In a recessed fixture, the integral magnetic transformer is located on the side of the wiring compartment (junction box). Since the components of a recessed fixture are hidden above the ceiling, the size, weight and appearance of a transformer is not a consideration. Usually, there is one transformer per fixture, the transformer powers 50 watt lamps maximum, and the transformer is cased in a 2" x 2" x 2" metal box (for electrical and safety reasons). In track fixtures, the integral magnetic transformers are located inside of the track fixture and below the track itself.

To differentiate between line voltage and low voltage track fixtures with magnetic integral transformers, you can look at three things: (1) the physical characteristics (some transformers are encased in a box or the fixture housing, allowing the fixture to be moved anywhere along the 120 volt track or the fixture socket accepts a bi-pin lamp), (2) the weight of the low voltage fixture is substantially greater, and (3) the lamp specifications for use with the fixture.

Remote Laminated Magnetic Transformers

Remote laminated magnetic transformers are larger in size and weight and, as the name states, are designed to mount in a remote location. A remote location could be above a ceiling (with access), in the attic (be aware of high ambient temperatures!), in a suitable cabinet (e.g., kitchen base cabinet) or basement/crawl space.

Remote transformer outputs vary from a minimum of 150 watts to a maximum of 300 watts per output, at 12 volts; and range from 250 watts to a maximum 500 watts per output at 24 volts. Each transformer can have from one up to two outputs, each individually protected with a short circuit protection on the low
Remote transformers are available either at the designated voltage or in multi-tap versions. The various taps are 12-13-14-15 volts for a multi tap, "12 volt" transformer and 24-26-28-30 volts for a multi tap "24 volt" transformer. Further explanation is contained later in this module.

**Surface Mounted Toroidal Transformers**

The third type of magnetic transformer mounts below the ceiling cavity and is visible on the ceiling or wall surface. These are found in the Ambiance® RX Lighting System and are encased in a decorative housing to match the finish of the system components. The surface mounted transformers are toroidal transformers that will be further defined in a later paragraph. Toroidal transformers are perfect for surface mounting due to their lower profile construction.

**12 volts vs. 24 volts**

A 24 volt system should be considered in installations where there are long runs of incandescent lights, such as in cove ceilings, or in certain other commercial applications. There is up to 70 % less voltage drop using a 24 volt system than when using a comparable 12 volt system. Voltage drop is characterized by a difference in lamp brightness at the lamp closest to the transformer (or beginning of a run) versus the lamp farthest from the transformer (end of the run). One way voltage drop can be minimized is by placing the transformer in the center of the run and have multiple runs come out of it. This would reduce the length of the run, and reduce the load of the run. Another way to ensure that voltage drop is minimal is contained in the calculation chart located on the Voltage Drop Technical page. Please refer for a further definition and methods to minimize voltage drop.

*(Hint: Do not mix different voltages within the same job. If 24 volts is determined best suited for a room, the other rooms should follow the same voltage specification. This allows an easy identification when lamps need to be replaced.)*

**What Are the Attributes of a Quality Magnetic Transformer?**

Before we define a quality transformer, we must present this caution. Never, yes NEVER, use a "buck-boost" transformer to power lighting systems. A buck-boost transformer is a cheap, no frills transformer that was not intended to be used in low voltage lighting applications. A "buck-boost" transformer was designed to power industrial machinery and does not have the necessary safeguards to prevent problems as do good quality magnetic transformers specifically designed for low voltage lighting systems.

- Sea Gull Lighting laminated magnetic transformers have been manufactured with a Faraday shield. The Faraday shield stops the primary line (120V) from coming in contact with the secondary windings (12V), and thus preventing a short. Also, the shield prevents harmful electrical noise from being transmitted through the electrical system and eliminates any harm to sensitive computer or other electronic equipment.
- All Sea Gull Lighting magnetic transformers are encased and potted with epoxy (asphalt type of material) to reduce vibration and humming.
- All Sea Gull Lighting laminated magnetic transformers have a built-in thermostat in the primary side of the transformer. In the event of excessive heat in the transformer, this thermostat acts to disconnect itself from the primary side (120V), before any damage can occur. This feature provides protection from any excessive heat and subsequent fire to surroundings.
- All Sea Gull Lighting transformers are supplied with circuit breakers for the secondary side (12V) or the load side. This will shut the transformer down in case of a short circuit on the load or conductors (cable) which would cause excessive heat and damage the system. All circuit breakers are designed so that the operating ambient temperature is considered to prevent nuisance tripping. The ambient temperature refers to the temperature of air, surrounding the circuit breaker. Nuisance trips
refer to circuit breaker trips that could be caused by a non-damaging inrush or start-up current surges, as opposed to an over current that may cause dangerous overheating such as by a short circuit. This applies to practical situations such as display cases and also to attics in the South and Southwest.

- Some Sea Gull Lighting laminated magnetic transformers have a boost tap. A boost tap is a feature that increases the secondary output by 5%, which may compensate for voltage drop. Voltage drop is an effect of increased wattage (load) and length (run), where the voltage and the lamp brightness near the transformer are higher than the end of the run. The multi-tap versions of Ambiance® Lighting Systems’ remote transformers do not contain a boost tap. For long runs or higher wattages which produce severe voltage drop, the multi tap transformers allow the flexibility of using a higher voltage to reduce or eliminate severe voltage drop which could compromise the design and the system. We will cover voltage drop and methods for reduction in Module 4.

Following these guideline will insure that the transformers used within the Ambiance® Lighting Systems will be trouble free and will comply with the specifications, U.L. or E.T.L. listings and warranties associated with each system.

**Toroidal Transformers**

For the Ambiance® RX Lighting System, we use a special type of transformer, called a toroidal transformer, where it is determined that the transformer must be surface mounted.

Most toroids are smaller than their laminated magnetic transformer counterparts. Electrical and lighting designers appreciate a toroid's compact dimensions. They are particularly well suited where low height is a consideration such as surface mounting.

Due to the special insulators and a tightly wound core, toroids can be extremely quiet in their operation. Toroids can be up to 50% lighter, (depending on power rating), than conventional laminated transformers because they are more efficient. A toroid’s potentially low weight simplifies end product design by reducing mounting hardware and supporting enclosure requirements.

The Ambiance® RX system’s toroidal transformers have the following quality and safety characteristics:

- Circuit Breakers
- Dimming core
- Insulators to minimize vibration and noise

Surface mounting is as easy as installing a standard lighting fixture.

The following summarizes important information about toroidal transformers:

- Toroidal transformers are core and coil, isolated type magnetic transformers.
- Each transformer features a resettable magnetic circuit breaker on secondary side (12V) to protect against shorts.
- Ambiance® RX Lighting System toroidal transformers feature an integral dimming coil to reduce any audible noise when installed using a dimming control device.
- Toroidal transformers’ housings are designed to be visible and are particularly well suited where low height is a consideration such as surface mounting.
- Ambiance® RX Lighting System toroidal transformers are available in 12 volts only.
- Toroidal transformers may be loaded between 0% and 100% and will still operate efficiently.
Electronic Transformers

Electronic transformers used in the Ambiance® LX Lighting System, and some applications within the RX Lighting System, utilize electronic components to step down the voltage from 120 volts (line voltage) to 12 volts. Unlike magnetic transformers where the low voltage output is 12 or 12.6 volts, the electronic transformer's output is actually 11.5 volts. Since the output starts at a lower voltage, this makes it more susceptible to voltage drop. For this reason electronic transformers should not be considered for use in distant remote applications.

For proper operation of an electronic transformer, it should be loaded within the described range:

- 60 watt transformers should be loaded between 15 and 60 watts
- 150 watt transformers should be loaded between 60 and 150 watts

If the load does not fall within the specified range, the transformer might either cause the lamps to flicker, or not function at all.

Since the electronic transformers operate at a higher frequency (22,000 Hz) than a voltmeter, multi-meter or amp-meter (which operate around 15,000 Hz), measuring the output voltage of the electronic transformer using any standard voltage meter will not be accurate. The best way to test an electronic transformer to determine if it is working properly or at all is to apply a load (or lamps) that fall within the specified wattage range. Simply put, if the lamps light, the transformer works.

Electronic transformers come either in a "hard-wire" version for the electrical contractor, or a "plug-in" (supplied with a cord and plug) version for the "do-it-yourselfer." Presently, the largest electronic transformer has a single output of 150 watts. For disk lights, Sea Gull Lighting offers an additional dual output, 120 watt transformer (two 60 watt transformers) with a special plug assembly for easy installation. A hardwire version of this transformer is also available but without the special plug assembly. Additionally, an "in-line" electronic transformer (150 watt capacity) is available for use with the LX Lighting System where wiring has been previously stubbed out for another fixture such as fluorescent undercabinet lighting.

Electronic transformers, as with any electronic component, may cause Radio Frequency Interference (RFI). RFI can cause static on a radio, television, or computer. Most electronic transformers do have built-in filters to reduce or eliminate RFI, but there are cases where interference is still present. If this should happen, first try to rotate the position of the transformer, similar to adjusting the antenna of a television, to get better reception. If all efforts fail, and as a last resort, consider switching to a magnetic transformer which does not cause RFI.
Transformer Placement

Sea Gull Lighting recommends placing transformers used with any Ambiance® Lighting System as close to the area being illuminated as possible.

Be advised that the laminated remote magnetic transformers should be mounted in its intended vertical position. If the transformer must be horizontally mounted, the maximum wattage needs to be reduced to 80% of the rated capacity. The reason for this is due to the placement of the thermal protector within the transformer housing. Mounting in any position other than vertically affects the internal temperature readings.

For long runs, it is recommended that the transformer be placed in the center of the application with several runs of equal wattage load wired to the transformer. This will help compensate for noticeable voltage drop which may occur.
Class I vs. Class II

For our definition, a Class II fixture is any low voltage fixture or component that has 18 gauge wire connecting to the power source or tap leads. A Class II transformer can only power this type of fixture.

The National Electrical Code (NEC) classifies any transformer with maximum output of 60 watts or less at 12 volts (and marked as such) as a Class II transformer (5 amps or under). Any transformer with a larger output than 60 watts is defined as a Class I transformer. The only way to use a Class I transformer with Class II fixture is to add an in-line 5 amp fuse (or fused plug) between the transformer and the fixture’s tap leads. The fuse protects the 18 gauge wire in case of a short and must not be placed in an inaccessible enclosed area. The rationale behind this theory is as follows:

\[
60 \text{ watts/12 volts} = 5 \text{ amps}
\]

Factually, 18 gauge wire is rated for no more than 5 amps. The 5 amp protection fuse is necessary when using a Class II fixture on a Class I system.
Switching Transformers

Sea Gull Lighting always recommends switching transformers used with the Ambiance® Lighting Systems on the line voltage (120V or primary) side of the connection for optimum performance and safety. The following illustration should help define the rationale.

For illustrative purposes, we will use a residential situation. Residential switches are rated for a maximum load of 15 amps or 1800 watts (15 amps X 120 volts=1800 watts). If we have a hypothetical Ambiance® Lighting System installation totaling 300 watts, watch what happens.

Assuming the standard formula of Amps=Watts/Volts, at 300 watts a 12 volt system would produce 25 amps.

\[
\frac{300 \text{ watts}}{12 \text{ volts}} = 25 \text{ amps}
\]

Too much!!

This is obviously too great for a 15 amp switch. However, the same 300 watts on the 120 volt side produces a mere 2.5 amps which is, obviously, perfectly acceptable.

\[
\frac{300 \text{ watts}}{120 \text{ volts}} = 2.5 \text{ amps}
\]

Just right!!

So, therefore, we always recommend switching on the primary (120 volt) side and not the low voltage (secondary) side.

For applications which require switching to be done on the low voltage (secondary) side of the connection (an extremely rare situation), there are important factors which need to be considered. When switching the secondary side of the connection, it is very important that the switch used is rated for the amperage created and that the wattage load (when switched) never drops below 50% of the transformer's rated capacity. But don't try it!!!

For the sake of your safety and the simplicity of the installation, Sea Gull Lighting does not recommend that you switch on the secondary side.

To calculate amperage, use the following formula:

\[
\text{Amperage} = \frac{\text{Wattage}}{\text{Voltage}}
\]
Dimming

Due to the potential interruption of the Halogen regenerative cycle, dimming halogen lamps, without burning at full capacity every so often, may severely affect lamp life. However, the Ambiance® Lighting Systems may be dimmed and will not damage xenon or incandescent lamps when these sources are used. When dimming the system, it is recommended that the dimmer be placed on the line voltage (120V or primary) side of the transformer dimming the power coming into the transformer. The same rules apply for dimming as they do for switching.

For Ambiance® Lighting Systems’ magnetic transformers, a high quality incandescent line voltage (120V) dimmer may be used. However, some control manufacturers will not warranty their products based on such usage and Sea Gull Lighting cannot assume responsibility. If this is a concern, a low voltage (VA) dimmer may be used as well.

For most electronic transformers, use a high quality **low voltage electronic dimmer** on the line voltage (120V or primary) side. Please see the Ambiance® Lighting Systems current catalog to identify those few electronic transformer that may be dimmed using a standard incandescent dimmer.
Transformer Wiring

Wiring the transformer correctly is important to the safety and integrity of the entire system. Listed below are examples of how to wire the primary side (120V line voltage) and the secondary side (12V low voltage) of the transformers.

