



KMG High Performance Output Filter FAQs

Filter Design

1. What level of voltage distortion can I expect from the output of a sine wave filter?

The objective of the filter is to duplicate the efforts of typical power utilities. According to utility standards, the power quality is to limit voltage distortion to approximately 5%. The MotorGuard filter follows that challenge but limits voltage distortion to between 5 and 7%. This is well within the operating standards of any conventional squirrel cage induction motor. It is well accepted by any standard transformer as well should the load to the filter be a transformer.

2. How does this filter vary from a KLC or even a line reactor on the output side of the VFD?

The TCI KLC output filter is designed to limit the peak voltage to approximately 1,000 volts. These filters are successful in most simple drive/motor applications where lead lengths are about 1,000 feet or less, and a modulated output waveform is acceptable to the load. In terms of a line reactor, the inductive reactance achieved with a line reactor works to slow down the rise time of the spike but can do nothing to limit the magnitude of it. The MotorGuard goes beyond this to eliminate the carrier frequency effects in the modulation process. The result is a smooth sinusoidal waveform and load friendly power supply. This is explained more in the MotorGuard brochure and specification pages.

3. What are the main components of the KMG filter?

The MotorGuard high performance output filter is an L-C-R, low pass filter. This is a tuned filter which combines inductance, capacitance, and resistance. Along with these fundamental components, the filter contains a protection monitor board. This board insures that the filter is providing adequate dv/dt and peak voltage protection and includes a fault alarm relay for customer use. For more detailed information, please refer to the Installation, Operation and Maintenance Manual.

4. What type of circuit does this filter utilize?

As described in # 3, the L-C-R, low pass filter uses passive components. The circuit utilizes a series inductor along with parallel capacitors and resistors. The power schematic is pictured in the Installation, Operation and Maintenance Manual.

5. Can I get these filters modified for my specific applications?

TCI has designed the MotorGuard with the standard features most commonly requested. Visit the TCI website for the MotorGuard's standard features. You can also contact your local TCI representative or the TCI Technical Support Group for additional information on the MotorGuard high performance filter.

6. Can I get the KMG in outdoor cabinets?

TCI is launching the MotorGuard filter in both Open Panel designs and NEMA 1 general application industrial indoor enclosures. NEMA 3R or NEMA 4 outdoor enclosures will be available in future product releases. TCI would be happy to assist you with the mounting of an open panel design into an enclosure of your choosing. For additional assistance, contact the TCI Technical Support Group.



7. Do these filters use power?

Like virtually all passive devices, there is an associated loss factor. The actual equipment efficiency depends on the RMS current loading. The power resistors are voltage, not current sensitive, and will experience a constant loss factor. Full load loss information stated in watts is available in the product brochure, on the TCI website, or from your local TCI distributor.

Product Applications

8. What is the purpose of the output filter?

The purpose of the filter is to take the output power of a PWM drive and remove the high frequency voltage distortion. This distortion is a result of the modulation protocol of the drive. This distortion is typical with all PWM VFDs. The purpose of the filter is to produce a smooth waveform that is near sine wave performance.

9. How is this device rated?

The MotorGuard High Performance Output Filter is a current rated device and is available in 460/480 volt and 575/600 volt versions. The brochure lists nominal horse power and maximum continuous currents based on the NEC motor full load current table for standard 460 volt and 575 volt motors.

10. How do I size the MotorGuard filter?

We have selection charts listing nominal horsepower ratings with maximum continuous current ratings. If you have non-standard motors or motors other than NEMA design B with high full load amp ratings, you can use the actual motor nameplate FLA for making the selection. Contact your TCI distributor or representative if the current rating is in question.

11. Can I use this filter on any brand of drive?

TCI has developed the MotorGuard filter with technical input from many major drive manufacturers. We have reviewed their drive topology to insure compatibility; however, there is no guarantee of filter compatibility with all drive topologies. Contact TCI for application assistance if drive compatibility is in question.

12. How does this filter affect the line voltage to the drive?

The main effects of the filter are the benefits enjoyed by near sine wave power to the load. This tuned filter has been lab and field-tested and demonstrates excellent output performance. The filter has no affect on the input line voltage to the drive!

