

# Solution Profile



## Motor Protection Guide

Load-side solutions for power quality in systems using Variable Frequency Drives.

### How Variable Frequency Drives (VFDs) Work

VFDs serve as a way of controlling the speed of AC motors by varying the frequency of the power source using pulse width modulation (PWM). This is done by switching the transistors, IGBTs, or thyristors, on and off continuously.

While the introduction of VFDs has brought precise control of motors and greater energy savings, it has also introduced new problems that, left unaddressed, can cause downtime.

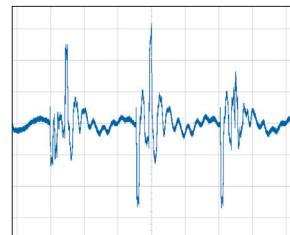
### The Destructive Effects of Power Distortions

The presence of power distortions between VFDs and motors can damage equipment, jeopardize productivity, and decrease profitability.

#### Problems that can occur without motor protection filtering:

- **Damage** to motor bearings
- Unexpected **ground fault trips**
- **Erratic behavior** of VFDs and PLCs
- Premature **motor insulation failure**
- **Cable damage**

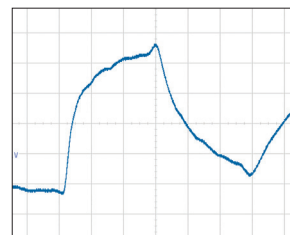
### Common Mode



Three-phase utility power produces three smooth sinusoidal waves which at any point average a sum of zero. This creates an optimal scenario with zero Common Mode.

VFDs give off power in a continuous generation of pulses, which on average achieve a sinewave. However, the sum at any point is not always zero, which results in damaging common mode. This can cause motors to break down over time.

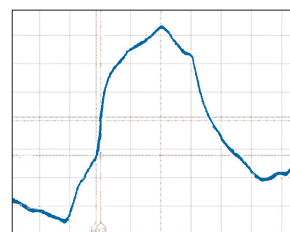
### Peak Voltages



The pulse of VFDs is not a clear square pulse. Each rise and fall of the pulse has an overshoot or transient over voltage. This phenomenon is also known as a "reflected wave." These voltage spikes, especially

in long cable leads, can reach dangerous levels and damage drives and motors.

### Rise Time



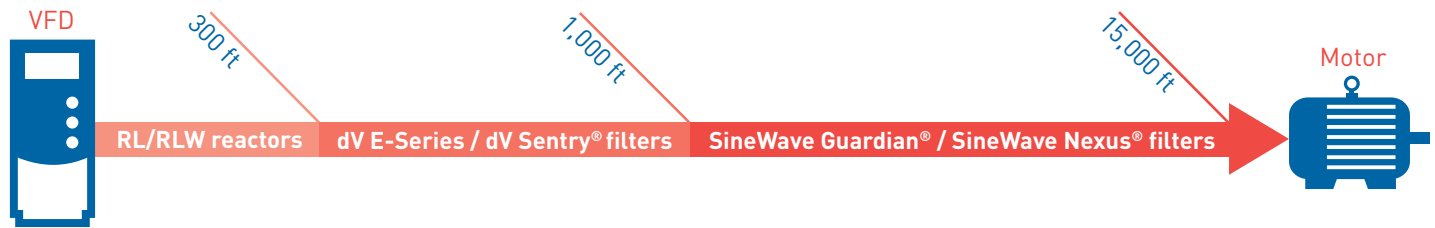
Modern VFDs utilize IGBT systems that create extremely fast rise times which can increase motor performance. This can also result in increased motor insulation

heating, which can reduce motor life over time.

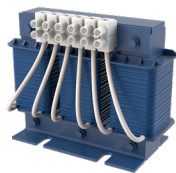


## Motor Protection is Critical

MTE offers a full line of best-in-class products to protect motors and improve productivity.



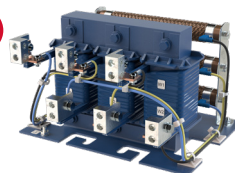
### RL/RLW Reactors



- Protects against surges and transients
- Reduces
  - » Nuisance over-voltage tripping
  - » Harmonic distortion (30-35%)

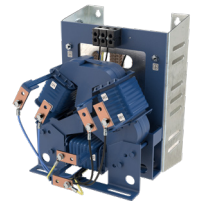
**NEW!**

### dV E-Series



- Peak voltage protection and rise time reduction extends the life of motor and cables
- Small footprint and easy terminations make for smooth installation
- Lighter, more efficient, and run cooler than other dV/dt filters
- Optimal dV/dt solution for leads less than 1,000 ft

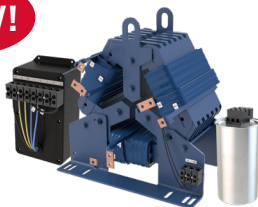
### dV Sentry®



- Reduces dangerous peak voltages and eliminates reflective waves
- Reduce peak common mode voltage by over 50%
- Combines a dV/dt filter and common mode choke into one compact solution

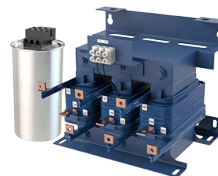
**NEW!**

### SineWave Nexus®



- Only comprehensive motor protection solution on the market
  - » 5-year motor bearing warranty
- Eliminates common mode and differential mode noise
- Pricy "VFD" cable and insulated bearings not required
- **Microdrive Nexus also available**
  - » Sized optimized to easily integrate into motor control cabinet

### SineWave Guardian®



- Better than 5% Total Harmonic Voltage Distortion (THVD)
- Low voltage drop
  - » Only a 6% insertion loss
- Better efficiency than traditional LC filters
  - » Greater than 98% efficiency

### High Frequency SineWave Guardian®



- Ideal solution for permanent magnet motors (PMM) protection
  - » Protects PMM's from demagnetization due to overheating
- Low voltage drop
  - » Max 6% at 150Hz
  - » Max 12% at 300Hz

MTE Corporation

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