*Note: To ensure the full 25 amp capability of any of the Ambiance® Lighting Systems and not to disturb its integrity, the jumper wire from the transformer to where the system begins MUST be 10 gauge wire. In other words, if the 10/2 stranded, 105° cable is used, the jumper wire must be of the same gauge e.g., 10 gauge romex.*

Primary Wiring / Boost Tap Connector

To compensate voltage drop in remote applications, some of Sea Gull Lighting's laminated magnetic transformers include a boost tap connection. The boost tap increases the secondary voltage (low voltage) by 5%. The boost tap is intended for use in applications where the distance from the transformer to the first light of the system is greater than 20 feet.

Multi Tap Transformers

For distances where the first lamp is too far away (30 feet or more) and more voltage is required, a multi tap laminated transformer may be the best choice. Multi-tap transformers do not have a boost tap, but they do have additional voltage choices to compensate for severe voltage drop situations. Multi tap transformers have individual 12, 13, 14, and 15 volt taps for "12 volt" transformers and 24,26,28 and 30 volt taps for "24 volt" transformers.
Low Voltage Transformers

If the distance from the transformer to the first light is less than 20 feet, use the 120v tap. Cap off the boost tap!

<table>
<thead>
<tr>
<th>LINE VOLTAGE</th>
<th>TRANSFORMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK WIRE</td>
<td>120v</td>
</tr>
<tr>
<td></td>
<td>BOOST</td>
</tr>
<tr>
<td></td>
<td>COMMON</td>
</tr>
<tr>
<td>WHITE WIRE</td>
<td></td>
</tr>
</tbody>
</table>

If the distance from the transformer to the first light is greater than, or equal to 20 feet, use the boost tap. Cap off the 120v tap!

<table>
<thead>
<tr>
<th>LINE VOLTAGE</th>
<th>TRANSFORMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK WIRE</td>
<td>120v</td>
</tr>
<tr>
<td></td>
<td>BOOST</td>
</tr>
<tr>
<td></td>
<td>COMMON</td>
</tr>
<tr>
<td>WHITE WIRE</td>
<td></td>
</tr>
</tbody>
</table>

Low Voltage Transformers

12 Volt Magnetic Transformers
Low Voltage Transformers

24 Volt Magnetic Transformers

- Encased and potted: Asphalt material to reduce heat, noise, and vibration.
- Primary line (120v) (input)
- Ground stud
- Terminal block (23v secondary output)
- Resettable circuit breaker
- Mounting bracket
- Low voltage (out)
- Cover
- Mounting bracket
- Faraday shield
- Separates low voltage/line voltage to ensure safety.
- Boost tap*: Increase low voltage, output by 5%.
- Knockouts
- Conduit fitting
- *Not supplied

12 Volt Electronic Transformers (Cord & Plug)

- Mounting bracket
- Output (secondary 12v)
- Plug
- Switch
- Input (primary 120v)
- 8 ft. of 18/2, SPT-2, 300v, 105°C cord

12 Volt Electronic Transformers (Hard Wire)
Review

1. Another definition for a low voltage transformer is a:
   - Ballast
   - Step up transformer
   - Step Down Transformer

2. It is recommended that the laminated magnetic transformers used with the Ambiance® Lighting Systems be loaded between:
   - 50% and 100%
   - 0% and 100%
   - 0% and 80%

3. Transformers overdriving the lamps will not adversely affect lamp life.
   - True
   - False

4. The three identifiable types of transformers used with the Ambiance® Lighting Systems are:
   - Electronic - Core & coil - Magnetic
   - Toroidal - Laminated - Electronic
   - Laminated - AC/DC - Integrated

5. All Ambiance® Lighting System transformers have a faraday shield.
   - True
   - False

6. All Ambiance® Lighting Systems transformers are dimmable.
   - True
   - False

7. All transformers used with the Ambiance® Lighting System are available in 12 v or 24 v.
   - True
   - False

8. Lighting designers like a toroidal transformer's low profile because:
   - They look like space vehicles
   - They are not rectangular
   - They are perfect for surface mounting
9. Choose the correct three features of laminated magnetic transformers:
- Faraday Shield, Circuit Breaker(s), Thermally Protected
- Potted for quietness, electronic components, small in size
- 12v/24v capabilities, multi-tap versions, round design

10. Toroidal transformers should be operated between 50% AND 100% capacity.
- True
- False

11. Choose the correct three facts about electronic transformers:
- Plug in only, voltage read with a volt meter, in line version available
- True 12 volt output, standard dimmer acceptable, 150 watt maximum
- Hard Wire or Plug In, Output 11.5 volts, dimmable with an Electronic Low Voltage Dimmer

12. All magnetic transformers never have to be de-rated.
- True
- False

13. The only way to test whether an electronic transformer works properly is to be certain a proper wattage load is applied.
- True
- False

14. Multi tap transformers should be used in conditions of severe:
- Weather
- Voltage Drop.
- Lumen Output

Check my answers
Voltage Drop

When voltage at the beginning of a length of cable/conductor (at the transformer) is higher than the voltage at the end, the difference is known as "voltage drop." Consequently, if the brightness of the lamps placed on a particular run is greater at the beginning of the system (closest to the transformer) than the lamps placed at the end of the system, then this is due to voltage drop.

Wires carrying current always have inherent resistance, or impedance, to the current flow. Voltage drop is defined as the amount of voltage loss that occurs through all or part of a circuit due to impedance (resistance).

A common analogy used to explain voltage, current and voltage drop is the infamous garden hose analogy. Voltage is compared to the water pressure supplied to the hose. The current is comparable to the water flowing through the hose, and the inherent resistance of the hose is determined by the type and size of the hose - just like the type and size of an electrical wire determines its resistance. The higher pressure and the larger size of the hose will allow water to flow more consistently. When the pressure is reduced and the hose diameter is smaller, less water reaches the end. Thusly, the water is more forceful nearest to the faucet and trickles at the end; a classic example of voltage drop.

Excessive voltage drop in a circuit can cause lights to flicker or burn dimly. This condition causes the load to work harder with less voltage pushing the current.

Voltage drop can be minimized through proper selection of the cable/conductor size between the transformer and first fixture based on the total wattage load and length of the run. We will explore other methods to minimize voltage drop later in this section.
How to Determine Voltage Drop

Voltage drop is determined by multiplying the total watts on the system by the total length of cable/conductor, and dividing by the cable/conductor constant. (These cable constants are listed below)

- Total Watts - Sum of wattage for every lamp on one run.
- Cable/Conductor Length - Length of cable/conductor used (in feet) from the transformer to the fixture for which you are calculating voltage drop.
- Cable/Conductor Constant - Indicates thickness of the cable/conductor. The thicker the cable/conductor, the lower the conduction resistance and the lower the voltage drop.

<table>
<thead>
<tr>
<th>Conductor @ Voltage</th>
<th>Cable/Conductor Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/2AWG @ 12V</td>
<td>0.00070</td>
</tr>
<tr>
<td>10/2AWG @ 13V</td>
<td>0.00065</td>
</tr>
<tr>
<td>10/2AWG @ 14V</td>
<td>0.00060</td>
</tr>
<tr>
<td>10/2AWG @ 15V</td>
<td>0.00055</td>
</tr>
</tbody>
</table>

To calculate voltage drop using the Ambiance® Lighting System's low voltage cable/conductor, use the following formula:

\[ \text{Cable/Conductor Constant} \times \text{Total Consumed Wattage Load on Run} \times \text{Length of Run} = \text{Voltage Drop \%} \]

Remember - Voltage drop is per run, not per transformer!!

To achieve optimum lighting effects using the Ambiance® Lighting System, do not allow the voltage drop to be greater than 8% (75% light output). Halogen lamps' light output and lamp life are severely affected when operated with voltage over 12.5 volts and with a voltage drop greater than 10%.

Incandescent lamps (which include Xenon lamps) may be operated with any voltage drop. However, higher voltage drop will result in lowered light output and color of light becoming yellow. In some applications up to 18% voltage drop (50% light output) may be acceptable where the level of illumination is not objectionable. The lower voltage will extend the non-halogen light bulb life. For example, a 10% drop in voltage will extend the non-halogen’s light bulb life approximately four times, while reducing the illumination level by 30%.

To achieve even illumination on an Ambiance® Landscape Lighting system at points where two different lighting segments meet, do not allow for more than 5% voltage drop at the ends. A differential over 5 % will have a noticeable change in light.
Planning Low Voltage Layouts to Minimize Voltage Drop

These diagrams show some of the most common low voltage cable/conductor layouts. Your choice of layout can help minimize voltage drop.

1. Straight run installation
Fixtures run in sequence directly from the transformer.

```
  O O O O O O
```

2. Split run installation
Split the load using the recommended maximum cable/conductor length in two or more directions from the transformer. This method is also for use with multi-tap transformers.

```
  O O O O O O
  O O O O O O
  O O O O O O
  O O O O O O
```

3. "T" Installation
This method allows for the equal distribution of power to the center of a run, or to a run some distance away. The cable/conductor running from the transformer should be of a heavier gauge (10 gauge).

```
  O O O O O O
     O O O O O O
```

Warning: Loop installation *(Not recommended by Sea Gull Lighting!)* This method is thought to help reduce voltage drop and produces a more uniform light output. It is important that you connect the same wire leads to the proper transformer terminals by noting the ridge or marking on one side of the cable!!! Safety is our greatest concern. Therefore, we do not recommend this method of reducing voltage drop.

**Other Thoughts to Minimize Voltage Drop**

The closer your lamps are placed to the transformer, the higher their voltage (and wattage) readings will be. Those farthest away will have lower voltages. If a cable/conductor run is too long, or if too many fixtures are being powered by a single transformer, noticeable voltage drop may occur. Voltage drop causes the lights farthest from the transformer to become dim. Voltage drop can be minimized in several different ways including those suggested in the illustrations above:

- Use a multi-tap transformer (12-13-14-15)
- Use multiple transformers
- Shorten cable/conductor lengths (use multiple runs from the transformer)
- Reduce individual fixture wattages
- Reduce the total number of fixtures on a run
- Convert the installation to 24 volts or 24 volt multi-tap.

Voltage drop can actually work to your advantage if differences in lamp brightness levels are not objectionable. Lower voltage will extend the life of a lamp, requiring less frequent replacement.

*Note: To ensure the full 25 amp capability of any of the Ambiance® Lighting Systems and not to disturb its integrity, the jumper wire from the transformer to where the system begins MUST be 10 gauge wire. In other words, if the 10/2 stranded, 105° cable is used, the jumper wire must be of the same gauge e.g., 10 gauge romex or equivalent.*
Formulas to Calculate Voltage Drop

The following formula is used to calculate voltage drop for linear lighting with even spacing and same wattage.

$$VD\% = \text{length of run} \times \text{wattage on run} \times \text{cable constant multiplier}$$

### Voltage at Transformer | Cable Size | Ambiance® Cable Constant Multiplier
--- | --- | ---
(*Multi-Tap transformers)* 12-volts 12/2 AWG | 0.00110 13-volts 12/2 AWG | 0.00100 14-volts 12/2 AWG | 0.00095

12-volts 10/2 AWG | 0.00070 13-volts 10/2 AWG | 0.00065 14-volts 10/2 AWG | 0.00060

15-volts 10/2 AWG | 0.00055 24-volts 10/2 AWG | 0.000189 26-volts 10/2 AWG | 0.000175 28-volts 10/2 AWG | 0.000162 30-volts 10/2 AWG | 0.000149

For Example:

Using 13-volt tap, 100 ft. (12/2 cable) x 75-watts x 0.00100 = **7.5% voltage drop**

- Voltage drop calculations are based on wattage & length information per run, **not per transformer**.
- The best way to minimize voltage drop is to centralize the transformer, and have multiple runs coming out of it.
- Each run should be the shortest distance as possible & carry a minimized load.

### A) Straight Run

$$VD\% = \text{ft} \times \text{W} \times \text{Cable Constant}$$

12V $VD = 60' \times 300\text{w} \times 0.0007 = 12.6%$
15V VD = 60′ x 300w x 0.00055 = 9.9%
24V VD = 60′ x 300w x 0.000189 = 3.4%

B) **Point Source**

VD% = ft x W x Cable Constant x 2

**Remote Wiring**

If positioning the transformer in a remote location be sure to run a jumper wire that meets all national and local codes. The jumper wire is the cable between the transformer and the start of the lighting run, or between two illuminated sections.

For jumper wire (or non illuminated section) voltage drop calculations use the lighting load as a point source.

**Example #1**

Ambiance® Rx Lighting

\[12V \text{ VD}\% = 20′ \times 150w \times 0.0007 \times 2 = 4.2%\]

The above example calculates the voltage drop on a 10 AWG jumper wire between the 12v transformer and the start of the Ambiance® Rx run with 150w load.