13. On what lead lengths do you suggest we use this filter?

The MotorGuard filter is typically used on extremely long lead applications, typically beyond 1,000 feet. These filters are currently in use on applications with varying lead lengths, up to as much as 15,000 feet.

14. Where should the MotorGuard filter be mounted?

We recommend the filter be mounted directly adjacent to the output terminals. In most applications, it is possible to mount the filter and drive side by side. Due to the possibility of increased parasitic component effects such as cable capacitance, it is recommended to limit the distance between the drive and the MotorGuard to less than 10 (wire) feet.

15. Can I use this filter on other than motor loads?

Yes, the MotorGuard sine wave output filter is a good filter to supply near sine wave power to any equipment that is vulnerable to the voltage distortion on the output of a PWM power supply. Shore to ship power is an example of a typical application using other than a motor load.



- 16. Do I have to buy a special drive to work with the MotorGuard Filter?**
TCI has designed and tested the MotorGuard filter with technical input from the major drive manufacturers as well as actual lab testing to ensure compatibility. TCI cannot be responsible for ongoing changes in drive topology. To date, the filter has been successfully operated with a multitude of drives. TCI feels confident the filter will be compatible with all major drive topologies. If the filter fails to function due to drive topology incompatibility, TCI will accept return of the filter for full credit.
- 17. Do I have to set up my standard drive in a special way to work with the MotorGuard.**
The MotorGuard requires the drive to have a carrier frequency of between 2 and 4 kHz. If the drive has a variable carrier, the average operating frequency must remain between 2 and 4 kHz. The drive should be operated in scalar mode. The maximum drive output operating frequency must be 80 Hz or less. There are no special drive requirements or modifications necessary for the successful operation of the KMG filter.
- 18. What types of enclosures are available for the filter?**
The MotorGuard comes in a standard open panel construction for customers installing the filter into their drive or auxiliary cabinet, and a NEMA 1 enclosed version for general industrial indoor applications.
- 19. What agency approvals apply to the filter?**
The filter is certified under UL, cUL 508. This agency approval provides acceptance in the United States and Canada, as well as many other parts of the world.
- 20. Can I incorporate the filter into my drive cabinet or MCC?**
It is quite common to specify the MotorGuard in an open panel design and install it in an open bay of the drive cabinet. TCI has worked with drive manufacturers to develop a standard set of back panel dimensions that easily incorporate into many standard drive cabinets. Please see filter dimensions and watts loss information published in the standard product brochure for use in your application.
- 21. Are there special applications where I can't use the MotorGuard filter?**
The MotorGuard High Performance Output Filter is designed to work on a variety of applications where the power quality of the drive output needs conditioning. It is most commonly used for motor applications involving very long lead lengths, multiple motors, power supplies for test equipment, or inputs for a step-up transformer. Care should be taken when using the filter on vector drives, due to the feedback loop from the motor to the drive. In some instances, the KMG filter is not compatible with a vector drive. If you have a unique application, please see your TCI representative or contact the Technical Support Group at TCI.
- 22. What are the standard ratings for the KMG filter?**
The MotorGuard output filter is available as a standard product in horsepower ratings of 5 through 600 HP.
- 23. What voltages do these filters come in?**
The MotorGuard output filter is available as a standard product in both 460/480 and 575/600 volt versions.
- 24. Can this filter be used with any brand motor?**
Yes, the brand of standard squirrel cage induction motor does not matter. For special motor applications, please contact the TCI Technical Support Group to verify compatibility.
- 25. Is it necessary to use an inverter grade motor with this filter?**
No, the filter was designed to be used with any NEMA squirrel cage induction motor.



26. If I use an inverter grade motor, do I still need a MotorGuard filter on long lead applications?

This is a very good question and is easy to answer. Modern motor designs with high dielectric insulating materials and spike resistant wire have greatly reduced the effects of dv/dt on motors. They still do not prevent the eventual long term degradation of the insulation system. The voltage spikes at the motor terminals of long lead applications continue to weaken the integrity of the dielectric materials. Typical areas that are vulnerable to failure include the end turns of the stator winding, the slot cells, and between the phase connections. As time progresses even the most advanced materials can weaken and fail. By utilizing efficient, high-grade inverter duty motors and the MotorGuard filter, the damaging effects of high peak voltages are eliminated and long service life can be expected.

