LOW VOLTAGE TRANSFORMERS: MAGNETIC OR ELECTRONIC?

Abstract
Electronic and magnetic transformers could hardly be more different. What do you need to know about them and their performance to ensure a successful low voltage lighting project? This article identifies the key points.

The Bottom Line
Transformers go head to head:
• Electronic units are smaller, but run hotter.
• Magnetic transformers are larger and run cooler and quieter.
• Electronic units are more vulnerable to line surges and transients so can be less reliable.
• Magnetics are more durable and able to withstand power quality problems.
• Electronics last about five years, magnetics last 25 or more years.

Every Low Voltage Lighting Project Should Include Consideration of Both Magnetic and Electronic Transformers to Ensure Success

There are major differences between electronic and magnetic transformers that you need to know to achieve the performance you want from a low voltage lighting system.

Magnetic units operate at line frequency (60 Hz in the USA). Electronic transformers kick this up to 100,000 Hz, which permits smaller sizes so that they can be integrated into fixtures.

In fact, the higher the frequency, the smaller the transformer. But electronic components are required to achieve this, reducing reliability. Electronic transformers, for example, depend on solid state components to withstand inevitable line surges and transients on power lines. This results in failure of these electronic components, without warning, over time.

Unfortunately, even the best made electronic components will fail “for no reason.”

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The major advantage is the initial acquisition cost of a stand-alone electronic transformer. The long term cost to operate and maintain may far exceed the greater acquisition cost of the magnetic units.

Magnetic units need no maintenance and can be expected to last 25+ years in service. Electronic units are usually considered old after five years.

It’s important to include the cost of any special accessories that may be required (dimmers and surge protectors) when calculating the true cost of an electronic transformer installation.

Electronics will never have the same reliability as magnetics (over the wide variety of field conditions encountered every day). One reason is that the quality of power delivered by utilities is getting consistently worse because of an aging grid and the lack of reserve power.

Electronic components are relatively inexpensive when produced in volume—hence the reason for the reduced price of electronic devices. This reduced cost does not result in more reliability, greater efficiency, or better performance.

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Semper Fi Power Supply transformers are shown installed in their enclosures. Their 25-year warranty means trouble-free operation.

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Another reason for high frequency operation of electronic transformers relates to audible noise. The range of hearing for a healthy young person is 20 to 20,000 hertz, but gets worse with age when the upper range is 14,000 hertz.

High frequency transformers require the use of special dimmers and control system modules for compatibility and also can lead to RFI issues with other devices—which is not an issue with magnetic transformers.

Some high frequency transformers are actually power supplies in the sense that the output voltage is fixed and cannot be “dimmed” in a conventional manner.

Low voltage lighting, of course, means high current. Two simple equations prove the point.

1. 12 volts x 25 amps = 300 watts
2. 120 volts x 2.5 amps = 300 watts

Total power (wattage) and high amperages generate quite a bit of heat that stresses electronic components.

Fluctuations in voltage also stress electronic components, when compared to Semper Fi’s magnetic transformers.

Magnetics will be larger, but the size and efficiency of the transformer will influence its operating temperature.

Imagine 50 watts being dissipated over an area equivalent to an MR-16 lamp and then that same wattage dissipated over an area the size of a PAR lamp. The larger unit will be much cooler than the smaller unit. That is why low voltage lamps run so much hotter than the equivalent wattage line voltage lamps.

The laws of physics dictate that the temperature rise for a given watt loss is inversely proportional to the surface area of the part—i.e. the smaller the part, the higher the temperature. The same is true for transformers and any other electrical component. Electronic transformers, even at high efficiencies, will usually operate at a higher temperature rise on its parts, even if the transformer case is relatively cool.

To be driven properly, low voltage lighting requires a flexible and adjustable transformer in the field. A Semper Fi 1,200 watt transformer is 95%+ efficient. If the 12 volt tap is utilized to power 12 volt lamps (1,200 watt load - no dimming and no long wire runs; i.e.: no voltage drop), then the VA of that transformer will be approximately 1,260 VA, but if dimming and/or long wire runs require using a 16 volt tap instead—then the VA rating would be 1,680 VA instead. The transformer has to do that much more work to get 12 volts to the lamps.

Handling this range of flexibility requires very robust design and construction. The winding and finishing of these multi-tapped units take time to build and package.

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