**Example #2**

Ambiance® Landscape Lighting

1 single 50w fixture

\[14V \text{ VD}\% = 50′ \times 50w \times 0.00060 \times 2 = 1.5%\]

C) **Combination of Non-Illuminated and Illuminated Sections**

For linear lighting systems where the transformer is remotely mounted and the non-illuminated section is significant, a voltage drop calculation should be performed on both sections: Non-Illuminated and Illuminated.

Treat each section separately and perform a voltage drop calculation separately.

1. **Non-Illuminated Section:**

\[(26v) \text{ VD}\% = 40′ \times 300w \times 0.000175 \times 2 = 4.2\% = 1.1v\]

**Note:** Be sure to verify in the field that the voltage at the 1st light is not over 25v.

26v less 4.2% Voltage Drop (= 1.1 volts) = 24.9 volts at start of lighting run (or illuminated section).

2. **Illuminated Section:**

**Note:** When the starting voltage falls between two voltages, use the lower voltage to determine the cable constant.
The Voltage Drop between the first and last lamp is less than 1%, so there is no noticeable difference of light output between first and last lamp.

**Multi-Tap Transformer Advantage**

The advantage of using a Multi-Tap (12v, 13v, 14v, and 15v) or (24v, 26v, 28v, and 30v) transformers:

You can choose the appropriate output tap for a particular set of fixtures, *(so the voltage at each lamp is between: 11.0-volts and 12.5-volts for 12 volt lamp; and between 22.0 volts and 25.0 for 24 volt lamps).*
Voltage Drop Quick Charts

Legend
- Voltage Drop below 8% not visible to the eye; does not shorten halogen lamp life
- Voltage Drop between 8% and 16% will shorten halogen lamp life; for incandescent or Xenon lamps it will increase lamp life, but will be noticeable
- Voltage Drop over 16%; not recommended

% voltage drop per illuminated section (10/2 cable/conductors)

### 12 volts

<table>
<thead>
<tr>
<th>ft</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.7</td>
<td>1.1</td>
<td>1.4</td>
<td>1.8</td>
<td>2.1</td>
<td>2.5</td>
<td>2.8</td>
<td>3.2</td>
<td>3.5</td>
<td>3.9</td>
<td>4.2</td>
</tr>
<tr>
<td>40</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>4.2</td>
<td>4.9</td>
<td>5.6</td>
<td>6.3</td>
<td>7.0</td>
<td>7.7</td>
<td>8.4</td>
</tr>
<tr>
<td>60</td>
<td>2.1</td>
<td>3.2</td>
<td>4.2</td>
<td>5.3</td>
<td>6.3</td>
<td>7.4</td>
<td>8.4</td>
<td>9.5</td>
<td>10.5</td>
<td>11.6</td>
<td>12.6</td>
</tr>
<tr>
<td>80</td>
<td>2.8</td>
<td>4.2</td>
<td>5.6</td>
<td>7.0</td>
<td>8.4</td>
<td>9.8</td>
<td>11.2</td>
<td>12.6</td>
<td>14.0</td>
<td>15.4</td>
<td>16.8</td>
</tr>
<tr>
<td>100</td>
<td>3.5</td>
<td>5.3</td>
<td>7.0</td>
<td>8.8</td>
<td>10.5</td>
<td>12.3</td>
<td>14.0</td>
<td>15.8</td>
<td>17.5</td>
<td>19.3</td>
<td>21.0</td>
</tr>
<tr>
<td>120</td>
<td>4.2</td>
<td>6.3</td>
<td>8.4</td>
<td>10.5</td>
<td>12.6</td>
<td>14.7</td>
<td>16.8</td>
<td>18.9</td>
<td>21.0</td>
<td>23.1</td>
<td>25.2</td>
</tr>
<tr>
<td>140</td>
<td>4.9</td>
<td>7.4</td>
<td>9.8</td>
<td>12.3</td>
<td>14.7</td>
<td>17.2</td>
<td>19.6</td>
<td>22.1</td>
<td>24.5</td>
<td>27.0</td>
<td>29.4</td>
</tr>
<tr>
<td>160</td>
<td>5.6</td>
<td>8.4</td>
<td>11.2</td>
<td>14.0</td>
<td>16.0</td>
<td>19.6</td>
<td>22.4</td>
<td>25.2</td>
<td>28.0</td>
<td>30.9</td>
<td>33.6</td>
</tr>
<tr>
<td>180</td>
<td>6.3</td>
<td>9.5</td>
<td>12.6</td>
<td>15.8</td>
<td>18.9</td>
<td>22.1</td>
<td>25.2</td>
<td>28.4</td>
<td>31.5</td>
<td>34.7</td>
<td>37.8</td>
</tr>
<tr>
<td>200</td>
<td>7.0</td>
<td>10.5</td>
<td>14.0</td>
<td>17.5</td>
<td>21.0</td>
<td>24.5</td>
<td>28.0</td>
<td>31.5</td>
<td>35.0</td>
<td>38.5</td>
<td>42.0</td>
</tr>
</tbody>
</table>

### 13 volts

<table>
<thead>
<tr>
<th>ft</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.7</td>
<td>1.0</td>
<td>1.3</td>
<td>1.6</td>
<td>2.0</td>
<td>2.3</td>
<td>2.6</td>
<td>2.9</td>
<td>3.3</td>
<td>3.6</td>
<td>3.9</td>
</tr>
<tr>
<td>40</td>
<td>1.3</td>
<td>2.0</td>
<td>2.6</td>
<td>3.3</td>
<td>3.9</td>
<td>4.6</td>
<td>5.2</td>
<td>5.9</td>
<td>6.5</td>
<td>7.2</td>
<td>7.8</td>
</tr>
<tr>
<td>60</td>
<td>2.0</td>
<td>2.9</td>
<td>3.9</td>
<td>4.9</td>
<td>5.9</td>
<td>6.8</td>
<td>7.8</td>
<td>8.8</td>
<td>9.8</td>
<td>10.7</td>
<td>11.7</td>
</tr>
<tr>
<td>80</td>
<td>2.6</td>
<td>3.9</td>
<td>5.2</td>
<td>6.5</td>
<td>7.8</td>
<td>9.1</td>
<td>10.4</td>
<td>11.7</td>
<td>13.0</td>
<td>14.3</td>
<td>15.6</td>
</tr>
<tr>
<td>100</td>
<td>3.3</td>
<td>4.9</td>
<td>6.5</td>
<td>8.1</td>
<td>9.8</td>
<td>11.4</td>
<td>13.0</td>
<td>14.6</td>
<td>16.3</td>
<td>17.9</td>
<td>19.5</td>
</tr>
<tr>
<td>120</td>
<td>3.9</td>
<td>5.9</td>
<td>7.8</td>
<td>9.8</td>
<td>11.7</td>
<td>13.7</td>
<td>15.6</td>
<td>17.6</td>
<td>19.5</td>
<td>21.5</td>
<td>23.4</td>
</tr>
<tr>
<td>140</td>
<td>4.6</td>
<td>6.8</td>
<td>9.1</td>
<td>11.4</td>
<td>13.7</td>
<td>15.9</td>
<td>18.2</td>
<td>20.5</td>
<td>22.8</td>
<td>25.0</td>
<td>27.3</td>
</tr>
<tr>
<td>160</td>
<td>5.2</td>
<td>7.8</td>
<td>10.4</td>
<td>13.0</td>
<td>15.6</td>
<td>18.2</td>
<td>20.8</td>
<td>23.4</td>
<td>26.0</td>
<td>28.6</td>
<td>31.2</td>
</tr>
<tr>
<td>180</td>
<td>5.9</td>
<td>8.8</td>
<td>11.7</td>
<td>14.6</td>
<td>17.6</td>
<td>20.5</td>
<td>23.4</td>
<td>26.3</td>
<td>29.3</td>
<td>32.2</td>
<td>35.1</td>
</tr>
<tr>
<td>200</td>
<td>6.5</td>
<td>9.8</td>
<td>13.0</td>
<td>16.3</td>
<td>19.5</td>
<td>22.8</td>
<td>26.0</td>
<td>29.3</td>
<td>32.5</td>
<td>35.8</td>
<td>39.0</td>
</tr>
</tbody>
</table>

### 14 volts

<table>
<thead>
<tr>
<th>ft</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.7</td>
<td>1.0</td>
<td>1.3</td>
<td>1.6</td>
<td>2.0</td>
<td>2.3</td>
<td>2.6</td>
<td>2.9</td>
<td>3.3</td>
<td>3.6</td>
<td>3.9</td>
</tr>
<tr>
<td>40</td>
<td>1.3</td>
<td>2.0</td>
<td>2.6</td>
<td>3.3</td>
<td>3.9</td>
<td>4.6</td>
<td>5.2</td>
<td>5.9</td>
<td>6.5</td>
<td>7.2</td>
<td>7.8</td>
</tr>
<tr>
<td>60</td>
<td>2.0</td>
<td>2.9</td>
<td>3.9</td>
<td>4.9</td>
<td>5.9</td>
<td>6.8</td>
<td>7.8</td>
<td>8.8</td>
<td>9.8</td>
<td>10.7</td>
<td>11.7</td>
</tr>
<tr>
<td>80</td>
<td>2.6</td>
<td>3.9</td>
<td>5.2</td>
<td>6.5</td>
<td>7.8</td>
<td>9.1</td>
<td>10.4</td>
<td>11.7</td>
<td>13.0</td>
<td>14.3</td>
<td>15.6</td>
</tr>
<tr>
<td>100</td>
<td>3.3</td>
<td>4.9</td>
<td>6.5</td>
<td>8.1</td>
<td>9.8</td>
<td>11.4</td>
<td>13.0</td>
<td>14.6</td>
<td>16.3</td>
<td>17.9</td>
<td>19.5</td>
</tr>
<tr>
<td>120</td>
<td>3.9</td>
<td>5.9</td>
<td>7.8</td>
<td>9.8</td>
<td>11.7</td>
<td>13.7</td>
<td>15.6</td>
<td>17.6</td>
<td>19.5</td>
<td>21.5</td>
<td>23.4</td>
</tr>
<tr>
<td>140</td>
<td>4.6</td>
<td>6.8</td>
<td>9.1</td>
<td>11.4</td>
<td>13.7</td>
<td>15.9</td>
<td>18.2</td>
<td>20.5</td>
<td>22.8</td>
<td>25.0</td>
<td>27.3</td>
</tr>
<tr>
<td>160</td>
<td>5.2</td>
<td>7.8</td>
<td>10.4</td>
<td>13.0</td>
<td>15.6</td>
<td>18.2</td>
<td>20.8</td>
<td>23.4</td>
<td>26.0</td>
<td>28.6</td>
<td>31.2</td>
</tr>
<tr>
<td>180</td>
<td>5.9</td>
<td>8.8</td>
<td>11.7</td>
<td>14.6</td>
<td>17.6</td>
<td>20.5</td>
<td>23.4</td>
<td>26.3</td>
<td>29.3</td>
<td>32.2</td>
<td>35.1</td>
</tr>
<tr>
<td>200</td>
<td>6.5</td>
<td>9.8</td>
<td>13.0</td>
<td>16.3</td>
<td>19.5</td>
<td>22.8</td>
<td>26.0</td>
<td>29.3</td>
<td>32.5</td>
<td>35.8</td>
<td>39.0</td>
</tr>
</tbody>
</table>
% voltage drop per illuminated section (10/2 cable/conductors)