27. How will this filter save my motor?

The filter eliminates the effects of dv/dt on the motor insulation by removing the high frequency voltage distortion generated by the drive output power semi-conductors. The modern variable frequency drive has revolutionized the use of the conventional squirrel cage induction motor; however, current drive topology can contribute to insulation problems in the motor. The MotorGuard greatly attenuates the carrier frequency voltage distortion and lowers the level of line distortion.

28. Is there a lot of set-up work required to coordinate this filter with my drive?

The MotorGuard filter is designed with the installer in mind. An easy to follow installation manual is provided which includes schematic and connection diagrams to insure proper installation and startup. Unlike a drive, there are no programming parameters or start up configurations required to commission the filter.

29. I am an OEM and many of my machines are going to Europe. Can I use the 480 volt 60 Hz filter on a 380 volt 50 Hz system assuming the volts/Hz relationship is maintained?

Yes, the MotorGuard High Performance Output Filter is designed for use on the output side of the PWM drive. The input line voltage and frequency is not critical to filter operation because the drive is determining the output voltage and frequency. The low voltage control transformer is rated for both 50 and 60 Hz operation. The filter is designed to accept a maximum drive output frequency of 80 Hz. For special applications please contact the TCI Technical Support Group for assistance.

30. What are the environmental limitations of this filter?

Like most electronic equipment, heat, humidity, high elevations, and dirty environments require special considerations. The standard MotorGuard filter is designed for use in protected indoor environments similar to the standard drive. Normal indoor industrial environments are specified as having a maximum ambient temperature of 40 degrees C and are protected from dirt and moisture. Please contact your TCI distributor or representative if additional application assistance is required.

31. Is special startup required for these filters?

The MotorGuard filter was designed for ease of installation and commissioning. Special programming or factory qualified start up is not required. The comprehensive Installation, Operation, and Maintenance Manual provided with the filter is sufficient for most installations by a qualified installer.



32. What system information do you need from me to determine if this filter is right for my application?

We typically like to understand the system components and the operating environment of your application. TCI has an application worksheet available to assist you in providing this information. For additional information, please contact the TCI Technical Support Group.

33. Does the MotorGuard High Performance Output Filter have an effect on motor shaft bearing currents?

Yes, by virtue of attenuating the high frequency components present in the PWM wave form and producing near sinusoidal voltage at the motor terminals, the amount of common mode current flowing through the motor bearings is greatly reduced. There is also a reduction in the amount of EMI when the KMG is installed.

Commercial Questions

34. Can TCI guarantee the performance of this filter?

TCI guarantees the output of the MotorGuard filter to greatly improve the quality of the drive output power. While drive output power does vary slightly from drive manufacturers, TCI has designed the filter to achieve near sine wave power. The outcome is guaranteed to be suitable for all standard NEMA design motors. Refer to the brochure for specific Performance Guarantee information.

35. Can you show me the before and after photos of the voltage waveform to prove the filters performance?

The waveform examples are available in the product brochure as well as in technical articles found on our website.

36. Why did TCI name this filter “MotorGuard”?

TCI designed and developed the sine wave filter to correspond with the industry’s demand for a High Performance Output Filter. This filter must improve the power quality and greatly reduce the effects of dv/dt on motor applications. The term “MotorGuard” signifies the function of guarding the motor from damaging voltage distortion that has been known to cause premature motor failure.

37. Does TCI have any application testimonies that prove the performance of this filter?

There are currently a great many TCI KMG filters in field use. Current field applications range from use as a power supply filter for shore to ship power to extreme long lead lengths found in down hole pumping installations. You may review the technical specifications and additional application data in the product brochure or on the TCI website. TCI will be publishing success stories and application tips in the near future.

38. Does TCI have any large customers who have standardized on this filter for the output of long lead applications?

TCI has collaborated with major drive manufacturers as well as equipment companies to install these filters. Drive OEMs, as well as Pump, Drilling equipment, HVAC and other equipment manufacturers are utilizing the TCI filter for successful system operation. Contact your local TCI representative for more application information.



