



High impedance or Low impedance?

Optimized Drive Reactors

Line reactors enhance the performance and protect variable frequency drives by providing impedance. Impedance, or Z , in an electrical circuit is a measure of the total opposition to current flow. "Low Z " line reactors provide a lower amount of impedance, while "High Z " line reactors provide a higher amount of impedance.

This article addresses the use of line reactors on the line side of variable frequency motor drives, not the output side of drives

When to use "Low Z " line reactors?

Any application where traditionally either a 1.5% or 3% reactor would be applied.

- 1) Variable frequency drive applications where a reactor is desired to prevent the possibility of drive problems associated with minor line voltage surges. Drive damage or fault conditions are not expected but could result. In virtually all applications, an inductor in front of the drive can be a measure of protection to extend the service life of the drive. Many low horsepower "micro" drives are **proved** as a low cost option for motor speed control or perhaps phase conversion. These are cost effective entry-level devices in the drive market. Many of these drives are designed without the use of reactors, filters, or chokes. This condition makes them vulnerable to damage due to line fluctuations, surges and spikes. A simple, low cost reactor can be used to protect the drive and the process from problems and interruptions
- 2) New and existing drive applications where a reactor is desired to help mitigate voltage and current harmonics where system harmonics are a minor concern
- 3) Drive protection and harmonic mitigation is desired with a minimal effect on line voltage feeding the drive
- 4) Drive applications where rapid speed changes are desired. The reactor will help smoothen the current surge
- 5) Reduction of nuisance tripping caused by:
 - Transient voltages caused by capacitor switching
 - Line notching
 - DC bus overvoltage tripping
 - Inverter overcurrent and overvoltage
- 6) Additional benefits include:
 - Lower injected percentage of harmonic current
 - Improving true power factor
 - Reducing cross-talk between drives
 - Adding impedance to drives with or without DC link chokes/reactors when more impedance is desired due to a relatively stiff source

Simplicity, Reliability & Efficiency!



When to use “High Z” line reactors?

Any rugged application where traditionally a 5% reactor would be applied.

- 1) Drastic line voltage surges and swings are seen on the line that have resulted in drive fault trips or perhaps even drive damage
- 2) Maximum harmonic mitigation is desired without going to a passive harmonic filter
- 3) Line voltage tends to be near the high limit of the drive input rating and tempering is desired to prevent over-voltage trips during operation, and the condition is not severe enough to warrant a transformer tap change or the use of a different transformer. The line reactor is not a voltage transformer but can assist in softening the incoming power when the drive is feeding current to the motor
- 4) The use of a single line reactor is required for multiple motors operating at the same time. If the application does not allow the use of individual reactors, a single high impedance device can be used to gain some drive protection and harmonic mitigation
- 5) KDR “High Z” offers the same superior benefits as Low Z plus additional benefits which include:
 - Helping prevent drive component damage
 - Providing maximum harmonic mitigation without adding capacitance
 - Further improving true power factor
 - Adding impedance to drives with or without DC link chokes/reactors when more impedance is desired due to a relatively stiff source

Can you have too much impedance?

The answer to this question is yes. Impedance is desirable to help stabilize and smoothen mild changes in line conditions as well as mitigating harmonics. This applies to both line voltage and current issues. Excessive line impedance may result in an excessive drop in line voltage along with drive faults. The line reactor is a good device to address line harmonics being initiated by the non-linear power supply such as the VFD. It is not, however, a replacement for a harmonic trap filter which may be required to reduce line harmonics to an acceptable level. There are other issues involving excessive impedance that is best suited for a more comprehensive system evaluation.

KDR at the output:

The addition of a KDR unit to the output of a drive will dampen overshoot peak voltage, reduce motor heating and audible noise, helping to extend the life of the motor. The units will also help prevent inverter instantaneous overcurrent trips because they provide needed inductance when the load on an inverter has an abnormally high capacitance.

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