<table>
<thead>
<tr>
<th></th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
<th>140</th>
<th>160</th>
<th>180</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.6</td>
<td>1.2</td>
<td>1.8</td>
<td>2.4</td>
<td>3.0</td>
<td>3.6</td>
<td>4.2</td>
<td>4.8</td>
<td>5.4</td>
<td>6.0</td>
</tr>
<tr>
<td>15</td>
<td>0.8</td>
<td>1.7</td>
<td>2.5</td>
<td>3.3</td>
<td>4.1</td>
<td>5.0</td>
<td>5.8</td>
<td>6.6</td>
<td>7.4</td>
<td>8.3</td>
</tr>
<tr>
<td>20</td>
<td>1.0</td>
<td>2.0</td>
<td>2.9</td>
<td>3.9</td>
<td>4.9</td>
<td>6.0</td>
<td>7.2</td>
<td>8.4</td>
<td>9.6</td>
<td>10.8</td>
</tr>
<tr>
<td>25</td>
<td>1.2</td>
<td>2.4</td>
<td>3.6</td>
<td>4.8</td>
<td>6.0</td>
<td>7.5</td>
<td>9.0</td>
<td>10.5</td>
<td>12.0</td>
<td>13.5</td>
</tr>
<tr>
<td>30</td>
<td>1.5</td>
<td>3.1</td>
<td>4.6</td>
<td>6.2</td>
<td>7.8</td>
<td>9.6</td>
<td>11.5</td>
<td>13.5</td>
<td>15.6</td>
<td>18.0</td>
</tr>
<tr>
<td>35</td>
<td>1.8</td>
<td>3.6</td>
<td>5.2</td>
<td>7.0</td>
<td>8.8</td>
<td>11.0</td>
<td>13.4</td>
<td>16.4</td>
<td>19.6</td>
<td>23.1</td>
</tr>
<tr>
<td>40</td>
<td>2.1</td>
<td>4.2</td>
<td>6.3</td>
<td>8.4</td>
<td>10.5</td>
<td>12.6</td>
<td>14.7</td>
<td>16.8</td>
<td>19.9</td>
<td>23.1</td>
</tr>
<tr>
<td>45</td>
<td>2.4</td>
<td>4.8</td>
<td>7.2</td>
<td>9.6</td>
<td>12.0</td>
<td>14.4</td>
<td>16.8</td>
<td>19.2</td>
<td>21.6</td>
<td>24.0</td>
</tr>
<tr>
<td>50</td>
<td>2.7</td>
<td>5.4</td>
<td>8.0</td>
<td>10.8</td>
<td>13.6</td>
<td>16.2</td>
<td>18.0</td>
<td>20.8</td>
<td>23.8</td>
<td>26.4</td>
</tr>
<tr>
<td>55</td>
<td>3.0</td>
<td>6.0</td>
<td>9.0</td>
<td>12.0</td>
<td>15.0</td>
<td>18.0</td>
<td>20.8</td>
<td>24.0</td>
<td>27.0</td>
<td>30.0</td>
</tr>
<tr>
<td>60</td>
<td>3.3</td>
<td>6.6</td>
<td>10.0</td>
<td>13.6</td>
<td>17.0</td>
<td>20.0</td>
<td>23.0</td>
<td>26.4</td>
<td>29.7</td>
<td>33.0</td>
</tr>
<tr>
<td>65</td>
<td>3.6</td>
<td>7.2</td>
<td>10.8</td>
<td>14.4</td>
<td>18.0</td>
<td>21.6</td>
<td>25.0</td>
<td>28.4</td>
<td>31.8</td>
<td>35.0</td>
</tr>
<tr>
<td>70</td>
<td>3.9</td>
<td>7.8</td>
<td>11.6</td>
<td>15.4</td>
<td>19.3</td>
<td>23.1</td>
<td>27.0</td>
<td>30.4</td>
<td>33.8</td>
<td>37.0</td>
</tr>
<tr>
<td>75</td>
<td>4.2</td>
<td>8.4</td>
<td>12.0</td>
<td>15.9</td>
<td>20.0</td>
<td>24.0</td>
<td>28.0</td>
<td>31.5</td>
<td>35.0</td>
<td>38.5</td>
</tr>
<tr>
<td>80</td>
<td>4.5</td>
<td>9.0</td>
<td>12.6</td>
<td>16.5</td>
<td>21.0</td>
<td>25.0</td>
<td>28.9</td>
<td>32.5</td>
<td>36.1</td>
<td>39.6</td>
</tr>
<tr>
<td>85</td>
<td>4.8</td>
<td>9.6</td>
<td>13.2</td>
<td>17.4</td>
<td>22.0</td>
<td>26.0</td>
<td>29.8</td>
<td>33.5</td>
<td>37.1</td>
<td>40.6</td>
</tr>
<tr>
<td>90</td>
<td>5.1</td>
<td>10.2</td>
<td>13.8</td>
<td>18.1</td>
<td>23.0</td>
<td>27.0</td>
<td>30.8</td>
<td>34.5</td>
<td>38.1</td>
<td>41.6</td>
</tr>
<tr>
<td>95</td>
<td>5.4</td>
<td>10.8</td>
<td>14.4</td>
<td>18.6</td>
<td>23.5</td>
<td>27.5</td>
<td>31.3</td>
<td>35.0</td>
<td>38.6</td>
<td>42.1</td>
</tr>
<tr>
<td>100</td>
<td>5.7</td>
<td>11.4</td>
<td>15.0</td>
<td>19.2</td>
<td>24.0</td>
<td>28.0</td>
<td>31.8</td>
<td>35.5</td>
<td>39.1</td>
<td>42.6</td>
</tr>
<tr>
<td>105</td>
<td>6.0</td>
<td>12.0</td>
<td>15.6</td>
<td>19.8</td>
<td>24.8</td>
<td>28.8</td>
<td>32.5</td>
<td>36.2</td>
<td>40.0</td>
<td>43.5</td>
</tr>
<tr>
<td>110</td>
<td>6.3</td>
<td>12.6</td>
<td>16.2</td>
<td>20.4</td>
<td>25.2</td>
<td>29.2</td>
<td>32.9</td>
<td>36.6</td>
<td>40.4</td>
<td>44.0</td>
</tr>
<tr>
<td>115</td>
<td>6.6</td>
<td>13.2</td>
<td>16.8</td>
<td>21.0</td>
<td>25.8</td>
<td>29.8</td>
<td>33.5</td>
<td>37.2</td>
<td>41.0</td>
<td>44.5</td>
</tr>
<tr>
<td>120</td>
<td>6.9</td>
<td>13.8</td>
<td>17.4</td>
<td>21.6</td>
<td>26.4</td>
<td>30.4</td>
<td>34.1</td>
<td>37.8</td>
<td>41.6</td>
<td>45.0</td>
</tr>
<tr>
<td>125</td>
<td>7.2</td>
<td>14.4</td>
<td>18.0</td>
<td>22.2</td>
<td>27.0</td>
<td>31.0</td>
<td>34.7</td>
<td>38.4</td>
<td>42.0</td>
<td>45.5</td>
</tr>
<tr>
<td>130</td>
<td>7.5</td>
<td>15.0</td>
<td>18.6</td>
<td>22.8</td>
<td>27.6</td>
<td>31.6</td>
<td>35.3</td>
<td>39.0</td>
<td>42.6</td>
<td>46.0</td>
</tr>
<tr>
<td>135</td>
<td>7.8</td>
<td>15.6</td>
<td>19.2</td>
<td>23.4</td>
<td>28.2</td>
<td>32.2</td>
<td>35.9</td>
<td>39.5</td>
<td>43.1</td>
<td>46.5</td>
</tr>
<tr>
<td>140</td>
<td>8.1</td>
<td>16.2</td>
<td>19.8</td>
<td>24.0</td>
<td>28.8</td>
<td>32.8</td>
<td>36.6</td>
<td>40.1</td>
<td>43.7</td>
<td>47.0</td>
</tr>
<tr>
<td>145</td>
<td>8.4</td>
<td>16.8</td>
<td>20.4</td>
<td>24.6</td>
<td>29.4</td>
<td>33.4</td>
<td>37.1</td>
<td>40.7</td>
<td>44.3</td>
<td>47.5</td>
</tr>
<tr>
<td>150</td>
<td>8.7</td>
<td>17.4</td>
<td>21.0</td>
<td>25.2</td>
<td>30.0</td>
<td>34.0</td>
<td>37.8</td>
<td>41.4</td>
<td>45.0</td>
<td>48.0</td>
</tr>
<tr>
<td>155</td>
<td>9.0</td>
<td>18.0</td>
<td>21.6</td>
<td>25.8</td>
<td>30.6</td>
<td>34.6</td>
<td>38.5</td>
<td>42.0</td>
<td>45.6</td>
<td>48.5</td>
</tr>
<tr>
<td>160</td>
<td>9.3</td>
<td>18.6</td>
<td>22.2</td>
<td>26.4</td>
<td>31.2</td>
<td>35.2</td>
<td>39.1</td>
<td>42.6</td>
<td>46.2</td>
<td>49.0</td>
</tr>
<tr>
<td>165</td>
<td>9.6</td>
<td>19.2</td>
<td>22.8</td>
<td>27.0</td>
<td>31.8</td>
<td>35.8</td>
<td>40.0</td>
<td>43.5</td>
<td>47.0</td>
<td>49.5</td>
</tr>
<tr>
<td>170</td>
<td>9.9</td>
<td>19.8</td>
<td>23.4</td>
<td>27.6</td>
<td>32.4</td>
<td>36.4</td>
<td>40.6</td>
<td>44.0</td>
<td>47.6</td>
<td>50.0</td>
</tr>
<tr>
<td>175</td>
<td>10.2</td>
<td>20.4</td>
<td>24.0</td>
<td>28.2</td>
<td>33.0</td>
<td>37.0</td>
<td>41.2</td>
<td>45.6</td>
<td>49.2</td>
<td>50.5</td>
</tr>
<tr>
<td>180</td>
<td>10.5</td>
<td>21.0</td>
<td>24.6</td>
<td>28.8</td>
<td>33.6</td>
<td>37.6</td>
<td>41.8</td>
<td>46.0</td>
<td>49.8</td>
<td>51.0</td>
</tr>
<tr>
<td>185</td>
<td>10.8</td>
<td>21.6</td>
<td>25.2</td>
<td>29.4</td>
<td>34.2</td>
<td>38.2</td>
<td>42.4</td>
<td>47.2</td>
<td>50.4</td>
<td>51.5</td>
</tr>
<tr>
<td>190</td>
<td>11.1</td>
<td>22.2</td>
<td>25.8</td>
<td>29.8</td>
<td>34.6</td>
<td>38.6</td>
<td>42.8</td>
<td>47.6</td>
<td>50.8</td>
<td>52.0</td>
</tr>
<tr>
<td>195</td>
<td>11.4</td>
<td>22.8</td>
<td>26.4</td>
<td>30.2</td>
<td>35.0</td>
<td>39.0</td>
<td>43.2</td>
<td>48.0</td>
<td>51.2</td>
<td>52.5</td>
</tr>
<tr>
<td>200</td>
<td>11.7</td>
<td>23.4</td>
<td>27.0</td>
<td>30.6</td>
<td>35.5</td>
<td>39.4</td>
<td>43.6</td>
<td>48.4</td>
<td>51.6</td>
<td>53.0</td>
</tr>
</tbody>
</table>

- **24 volts**
- **26 volts**
- **28 volts**
- **30 volts**
<table>
<thead>
<tr>
<th>Speed</th>
<th>1.3</th>
<th>2.7</th>
<th>4.0</th>
<th>5.4</th>
<th>6.7</th>
<th>8.0</th>
<th>9.4</th>
<th>10.7</th>
<th>12.1</th>
<th>13.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Jumper Cable Selector Chart

**12 Volt Jumper Cable Chart**
(Approximate Jumper Cable Size Selector Chart to Achieve 1 volt of Voltage Drop Max)

**Note:** 1 volt VD @ 12v = 8.3% voltage drop
@ 13v = 7.7% voltage drop
@ 14v = 7.1% voltage drop
@ 15v = 6.7% voltage drop

<table>
<thead>
<tr>
<th>Length of Jumper Wire</th>
<th>15ft</th>
<th>20ft</th>
<th>25ft</th>
<th>30ft</th>
<th>40ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load on Run</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150w</td>
<td>14AWG</td>
<td>12AWG</td>
<td>10AWG</td>
<td>10AWG</td>
<td>8AWG</td>
</tr>
<tr>
<td>300w</td>
<td>10AWG</td>
<td>8AWG</td>
<td>8AWG</td>
<td>6AWG</td>
<td>6AWG</td>
</tr>
</tbody>
</table>

**24 Volt Jumper Cable Chart**
(Approximate Jumper Cable Size Selector Chart to Achieve 1 volt of Voltage Drop Max)

**Note:** 1 volt VD @ 24v = 4.2% voltage drop
@ 26v = 3.8% voltage drop
@ 28v = 3.5% voltage drop
@ 30v = 3.3% voltage drop

<table>
<thead>
<tr>
<th>Length of Jumper Wire</th>
<th>15ft</th>
<th>20ft</th>
<th>25ft</th>
<th>30ft</th>
<th>40ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load on Run</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250w</td>
<td>14AWG</td>
<td>12AWG</td>
<td>12AWG</td>
<td>10AWG</td>
<td>10AWG</td>
</tr>
<tr>
<td>500w</td>
<td>10AWG</td>
<td>10AWG</td>
<td>8AWG</td>
<td>8AWG</td>
<td>6AWG</td>
</tr>
</tbody>
</table>

**24 Volt Jumper Cable Chart**
(Approximate Jumper Cable Size Selector Chart to Achieve 2 volts of Voltage Drop Max)

**Note:** 1 volt VD @ 24v = 8.4% voltage drop
@ 26v = 7.6% voltage drop
@ 28v = 7.0% voltage drop
<table>
<thead>
<tr>
<th>Load on Run</th>
<th>15ft</th>
<th>20ft</th>
<th>25ft</th>
<th>30ft</th>
<th>40ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>250w</td>
<td>14AWG</td>
<td>14AWG</td>
<td>14AWG</td>
<td>14AWG</td>
<td>12AWG</td>
</tr>
<tr>
<td>500w</td>
<td>12AWG</td>
<td>12AWG</td>
<td>12AWG</td>
<td>10AWG</td>
<td>10AWG</td>
</tr>
</tbody>
</table>
Summary

Be aware of the voltage drop caveats. It is necessary to perform your calculations for most instances. However, as you gain experience with each of the Ambiance® Lighting Systems, you might have a sense of where to check and where voltage drop will not be an issue. In either case, voltage drop can be detrimental and beneficial. Please be certain that the limits are adhered to in order to ensure a quality and peak performing installation.
Review

1. Voltage drop is defined as the amount of voltage loss that occurs through all or part of a circuit due to impedance.
   - True
   - False

2. Another term for impedance is:
   - Resistance
   - Holding
   - Voltage

3. What formula is used to calculate voltage drop for the Ambiance® Lighting Systems?
   - Lamps (X) Cable length (X) Transformer size
   - Cable constant (X) Total Consumed Wattage Per Run (X) Length of Run
   - Cable constant (X) Total Cable placed (X) Number of lampholders

4. Based on calculating a 12 volt system, you discover your voltage drop calculations exceed the recommended level. If you decide that 24 volts is your solution, what is the correct multiplier used?
   - .12
   - .24
   - .27

5. Sea Gull Lighting recommends looping the cable as a method to minimize voltage drop.
   - True
   - False

6. Choose the best three ways to minimize voltage drop.
   - Use a Multi-Tap Transformer (12-13-14-15), Use Multiple Transformers , Shorten Cable Lengths
   - Reduce individual fixture wattages, reduce the total number of fixtures on a run, raise the wattage of the lamps
   - Convert the installation to 24 volts or 24 volt multi-tap, use wedge base lamps, add more transformers

Check my answers
The Ambiance® LX Lighting System

System Overview

The Ambiance® LX Lighting System is an exclusive product designed, engineered, manufactured and patented by Sea Gull Lighting Products, LLC. The product line is a modular component system, which offers custom lighting solutions from stock components in a flexible, easy to install, safe, U.L. listed system.