39. Does TCI have any unique success stories using the MotorGuard filter?

To give you a general success story, TCI has widely used these filters in deep well pumping applications. They are successfully operating in Canada, the US and Central/South America on oil and gas exploration and pumping operations. This filter has allowed the use of modern low voltage drives with step-up transformers and custom designed medium voltage motors in extremely long lead applications to accomplish tasks never before possible with standard low voltage drive technology. Please visit the TCI website and contact your TCI representative for more details.

40. Are there any drive manufacturers that use this type of filter now?

While it is not the intention of TCI to promote any individual drive manufacturer, you may contact TCI for specific application information. TCI takes pride in jointly developing the MotorGuard to support modern drive technology. TCI is prepared to discuss the use of the MotorGuard with the drive of your choice.

41. What is the availability of the MotorGuard product?

TCI has installed an MRP system that allows for fast order turnaround times. Critical parts are in stock awaiting the placement of an order. This allows TCI to ship the filter in line with the standard shipping/build times of most drive manufacturers. Typical delivery of the completed product is four to five weeks. Contact your TCI distributor or representative to inquire about your specific lead time needs.

42. Are these filters CE approved?

The MotorGuard high performance does not have CE approval at this time.

43. What spare parts do I need to stock for these filters?

If down time is critical, power fuses, control circuit fuses, capacitors, and an alarm board should be stocked at the installation. In the uncommon event of failure, TCI uses commercially available control components. Inductors, capacitors, resistors, and design specific items can be acquired from TCI upon request.

44. What is the warranty of the filter?

The filter carries a product warranty of one year from date of commissioning, assuming proper storage as defined in the Installation, Operation and Maintenance Manual, or 18 months from date of shipment, whichever occurs first.

45. Can I test a KMG and return it if I'm not satisfied?

If your specific application is discussed in advance with a TCI representative, a trial application can be arranged. If the performance of the product is in question, your TCI distributor or representative will assist you in your application. It is the intent of TCI to insure the successful operation of the filter along with a long service life. If you purchase any TCI product, and you are not satisfied, feel free to return the product for full credit.

46. Does TCI have a test model available for me to use in my plant?

TCI does not have test and trial models available for general use. Your TCI distributor and representative can work with you to discuss your specific application and arrange for special considerations. It is the intent of TCI to insure proper product operation and customer satisfaction.

47. How long has TCI made this filter?

TCI has provided the MotorGuard filter for field applications for over 5 years. We have confidence that the product performs to our high standards, and will allow for good motor performance and a long service life.



48. Does TCI have special dealers or distributors for this product?

The MotorGuard is available from any of our industrial distributors offering our complete line of power quality products. We work closely with our extensive list of industrial distributors to provide proper product selection, field assistance, and after sale support. We look forward to working with you on your next power quality filter application.

49. Can I get a field demonstration of this product?

We are always happy to hear from you on your special applications and field requirements. While we do not have an actual demonstration unit available to be shipped in the field, we are happy to provide professional application information. TCI has a demonstration video available for your viewing. If you are interested in additional information and a discussion on the use of the MotorGuard filter, please give your distributor or TCI representative a call.

Documentation

50. Are outline drawings available for these filters?

All filter outline drawings are available on the TCI website at www.transcoil.com. If you require assistance, please contact your TCI distributor or TCI representative.

51. Are schematic diagrams available for the MotorGuard?

The filter schematic diagrams are available on the TCI website at www.transcoil.com. If you require assistance, please contact your TCI distributor or TCI representative.

52. Are wiring diagrams available for this filter?

Wirings diagrams and a full set of operational instructions are provided in the Installation, Operation, and Maintenance Manual provided with each filter. This document can be reviewed in advance by visiting the TCI website at www.transcoil.com.

53. What documentation comes with the MotorGuard filter?

The MotorGuard High Performance Output Filter is shipped with a comprehensive Installation, Operation, and Maintenance Manual along with model-specific outline diagram and electrical schematic. These tools allow the qualified installer to easily mount, connect, and commission the filter.

Competitive Products

54. Is there any other manufacturer who makes a similar product that has been proven to work?

There are other manufacturers who have labeled products as sine wave filters, high performance output filters, and the like. TCI has spent considerable time collaborating with drive and equipment manufacturers in design, testing, and field application, to insure the successful operation of the MotorGuard filter. This filter has been successful during its development stages as an engineered solution, and is now being released for general application as a standard product. TCI is happy to release this cost effective product to the industrial and commercial markets.