Introduced in 1992 by Sea Gull Lighting, the Ambiance® LX Lighting System was designed to give the lighting industry a versatile low voltage lighting system which allows light to be placed in virtually any space.

Since its inception, Sea Gull Lighting has continued to find more applications for which this exclusive product can be used. Now, in its latest generation of product introductions, the Ambiance® LX Lighting System is available in linear, recessed, pendant configurations and disk lighting assemblies for residential and commercial use.

The choices are endless!
The Ambiance® LX Lighting System

The Basics

The Ambiance® LX Lighting System is a 12 or 24 volt lighting system that provides safe, functional, easy to install surface mounted illumination. The low profile design allows it to fit into virtually any space and perform many accent or task lighting functions. Components are available in a variety of colors and finishes and may be painted to blend with any decor.

The opportunities appear to be endless! Ambiance® LX Lighting is perfect for under kitchen cabinets, showcases, cove lighting, toe-space lighting, night lighting and many more task and accent lighting applications. The system has many components which are U.L. (Underwriters Laboratories) listed for wet locations and are suitable for use outdoors.

The easiest way to understand how the Ambiance® LX Lighting System works is to simply define the component parts and understand their function. We will now explore the basic components of the Ambiance® LX Lighting System by identifying the five basic components of the system. If you know these five basic components, you understand the uncomplicated nature of the system!

What Are The Five Basic Components Needed?

- Cable/Wire
- Track
- Socket / Lampholder
- Lamps/Bulbs
- Transformer

Click here to access Lx 5 Basic Components Chart
Cable/Wire

Sea Gull Lighting’s low voltage cable has been specially designed for use with the Ambiance® LX Lighting System. The cable is designed for safe, easy piercing installations by using a self-sealing insulator over finely stranded copper wire. Sea Gull Lighting offers this item in 10/2 and 12/2 gauges for flexibility in application. The proprietary 12/2 cable is only for use when the Ambiance® LX Lighting systems is installed outdoors. The 10/2 cable is for indoor use only. Also, the cable is available in various length rolls from 25 to 1000 feet (white or black).

The 10/2 cable used with the Ambiance® LX Lighting System is rated for 105° centigrade. This high heat resistance is required by U.L. and Sea Gull Lighting to ensure protection of the system’s components and its surroundings since the lamps are positioned so close to the cable. Since this is so, the standard 60°C, 12/2 low voltage cable (familiarly used in landscape lighting) cannot be used in the Ambiance® LX Lighting System. Its use can create a serious safety hazard!

Sea Gull Lighting has also placed specially marked indicators at every two inches on the cable for easy socket spacing. This insures an easy and quick positioning of the sockets/lampholders on the system. The cable is also designed to fit perfectly into the exclusive track.

When using Sea Gull Lighting’s cable with the Ambiance® LX Lighting System, there are maximum wattage restrictions for each run. It is very important that the following limitations be respected when specifying and/or installing an Ambiance® LX Lighting system:

For 12 Volt Systems = 300 Watt Max Per Run
For 24 Volt Systems = 500 Watt Max Per Run

To summarize, the 10/2 AWG cable offers the following benefits:

- The thicker cable diameter assures less voltage drop due to less resistance.
- The thicker 10/2 AWG cable offers higher wattage capacities.
- The cable can be used in 12 volt or 24 volt systems.
- The cable has marks every two inches for easy socket/lampholder placement.
- The cable "self seals" if a socket/lampholder needs to be moved.

IMPORTANT NOTICE:
The use of another manufacturer’s cable (wire) or other component may cause the cable or other components to overheat and catch fire! Additionally, such use will void the Sea Gull Lighting warranty, UL listing, and present a potential safety hazard.

Note: To ensure the full 25 amp capability of any of the Ambiance® Lighting Systems and not to disturb its integrity, the jumper wire from the transformer to where the system begins MUST be 10 gauge wire. In other words, if the 10/2 stranded, 105° cable is used, the jumper wire must be of the same gauge e.g., 10 gauge romex or equivalent.
Track

The system uses a specially designed track which is extruded from Noryl® (plastic) and may be easily field cut, flexed, or curved to fit a specific application. Noryl® is a heat resistant polymer which is perfect for lighting systems particularly where there is close contact to a lamp or lampholder. There are a few choices when selecting the track for use in the LX system. Choose from the classic style, "Quick N Easy", fascia track or track with a lens. The track is used primarily to support the cable and to "lock" the lamholder/socket in place.

There are three basic mounting methods for the track.

- Firstly, the most popular is to screw the track onto a wooden surface using the pre-drilled holes in each track section. This can be accomplished by using our 9862 screws (Quick N Easy includes the screws) which will provide a smooth channel for supporting the wire and will eliminate any screws protruding so the lampholder/socket will snap into place smoothly and easily. This is often the best, most reliable way to install the track.
- Secondly, another method of securing the classic track is to use 9450 double faced tape. The tape is of a "high adhesion" compound manufactured by the 3M Company and is perfect where the application includes glass shelves or any material where screws are not practical. There are specific instructions to follow to insure proper adhesion of the tape to the intended surface. The track and the surface must be cleaned of any grease, dust, etc. by using an alcohol and water mixture. After the surface thoroughly dries, the tape can be installed on the track and then adhered to the surface. The tape must then cure for 24 hours to insure proper adhesion. After that time, the sockets may be installed and the system tested. Following these instructions will assure a proper installation using the double faced tape.
- Thirdly, using the 9438 clips will also attach the classic tracks used to a wooden surface. Mounting screws are included to support the track. The clips should be spaced according to the weight of the fixtures to prevent the track from sagging.

To summarize:

- The classic track is flexible and may be cut to conform to virtually any shape.
- Choose from four styles of track to meet your design requirements
- The track can easily be easily cut and adjusted directly in the field.
- The track is used to hold the cable in place and to secure lampholders.
- Three ways to mount the track are screws, double faced tape and clips.
Socket/Lampholder

Each socket is designed to be a miniature light source with a clean line appearance that will not detract from the beauty of the room even if it is installed with the wire and sockets exposed. Depending upon the application, you may select any one or a variety of sockets/lampholders that simply pierces the cable and snaps onto track at any point to make the electrical connection.

Sockets/Lampholders are available for linear lighting which use festoon, or wedge base lamps. The linear lighting sockets/lampholders are perfect for undercabinet lighting, cove lighting, valance lighting, toe space lighting, accenting inside cabinetry and a variety of other residential and commercial uses where low profile, linear lighting is required. Please see the following page for details of the sockets which may be used for a variety of linear lighting applications.

Click to see a larger image
Track style, directional accent lighting lampholders which use bi-pin halogen lamps (MR type) are also available for additional accent lighting where desired. Directional accent lampholders are available using MRC11 and MRC8 lamps depending upon the style and function requirements. You may use these directional lampholders to integrate accent lighting within your linear task lighting system.
Lamps/Bulbs

The Ambiance® LX Lighting System utilizes incandescent wedge base lamps (including Xenon), bi-pin halogen lamps and Xenon festoon cartridge lamps. Xenon is the "lamp of choice" for low voltage linear systems due to the positive properties associated with xenon lamps. Xenon has the following benefits when compared to halogen:

- Xenon can be installed with bare hands without affecting lamp life.
- Xenon does not emit potentially harmful UV rays.
- Xenon has long life. (E.g., 20 watt halogen = 2000 hours, 18 watt xenon = 10,000 hours)
- Xenon is a low pressure lamp. No shielding is required and no "non-passive end of life."
- Xenon produces less heat.

More detailed information about the available lamp choices is contained in Module 1.

Transformer

As the heart of the Ambiance® LX Lighting System, Sea Gull Lighting transformers are designed to operate quietly and efficiently while providing a safe power conversion.

A low voltage transformer reduces the incoming voltage from 120 volts (or line voltage) to a lower voltage, either 12 volts or 24 volts. There are two types of transformers used in the Ambiance® LX Lighting System; laminated magnetic and electronic. More detailed information about the available and applicable transformers is contained in Module 2.

*Remember: To ensure safety and retain the Sea Gull Lighting warranty and U.L. listing of the entire system, always use transformers supplied by Sea Gull Lighting which have been designed specifically for the Ambiance® LX Lighting System.*
Basic Component Summary

These are the five basic components necessary for any linear Ambiance® LX Lighting System needs to operate.

- Cable
- Track
- Socket / Lampholder
- Lamps/Bulbs
- Transformer

Other accessories and components, e.g., disk lights, pendant components and assemblies, track lampholders, covers, etc., are welcome additions, but not necessary for the system to operate. Your creativity is the only way to enhance the performance of the system and add to the beauty within the design.

Socket Spacing / Lamp Combinations

We recommend that you refer to each component's product features and restrictions when determining socket spacing. In addition, our current literature provides data to assist you in determining socket spacing to achieve the desired footcandle level. (See footcandle data chart in the Appendix)

However, experience does dictate some "rules of thumb." The following chart might assist you to apply the appropriate socket/lamp combination for any given situation.

Of course this chart does not represent every situation, but you can effectively choose the correct socket/lamp combination for a majority of the installations where the Ambiance® LX Lighting System is used.

Click to see a larger image
<table>
<thead>
<tr>
<th>Lamp Type</th>
<th>Lamp Number</th>
<th>Lx</th>
<th>Footcandles</th>
</tr>
</thead>
<tbody>
<tr>
<td>12V</td>
<td>9726</td>
<td>4&quot;</td>
<td>121</td>
</tr>
<tr>
<td>12V</td>
<td>9712</td>
<td>6&quot;</td>
<td>97</td>
</tr>
<tr>
<td>12V</td>
<td>9712</td>
<td>8&quot;</td>
<td>87</td>
</tr>
<tr>
<td>12V</td>
<td>9718-32</td>
<td>10&quot;</td>
<td>77</td>
</tr>
<tr>
<td>12V</td>
<td>9718-33</td>
<td>12&quot;</td>
<td>77</td>
</tr>
<tr>
<td>12V</td>
<td>9718-32</td>
<td>14&quot;</td>
<td>77</td>
</tr>
<tr>
<td>12V</td>
<td>9718-33</td>
<td>16&quot;</td>
<td>77</td>
</tr>
<tr>
<td>12V</td>
<td>9718-32</td>
<td>18&quot;</td>
<td>77</td>
</tr>
<tr>
<td>12V</td>
<td>9718-33</td>
<td>20&quot;</td>
<td>77</td>
</tr>
</tbody>
</table>

**Warning:** Use of other manufacturers' components will void warranty and rating and create a potential safety hazard. Serious risk of fire exists when mixing 12V lamps with 24V transformers.

Click here to print a helpful Ambiance® Lx Lighting System Layout Guide.
1. Choose the best answer, "The Ambiance® LX Lighting System is a ___________lighting system."
   - Rigid
   - 12V OR 24V
   - Halogen Only

2. Choose the correct five basic components of the Ambiance® Lx Lighting System:
   - Cable, rail, switch, plug, transformer
   - Cable, Track, Lampholder, Lamp, Transformer
   - Disk light, track, switch, connector, transformer

3. Choose the best three popular uses for The Ambiance® Lx Lighting System.
   - Cove lighting, under deck rails, warehouse lighting
   - Under Cabinets, Cove Lighting, Toe Space Lighting
   - Trade show displays, marine lighting, recessed in brick

4. Circle the correct gauge of the 105° cable used in the Ambiance® Lx Lighting System.
   - 14/2
   - 10/2
   - 16/2

5. The maximum wattage allowed per run in the Ambiance® Lx Lighting System is _____ watts at 12 V and _____ watts at 24 V.
   - 200/600
   - 300/500
   - 250/500

6. The 10/2, 105° proprietary cable is self sealing.
   - True
   - False

7. The cable is insulated with a heat resistant material called:
   - Norman
8. It is permissable to use another manufacturer's component with in the Ambiance® Lx Lighting System.

- True
- False

9. The Ambiance® Lx Lighting system may not be used outdoors.

- True
- False

10. The track may be cut to size in the field.

- True
- False

11. The two main purposes of the track is for the following:

- Hold the lamp securely, keep the cable straight
- Hold the lampholder securely, act as a cable guideway
- Hold the lamp securely, act as a cable guideway

12. The two basic construction types of transformers used in the Ambiance® Lx Lighting System are:

- Laminated, Magnetic, Electronic
- Toroidal, plug-in
- Buck & Boost, electronic

13. The three basic lamp types used in the Ambiance® LX Lighting System are:

- Xenon, Halogen, Fluorescent
- Xenon, Halogen, Standard Incandescent
- Xenon, HID, Halogen
Miniature Recessed Lighting System

The Basics

Ambiance® LX Lighting System’s miniature recessed lighting is a 12 volt or 24 volt lighting system that provides safe, functional, easy to install miniature recessed fixtures. The U.L. listed and low profile housings allow it to fit into virtually any accent or task lighting application. Each housing is designed to be a miniature light source with a clean line appearance that will not detract from the beauty of the room.

The miniature recessed lighting housings are rugged die-cast aluminum with a powder coat finish. Ambiance® LX Lighting System miniature recessed housings are designed to install into existing ceilings. The housing's exterior has two "wings" which expand once the housing is placed into the ceiling opening. This allows the housing to remain firmly and securely in the ceiling.

The recessed housings are thermally protected thus qualifying them to be placed in an enclosed ceiling. Additionally, the housings are rated for 14/2 AWG in and out which allows for feed-through wiring, or for 12/2 AWG in only. The die-cast aluminum housings accept MRC11 lamps, T-4 bi-pin halogen lamps and wedge base lamps, depending upon the trim selected.

The miniature recessed housings are Class I listed, therefore they may be used with any suitable Ambiance® Lighting System remote transformer.

Installation is as follows:

- A 2-inch hole is cut in the ceiling material for the housing to be placed in.
- The wire from the transformer is pulled through the 2-inch hole.
- The housing is wired below the ceiling surface.
- The housing is pushed into the ceiling cut out.
- The housing's internal screws are turned expanding the wings and closing in on the ceiling material.
- The lamp and trim is placed in and on the housing respectively.

What Components Are Needed?

- Recessed Housing
- Trim
- Lamp
- Transformer

The above components are the basic required components needed for the Ambiance® Lighting System’s Miniature Recessed Series. Depending upon the application, you may wish to add a variety of decorative trim rings to give your lighting application a more finished look. However, these optional trim rings are not required to operate the system or to meet U.L. listing classification.
Disk Light System

The Basics

This 12 or 24 volt, Class II lighting system provides safe and functional, easy to install, miniature recessed or surface mounted lighting. The low profile housings allow it to fit into virtually any application. Each housing is designed to be a miniature light source with a clean line appearance which will not detract from the beauty of the room.

The miniature disk lights are constructed of polycarbonate with a large precise anodized aluminum reflector. There are two reflector designs available. A segmented reflector (24° beam spread) provides excellent accent lighting while the anodized reflector (40° beam spread) provides even task illumination. Each disk light comes complete with a surface mounting trim that allows the flexibility of either recessing the disk light or surface mounting the disk light.

Since Ambiance® Disk Lights are not thermally protected, they cannot be used in drywall ceilings or any area that is inaccessible. For illumination from within a recessed, drywall ceiling, thermally protected recessed fixtures must be used. You may choose either the miniature cast aluminum recessed series or the integral transformer series for those areas. However, disk lights may be recessed within a wooden cabinet, in shelves, portable exhibits, etc.

The disk lights use a T-5 wedge base lamp. This allows flexibility of lamp selection and also makes the disk light 24 volt capable. For best results, use the 9774 Xenon, 12 volt lamp or the 9775 Xenon, 24 volt wedge base lamp depending on the voltage of the system designed.

Shielding

Glare control is always a consideration when designing a lighting system. The Ambiance® Disk Lighting System currently has two methods from which to choose for minimizing glare from the wedge base lamp. The two glare shields are:

- Eyelid trim
- Honeycomb Louver

A glass lens is also available, although not necessary when using a xenon lamp.
Review

1. In addition to linear lighting components, The Ambiance® Lx Lighting system also has the following luminaires:

- Hi-bays, deck lights, portables
- Miniature Recessed Lighting, Disk Lights, Directional Lighting
- CFL, gobos, pendants

2. Choose the best three popular uses for the additional Ambiance® Lx Lighting system lighting sources:

- Under Cabinets, Shower Lights, Display Cabinets
- Cove lighting, inside walls, bath lighting
- Saunas, eaves, outdoor pendants

3. Select the correct attributes of recessed luminaires:

- Steel housing, Integral transformers, MR lamps only
- IC rated, Remote transformers, Bi-pin lamps only
- Die Cast Aluminum, MR, Bi-Pin Lamps or Wedge Base, Integral or Remote Transformers

4. The maximum wattage permitted in MOST low voltage pendant luminaires is ____ watts.

- 20
- 35
- 50

5. Shades for pendants are available in:

- Art Glass, Pressed Glass, Natural Stone
- Marble, Alabaster, Wood
- Cased glass, Art glass, Parchment

6. Pendants are available in either component or complete form.

- True
- False

7. Disk Lights use xenon lamps only.

- True
- False

8. Disk Lights are suitable for under cabinet lighting.

- True
9. To use Disk Lights with a Class I transformer, you must include a ________ with each fixture.

- Clip
- Fused Plug
- Screw

10. The two basic types of approved transformers used with the Ambiance® Lighting Systems Disk Lights are:

- Toroidal, electronic
- Laminated magnetic, Electronic
- Electronic, Buck & Boost

11. The following glare control trims are available for Disk Lights:

- Honeycomb Louver, Eyelid
- Eyeball, Glass Trim
- Baffle, Trim Shield

Check my answers
The Ambiance® RX Lighting System

The Basics

The Ambiance® RX Lighting System is a 12 or 24 volt, one or two circuit lighting system that provides safe, functional, easy to install horizontally or vertically mounted illumination. The low profile, 21st century design allows it to fit into virtually any space and perform many accent or general lighting functions. The main components are available in a high tech finish (Eurotech), and decorative shades are available in a variety of styles, colors and finishes.

The opportunities are emormous! Ambiance® RX Lighting is perfect for general lighting, accent lighting, display lighting, galleries, restaurants and many more general and accent lighting applications. The ETL listed Ambiance® RX Lighting System is perfect where function and style coordinate to produce design solutions for most lighting design issues.

The easiest way to understand how the Ambiance® RX Lighting System works is to simply define the component parts and understand their function. We will now explore the basic components of the Ambiance® RX Lighting System by identifying its six basic components. If you know these six basic components, you understand the uncomplicated and simple nature of the system!

The Ambiance® RX Lighting System Components

What Are The Six Basic Components Needed?

- Rail
- Power Feed
- Mounting and Other Accessories
- Luminaire
- Lamps/Bulbs
- Transformer

Click here to access: Rx 6 Basic Components Chart.
Rail

The Ambiance® RX Lighting System rail is available in two basic versions; single circuit or two circuit capable. The single circuit version may be bent to form with a special tool or by hand and the other is a flexible, two circuit capable rail which may be formed by hand to fit virtually any shape or form the design dictates.

The single circuit rail is available in four or eight foot sections and is constructed with two conductors separated by a thermoplastic insulator to keep the conductors isolated. The rail may be bent with a special bending tool (94130) or by hand which makes creating a custom radius quick and easy. If the radius cannot be formed in the field, the factory may be consulted for custom radius availability. The rail comes complete with two end caps. An optional external joiner selection is available for multiple lengths of rail when longer runs are necessary.

The two circuit capable rail is also available in four foot and eight foot sections. No tools are required to form the two circuit capable rail into any desired form to provide a custom look. The two circuit capability adds design flexibility for certain design situations. Four, aluminum flexible conductors are separated by a thermoplastic insulator to keep the conductors isolated. The two circuit capable rail is easily cut to length "in the field" by using a sharp pair of snips. Cap the end with a dead end to ensure a smooth finish.

When using Sea Gull Lighting’s rail with the Ambiance® RX Lighting System, there are load restrictions for each run. It is very important that the following limitations be respected when specifying and/or installing an Ambiance® RX system:

- For 12 Volt Systems = 300 Watt Max Per Run
- For 24 Volt Systems = 500 Watt Max Per Run

Be certain when using connectors or joiners not to exceed the maximum wattage restriction for use with those accessories.

To summarize, the Ambiance® RX Lighting System rail offers the following benefits:

- The rail is one or two circuit capable, depending upon the rail selected.
- The single circuit rail may be formed by hand or by a special tool. The two circuit capable rail may be formed by hand. Use of the tool is not recommended.
- Single circuit rigid rail is available in 4’ or 8’ lengths and has two aluminum conductors separated by a thermoplastic insulator.
- Two circuit flexible rail is available in 4’ or 8’ lengths and has four aluminum conductors separated by a thermoplastic insulator.
- The maximum wattage is limited. Check to be certain you are within limits as per voltage.
- For longer lengths, joiners and connectors are available.

**IMPORTANT NOTICE:**
The use of another manufacturer’s component may cause the system or other components to overheat and catch fire! Additionally, such use will void the Sea Gull Lighting warranty, ETL listing, and present a potential safety hazard.
Review

1. Choose the best answer, "The Ambiance® Rx Lighting System is a ___________ lighting system."
   - Cable
   - Single or Two Circuit
   - Rigid Only

2. Choose the best answer, "The Ambiance® Rx Lighting System is also a ___________ V lighting system."
   - 12 OR 24
   - 12
   - 24

3. Name the six basic components of the Ambiance® Rx Lighting system:
   - Rail, Track, Fixture, Bulb, Transformer
   - Rail, Power Feed, Luminaire/Fixture, Lamps/Bulbs, Transformer, Mounting and other accessories
   - Track, Power Feed, lampholder, lamp, light bulbs

4. Choose the best three popular uses for the Ambiance® Rx Lighting system:
   - Display Lighting, Restaurants, Illuminating Art
   - Trade show displays, Gazebo lighting, Accent lighting
   - Over Kitchen Islands, Deck Lighting, Cove Lighting

5. As with the Ambiance® Lx Lighting System, the maximum wattage allowed per run for the Ambiance® Rx Lighting System is ____ watts at 12 V and ____ watts at 24 V.
   - 300/500
   - 250/500
   - 300/600

6. All luminaires may be used on either the single circuit or dual circuit rail.
   - True
   - False

7. Name three attributes of the rail’s construction.
   - Rigid only, field bendable, steel conductors
   - Hand bendable only, aluminum conductors, black and white finish
   - Single or two circuit, available in 4’ or 8’ sections, conductors separated by thermoplastic insulators

8. It is permitted to use another manufacturer’s component with in the Ambiance® Rx Lighting System.
9. The Ambiance® Rx Lighting System accessory ring is for use only with MRC16 lamps
   ☐ True
   ☐ False

10. You may check polarity of the rail and luminaires (circuit 1/ circuit 2) visually. Smooth indicators vs. ridged indicators.
   ☐ True
   ☐ False

11. Three types of Ambiance® Rx Lighting System power feeds are:
   ☐ Wall Feed, Floor Feed, Flexible Feed
   ☐ Transformer Feed, Power Wall Feed, Electronic Feed
   ☐ Power Feed Ceiling Canopy, Flexible Feed, Wall Feed

12. Choose the best description of the two types of magnetic transformers used in the Ambiance® Rx Lighting System:
   ☐ Electronic, Magnetic
   ☐ Laminated, Toroidal
   ☐ Floating, Remote

13. The three basic lamp types used in the Ambiance® Rx Lighting System are:
   ☐ MR 16, MRC 16, GY6.35 BI-PIN HALOGEN
   ☐ MR16, MR11, MR8
   ☐ A19, PAR36, BR30

14. Ambiance® Rx Lighting System lampholders and pendants all use the same glass shades.
   ☐ True
   ☐ False

15. Any of the Ambiance® Rx Lighting System mounting accessories (power feeds and supports) can be used together.
   ☐ True
   ☐ False

   Check my answers
The Ambiance® Lighting System Decorative Pendants

System Overview

The Ambiance® Lighting System are products designed, engineered, manufactured by Sea Gull Lighting Products, LLC The product line is a modular, miniature track component system, which offers custom lighting solutions from stock components in a flexible, easy to install, safe, U.L. listed system.

Introduced in 1992 by Sea Gull Lighting, the Ambiance® Lighting System was designed to give the lighting industry another optional, versatile low voltage lighting system which allows light to be placed in virtually any residential or commercial space.

The Ambiance® Lighting Systems have been enhanced over the years to include low voltage and line voltage rail systems and pendants. Now coordinated sconces add additional design opportunities within the systems.

Whether your use is for low profile residential or commercial lighting, any of the Ambiance® Lighting Systems, available in, linear, surface mounted, suspended, pendant configurations and sconces are perfect choices for today's lighting solutions.

The choices are endless!
The Ambiance® Lighting System Decorative Pendants

Introduction

The Ambiance® Lighting Systems, whether line or low voltage, provide safe, functional, easy to install surface mounted illumination. The low profile designs allow them to fit into virtually any space and perform many general, accent or task lighting functions. Within the Ambiance® Lighting Systems, there are many pendant choices for single or system mounting with a variety of choices. Some pendants have coordinated sconces to complement the pendant choice within the interior space.

The opportunities appear to be endless! Ambiance® Lighting System pendants and sconces are perfect for kitchen islands, over task areas, wet bars, tables, occasional furniture, bath areas and many more design choices. These decorative components are the perfect design solution for most residential or commercial applications.

The easiest way to understand how the Ambiance® Lighting System's pendants and sconces work is to simply define the component parts and understand their function. We will now explore easy selection process by identifying the basic components of the system. If you know these basic components, you understand the uncomplicated nature of the system.

The Basics

The Ambiance® Lighting Systems include a variety of low voltage choices to provide safe, functional, easy to install pendant lighting. Each pendant is designed to be a miniature light source with a clean line appearance. The popularity of pendant systems for both residential and commercial applications has risen dramatically for both low voltage and line voltage choices.

The Ambiance® Lighting System's low voltage pendants are available in assorted art glass and natural material styles to suit almost any contemporary or eclectic décor. Most glass is cased or etched glass, but colors are also available in a pressed, step glass style to add dimension to your desired style. For the discriminating specification, choose from art glass styles or multi-color and stone shades that add a unique touch to your design. The art glass pendants are available for use with the Ambiance® Transitions and RX Lighting System, but you may select these styles as a mono-point for a further custom look. Low voltage pendant assemblies, including the canopy and pendant assembly, are available as well as a 120V mono-point assembly where low voltage usage is impractical.

For low voltage choices, the lamp selection includes either an MRC16 lamp or a halogen, T-4 bi-pin which is covered by a frosted glass, test tube like cover to give even illumination with maximum light output. The maximum wattage for most pendant combinations is 50 watts. A lamp accessory ring is available for use with an MR16 lamp and a choice of louvers or lenses for special effects. For line voltage choices, the lamp selected is a 40 G9 lamp which is covered by a test tube like cover to give even illumination with maximum light output.

The miniature pendants may be mounted on a mono-point, or on the Ambiance® Transitions or RX systems. Pendants are also available for use with Sea Gull Lighting's standard line voltage track system by using a specially design low voltage transformer adaptor and then selecting the desired shade. Choose the application and the mounting method which best suits your design and installation requirements.
The Ambiance® Lighting System Decorative Pendant Components

What Components Are Needed?

- Pendant or pendant assembly
- Lamp
- Transformer
- Shade
  - **Accessories:**
    - Mono-Point Canopy or Assembly
    - Track / Rail
    - Lamp accessory ring

The above components are the basic required and optional components needed for the Ambiance® Lighting Systems decorative low voltage and line voltage pendant choices.
Review

1. The Ambiance® RX Lighting system pendants are available in or v voltage.
   - 12v / 24v
   - LINE / LOW
   - Both 1 & 2

2. Name the basic components of the Ambiance® Lighting System's pendants:
   - Pendant assembly, shade, shield
   - Pendant assembly, shield, socket
   - Pendant assembly, shade, lamp

3. Name best example of popular uses for the Ambiance® Lighting System Pendants:
   - Kitchen islands, wet bars, accent tables
   - Outdoor Kitchens, Retail displays, wet bars
   - Home Theaters, Over bathtubs, Recreation rooms

4. Name the lamp types used with Ambiance® Lighting System pendants
   - Halogen T-4, MR 16 type lamps, 120 volt G-9 lamps
   - Fluorescent, GY 6.35 halogen, Metal halide
   - HID, Low Pressure Sodium, CFL

5. It is permissable to use another manufacturer's transformer within the Ambiance Lighting Systems.
   - True
   - False
The Ambiance® Transitions Lighting System

The Basics

The Ambiance® Transitions Lighting System is a line voltage lighting system that provides safe, functional, easy to install horizontally or vertically mounted illumination. The low profile, 21st century design allows it to fit into virtually any space and perform many accent or general lighting functions. The main components are available in an antique bronze or antique nickel finish, and other glass and metal components are available in a variety of styles, colors and finishes.

The opportunities are enormous! With contemporary and transitional/traditional styles, the Ambiance® Transitions Lighting Systems are perfect for general lighting, accent lighting, display lighting, galleries, restaurants and many more general and accent lighting applications. The ETL listed Ambiance® Transitions Lighting System is perfect where function and style coordinate to produce design solutions for most lighting design issues.

The easiest way to understand how the Ambiance® Transitions Lighting System works is to simply define the component parts and understand their function. We will now explore the basic components of the Ambiance® Transitions Lighting System by identifying its five basic components. If you know these five basic components, you understand the uncomplicated and simple nature of the system!

The Ambiance® Transitions Lighting System Components

What Are The Five Basic Components Needed?

- Rail
- Power Feed
- Mounting and Other Accessories
- Luminaire
- Lamps/Bulbs

Click here to access Transitions 5 Basic Components Chart
Rail

The Ambiance® Transitions Lighting System rail is available in single circuit only. The single circuit rail may be bent to form by using a customized template, with a special, available bending tool or by hand to fit virtually any shape or form your design dictates.

The rail is available in four or eight foot sections and is constructed with two 12 gauge conductors contained in a thermoplastic insulator. The rail may be bent with a special bending tool (94130) or by hand which makes creating a custom radius quick and easy. A field customized template may be used to form the rail into custom shapes. If the radius cannot be formed in the field, the factory may be consulted for custom radius (min. 12” radius) availability. The rail comes complete with two end caps. An optional joiner selection is available for multiple lengths of rail when longer runs are necessary. Rail may also be cut to length in the field.

For easy and foolproof installation, or where simplicity is the objective, the rail is available in complete kits. Using a four foot rail, we offer rail kits with a straight rail section which may be formed in the field. Each complete assembly comes with:

- A four foot, field bendable rail section
- Power feed
- Standoff
- Three fixtures
- Three G9 Lamps
- Three optional accessory reflectors for a more focused beam if desired.

The key here is simplicity and the complete kits accomplish that objective. However, if the design should change requiring additional lengths to the initial kit, the Ambiance® Transitions kits may be added to at a later date.

When using Sea Gull Lighting's rail with the Ambiance® Transitions Lighting System, there are wattage restrictions for each run. It is very important that the following limitations be respected when specifying and/or installing an Ambiance® Transitions system:

\[
20 \text{ amps} \times 120 \text{ volts}=2400 \text{ watts}
\]

Since a 20 amp breaker is not designed to carry a full load,
the derated capacity per run is 1920 watts

Be certain when using connectors or joiners not to exceed the maximum wattage restriction, if any, for use with those accessories.

To summarize, the Ambiance® Transitions Lighting System rail offers the following benefits:

- The rail is single circuit capable.
- The rail may be formed by hand, by a special tool or by the use of a specially designed, field constructed template.
- Ambiance® Transitions is available in 4' or 8' lengths and has two 12 gauge conductors isolated by a thermoplastic insulator.
- The maximum wattage per run is limited. Check to be certain you are within limits as per voltage.
- For longer lengths, joiners and connectors are available.
- For simplicity, complete rail kits are available.
Power Feeds

Once the specified rail is determined, the next step is to select the appropriate power feed to supply power from the transformer to the Ambiance® Transitions Lighting System. The power to the system may be delivered in a number of different configurations from a simple junction box. Additionally, the power feed may be placed anywhere along the length of the rail:

- Power feed canopy adaptor
- Wall feed adaptor
- Wall feed canopy
- Flexible feed adaptor

Any of these available options to supply power to the system is available for increased flexibility of design for vertical, horizontal or suspended installation. Simply place the portion of the power feed aligning the contacts into the side of the rail with the conductors. You would then close the adaptor, install the cap and tighten all screws to assure solid contact.

To summarize:

- There are four methods to power feed the Ambiance® Transitions Lighting System.
- Each power feed supplies one circuit to the system.
- Feed from the ceiling, wall or from a remote junction box.
- Each run has a capacity of 1920 watts, derated.

Mounting and Other Accessories

The Ambiance® Transitions Lighting System can be mounted horizontally or vertically on a solid surface. For horizontal mounting there are accessories which allow either suspended or semi-flush mounting of the rail. The support adaptors coordinate with the power feeds to provide sturdy mounting of the Ambiance® Transitions Lighting System regardless of the design.

The standoffs, or support adaptors include:

- Rail wall support (use with wall feed/support)
- Semi-flush support adapter (use for ceiling or wall mount with most power feeds)
- Slope ceiling adapter (use with flexible feed adapter, slope ceiling feed or wall feed canopy)
- Cable support adapter (use with all power feeds)
- T-bar ceiling clip with support adaptor (use with most power feeds)

Other applicable accessories include:

- Electrified flexible joiner to electrically connect two rail sections for a tight offset or turn
- Electrified straight joiner for longer runs
- Electrified standoff joiner for a smooth power transition
- Stem extensions to use with rail feed and support adaptors
- Various louvers and filters for lampholders and pendants
- Field bending tool for the rail

Lastly, there is a full array of coordinated mono-point fixtures with lampholders pre-installed on the canopy.
These fixtures have similar properties as the rail lampholders. They are available as complete fixtures and are designed to coordinate with each Ambiance® Transitions family of designs. These coordinated mono-point fixtures are suitable for ceiling or wall mounting.

To summarize:

- A variety of coordinated support adaptors are available to coordinate with any power feed selected.
- A full array of coordinated connectors, joiners, stem extensions for the rail, and specialty accessories are available.
- Coordinated lampholders are preinstalled on a monpoint canopy and are available as complete fixtures or style/glass component selection.
Luminaire/Fixture

The Ambiance® Transitions Lighting System's luminaires are available in "track" lampholder style, adjustable length pendants and in specialty versions to suit any general or accent lighting design requirement. The luminaires are available in either an antique bronze or antique nickel finish to coordinate with any contemporary, transitional or eclectic décor in the space designed, and are styled as coordinated families.

Lampholders

The lampholders are available in many distinct styles to suit any décor. Also, many lampholders is available in either complete fixture form or there are component forms available where your shade may be selected to suit the design. In either case, two lamp types are specific to particular lampholders. Some lampholders use a line voltage, G9 lamp and others are specifically designed to accommodate a 12V, MRC16 lamp.

An accessory ring is available for use with the lampholders using an MR16 type lamp. When using the accessory ring with lenses or louvers, you must use an MR16 lamp. The accessory ring may not fit correctly if an MRC16 lamp is used. You may select from spread lenses to form or filter the beam pattern of an MR16 lamp, honeycomb louvers for glare control, and a museum quality, U.V. filter to minimize ultraviolet rays from the lamp beam itself which is required for most galleries or where U.V. is an issue.

The variety of complete fixtures and the flexibility of designing your own add to the various choices when designing and selecting function and style.
Pendants

The Ambiance® Transitions Lighting System also has pendant fixtures from which to choose. Whether they are selected for use in a restaurant, residence, office setting or conference room, these functional, miniature pendants add style and performance to your desired design.

The pendants are available in many distinct styles or families to suit any décor. Also, most families of pendants are available in either complete fixture form or in component form where your shade may be selected to suit the design. In either case, the line voltage, G9 lamp is approved for use with these pendants. Mounting methods include installing pendants directly on the rail or by a mono-point canopy which may be included as an option in some pendants. To coordinate with some pendants, coordinated wall sconces are available for some styles of pendant glass.

The variety of complete fixtures and the flexibility of designing your own add to the plethora of choices when designing and selecting function and style.

Wall Sconces/Specialty

There are specialty fixtures available for energy saving situations. There is a choice of pendants and coordinated wall sconces using self-ballasted CFL technology for energy conservation while not sacrificing good color rendering and providing excellent color temperatures. These comply with the EPA's Energy Star® program, Title 24 or may satisfy other state or local legislated energy codes. Please check with your state or local code officials for compliance.

To Summarize:

- Lampholders and pendants are available in complete and component versions.
- Mix and match lampholders and pendants to solve general lighting and accent lighting design issues.
- Use the available accessory ring with lenses and/or louvers to achieve special glare control or beam control using 12V lampholders.
- Specialty fixtures are available for energy savings and wall sconce lighting.

Lamp/Bulb

The Ambiance® Transitions Lighting System utilizes a line voltage, G9 lamp for directional lampholder and pendants. An MRC16 lamp is used with the applicable directional lampholder and uses an MR16 with the lamp accessory ring. For further lamp information and data, please refer to the lamp information module in this training guide.
Ambiance® Transitions Lighting System Five Basic Component Summary

These are the five basic components necessary for any Ambiance® Transitions Lighting System to operate. By understanding the five basic components and becoming familiar with the products themselves, you can offer your customers/clients an exceptional design which will be both visually appealing and functional. Your creativity is the only way to enhance the performance of the system and add to the beauty within the design.

More Transitions Options

Ambiance® Transitions makes it even easier for you by allowing you the choice of eight prepackaged kits using either directional fixtures or pendants. Each kit contains:

- Four foot rail
- Power feed
- Standoff
- Three fixtures/pendants
- 120v G9 lamps
- Optional reflectors

This make the selection and installation of Ambiance® Transitions an easy solution for kitcehn islands, occasional tables, small vertical spaces or wherever simple rail solutions are required.

Click here to print a helpful Ambiance Transitions Lighting System Layout Guide
Review

1. Choose one answer: The Ambiance® Transitions Lighting System is a ____ V lighting system.
   - 12
   - 24
   - 120

2. Choose the five basic components of the Ambiance® Transitions Lighting System:
   - Rail, power feed, luminaire/fixture, lamps/bulbs, mounting and other accessories
   - Power feed, bulb, connector, standoff, lamp
   - Rail, feed, standoff, stem, lampholder

3. Choose the best three popular uses for the Ambiance® Transitions Lighting System:
   - Bath lighting, outdoor kitchens, gazebos
   - Display lighting, kitchen islands, galleries
   - Landscape lighting, art displays, kitchen islands

4. The maximum wattage allowed per run is 1920 watts.
   - True
   - False

5. Is this statement true or false of the rail's construction: "Single circuit, 20 amp capable, available in 4’ or 8’ sections."
   - True
   - False

6. The Ambiance® Transitions Lighting System accessory ring is for use with MRC 16 lamps only.
   - True
   - False

7. The rail is field cuttable.
   - True
   - False

8. Three types of Ambiance® Transitions Lighting System power feeds are:
   - Ceiling mount, wall mount, remote mount
   - Low voltage, ceiling mounted, standoff
   - Line voltage, transformer mounted, wall mounted
9. The three basic lamp types used in the Ambiance® Transitions Lighting System are:

- MR 16, MRC 16, G-9
- GY6.35, MRC 11, T-4
- A Lamp, CFL, MR 16

10. Ambiance® Transitions Lighting System lampholders and pendants all use the same glass shades.

- True
- False

11. Any of the Ambiance® Transitions Lighting System mounting accessories (power feeds and supports) can be used together.

- True
- False
Designing With Light

A low voltage, linear lighting system can be the most flexible and the easiest way to install lighting systems today. The ability for a designer to use any of the residential or commercial systems for under and inside cabinet lighting, cove lighting, toe space lighting, track lighting, display lighting, disk lighting, night lighting, outdoor lighting and any combination of these design requirements, proves the above point. The following section illustrates and recommends system design suggestions and installation techniques.

As a painter paints his canvas to tell a story, create moods, express feelings, so can a lighting designer paint the space with light. After all, lighting is both an art and science. We can set moods, affect behaviors, create custom atmospheric conditions and so much more. On the other hand, light as a science can be calculated to bring the right amount of light, and produce the proper lighting design to a space, so tasks may be comfortably completed, there is enough light for safe movement, items may stand out for viewing, etc.

In this session, we explore the concept of designing with light ... as a painter paints, so does a designer create the space with light.

Creating More Interesting Spaces

A good lighting design consists of a process called "layering." Where once a surface mounted fixture or simply recessed lighting was used, we now need to produce more interesting and functional spaces. No longer can we simply have a decorative fixture to "provide light" but current design technique dictates that we balance the decorative with functional. We accomplish this by designing complete lighting systems for:

- Ambient or General Lighting - Light we need for movement.
- Task Lighting - Light we need for performance.
- Supplementary Task Lighting - Additional light to complete finite tasks.
- Accent or Highlighting - To accentuate special effects and possessions.

These four basic design elements allow you to identify your lighting design issues and provide quality and interesting lighting design solutions for a total lighting system.

Lighting criteria for interior spaces

- Quality of Light - diffuse or directional
- Brightness Relationships - Visual comfort, glare control
- Seeing Zones - task area, immediately surrounding, general surroundings (layering)
- Reflectance - helps with overall luminance
- Veiling Reflections - glossy surfaces eg., granite, gloss paint
- Reflected Glare - high gloss causes visual discomfort
- Light and Color - use sources so colors are consistent to the viewer
- Quantity of Light-enough light in the space for the task?

Other interior lighting design considerations
Light sources for interior spaces

- Select more than one source to layer
- Color temperature and CRI
- Durability
- Ease of Maintenance
- Energy Efficiency
Lamp Characteristics

General Lamp Information

As with any lighting system, knowledge of lamps and light sources is an integral part of understanding the system's function and performance. Understanding the variety of lamps available with line or low voltage lighting systems, will allow you to use different lamps to achieve specific lighting design and performance criteria.

The performance of a lamp or type of lamp can be measured according to many different characteristics. For the purpose of selecting the lamp best suited for an application using line or low voltage flexible lighting systems, we are going to explore just a few characteristics.

Color Appearance / Temperature

The actual color of the light emitted from a light source is referred to as color appearance, color temperature or chromaticity. Color temperatures, also referred to as Correlated Color Temperatures (CCT) can establish moods of warmth or coolness, as well as affect behavior or work performance. Additionally, the color temperature of a lamp can affect the appearance of an object.

A common comparison to the varying degrees of color temperatures expressed in degrees Kelvin would be the infamous "iron" comparison. Imagine a piece of iron firstly becoming "red hot." At this time, the reddish-yellow light emitted by the iron at this temperature is warm in appearance. An incandescent lamp at 2700 Kelvin is a good example of this. While the metal continues to heat, it then becomes "white hot" increasing the degrees Kelvin of the iron. Similar to cool white fluorescent, the temperature might reach 4100 Kelvin.

Please see the color chart which best illustrates the degree of warmth or coolness of white light radiated by a lamp and measured in degrees Kelvin or "K".

Color Rendering (CRI)

A lamp's ability to represent colors in objects is called its Color Rendering Index or CRI. The higher the CRI, the more vibrant or closer to natural the colors appear. The scale of 0 to 100 is based on a relative measurement which rates light sources. Lamps that have CRI ratings of 70-80 are considered good, while those lamps, which have a CRI of 80 or above are considered excellent and are also considered to have a high quality of light. The higher the CRI, the better perceptions of appeal objects and people have.

Efficacy / Lumens Per Watt (LPW)

Simply put, the light output of a lamp is measured in Lumens. The higher the lumen rating of a particular lamp, the brighter the lamp's light output will be. A lamp's efficacy is the relationship of which a lamp is able to convert power (Watts) into light (Lumens) as expressed in lumens per watt (LPW). LPW can be best compared to "miles per gallon." The more efficiently a car engine operates, it increases the mileage obtained for each gallon of gasoline. The same efficiency rules apply here. The more efficiently the
conversion of power (watts) is into usable light (Lumens), the higher the efficacy of the lamp.

**System Design**

Once again, a good lighting design consists of a process called "layering." To accomplish this we design for:

- Ambient or General Lighting - Light we need for movement.
- Task Lighting - Light we need for performance.
- Supplementary Task Lighting - Additional light to complete finite tasks.
- Accent or Highlighting - To accentuate special effects and possessions.

These four basic design elements allow you to identify your lighting design issues and provide quality and interesting lighting design solutions for a total lighting system.
Lighting Design Solutions and Trends for a Complete Lighting System

With all of the prior knowledge, how do we accomplish a good layered lighting design? By using the latest in technology and product availability that the lighting industry has to offer. Some suggestions are:

General Lighting:

- Use a fluorescent fixture with excellent color rendering lamps (80 CRI or better) for general lighting in kitchens. Choose a decorative fluorescent fixtures to accomplish this effect.
- Use recessed lighting for general or ambient lighting with either incandescent or compact fluorescent lamps.
- Use a low voltage pendant cluster to supply general lighting for a nook or breakfast area in a kitchen.
- Use a low voltage, or line voltage flexible rail complete or custom assembly, and choose general lighting luminaires, to provide light over tables, counters, conference areas or anywhere ambient light is required.

Task Lighting:

- Use line or low voltage pendants or recessed low voltage lighting over a kitchen island for proper task lighting. Choose among the variety of shapes and finishes to complement any décor or design solution.
- Use low voltage linear lighting under kitchen or bath cabinets for task lighting. The fluorescent under cabinet fixture is now passé.
- Use a mini-recessed fixture approved for use as a shower light.

Supplemental Task Lighting:

- Use recessed low voltage lighting to provide supplemental task lighting on counter space work areas in kitchens or baths.
- Use a portable, over cabinet fixture to provide additional task lighting to supplement for displays and counter areas.

Accent Lighting:

- Use low voltage linear lighting inside cabinets with transparent fronts to highlight or accent special items.
- Use xenon disk lights to illuminate through glass shelves in a glass front cabinet.
- Use small, adjustable and directional track fixtures integrated with the under cabinet system to accent items on a counter top or in a cabinet.
- Use a line or low voltage flexible rail system to accent vertical surfaces while additionally providing interesting forms within the space.
- Add another layer of light by lighting above your cabinets with a low voltage system's linear components.
- Use low voltage linear lighting under the toe space of a bath cabinet for night lighting.

Finally, a lighting control system adds flexibility to your lighting design to change the mood or allow for the function within your illuminated space. These systems pre-set the light levels to your desired functional requirements. For example, if you are cleaning up after a dinner party, you may set the level for all fixtures to be fully illuminated. If you are welcoming guests, you may set the under cabinet and toe-space lighting to
a medium setting and have the remainder of the fixtures off or at low levels. These systems provide you with the maximum flexibility and ease for different lighting levels for various functions as well as add a dramatic effect and set a mood. Some systems need to be wired during construction, but others are available for retrofit and operate by radio frequency with a remote transmitter.

These are just some lighting design solutions for you as you assess the lighting requirements for your space using line or low voltage lighting systems. The beauty of the lighting design is only limited by your creativity. The lighting industry will continue to develop new products inspired by new technologies, which will allow you to continue improving your functions within the space so you may enjoy and maximize the beauty and comfort of your residential or commercial space.
How Do I Start?

Again, the basic elements of any lighting design include ambient or general lighting, task lighting, supplementary task lighting and accent lighting. Any one or a combination of these is best used to achieve the requirements of good lighting design in a given space. Flexible line or low voltage lighting systems are perfect for most task or accent lighting designs and is an excellent complement to ambient or general lighting element. Rail lighting systems have elements which may provide soft, general illumination where needed.

To initiate good lighting design, these question must be asked and answered in this order:

- What to Light?
- How to Light It?
- What to Light It With?

Let's begin to explore some methods you should apply to answer these questions ...

One must gather information in order to identify the purpose for the lighting design based on the client's needs and then offer and develop solutions to fulfill those needs. The elements that contribute to the design solution are defined as the design issues. Following the evaluation of the design issues, the designer should then begin to layout the system on a plan (preferably a scaled drawing or architectural plan) submitted by the client or the architect or sketched by you after gathering the necessary information. Once the lighting plan has been defined, add the appropriate suggestions to enhance the lighting design.

When determining the design solution by first assessing the design issues, you must be aware of the materials used in the space. For example, if you are designing under cabinet lighting for a kitchen, you must be aware of the materials used in the kitchen. Firstly, you should ask if the counter surfaces are polished or are they constructed of a matte finish material. The surface material used would dictate the lamp type used in that particular situation. This example illustrates why it is extremely important to ask the proper questions to ascertain the types of materials used in the space.
Additional Design Issues

Some additional design issues you might wish to determine would be:

- What is the client's perception of light? Do they like it "bright?" Do they want their lighting more subdued?
- What are the colors in the space? Are the colors light which provide good reflectance? Are the surfaces too dark?
- How much or what length of the overall plan will be illuminated? Will they illuminate inside glass front cabinets? Do they have vertical surfaces to light?
- Are there any special items or heirlooms targeted for accent lighting?

Once the design issues are identified and the design solution is agreed upon, it is time to select the light sources best suited to the particular lighting purpose and finally determine the system components. Follow this guide in order to select the components for a low voltage lighting system:

- Determine the proper lamp for the design solution.
- Determine the proper or preferred luminaire for the particular lamp.
- Calculate required components for a complete installation based on your design solution.
- Add any applicable accessories where and when needed.
- Determine the quantity of luminaires and lamps required.
- Calculate the load (total consumed watts) to determine the proper transformer capacity and the number of transformers required.
Summary

The basic components of a layered lighting design are:

- Ambient or General Lighting
- Task Lighting
- Supplementary Task Lighting
- Accent or Highlighting

When planning a lighting design using any line or low voltage flexible system, determine your design issues by assessing the client’s needs and utilize the proper components and lighting techniques to provide good and creative design solutions to provide a quality installation with sound lighting practice.
Review

1. These questions should be answered when seeking to light a space or object:
   - What Object?, Why am I doing this?, Whose job am I on?
   - What do I want to Light?, How will I light it?, What will I choose to Light it with?
   - How bright?, Why not?, Who/When?

2. Good lighting design technique consists of a process called:
   - Layering
   - Efficacy
   - Efficiency

3. Name the basic techniques encompassing a good, layered lighting design:
   - Grazing, shadowing, filling, drawing
   - General lighting, task lighting, uplighting, moon lighting
   - Ambient or general lighting, task lighting, supplementary task lighting, accent or highlighting

4. You gather information to determine the:
   - Design Issues
   - Question
   - Color

5. The information is applied to provide the:
   - Design statistics
   - Design solution
   - Design commission

6. Lamp selection is essential when designing toward a lighting solution.
   - True
   - False

7. Color and reflectance within the space are critical factors when considering your design issues and solutions.
   - True
   - False

8. The client's perception of light is not a critical factor when considering your design issues and solutions.
   - True
False