



Inspector™ Application note

Using INSPECTOR™ For «VFD» Variable Frequency Drive Analysis
Drive-Aware Monitoring for Variable-Speed Systems



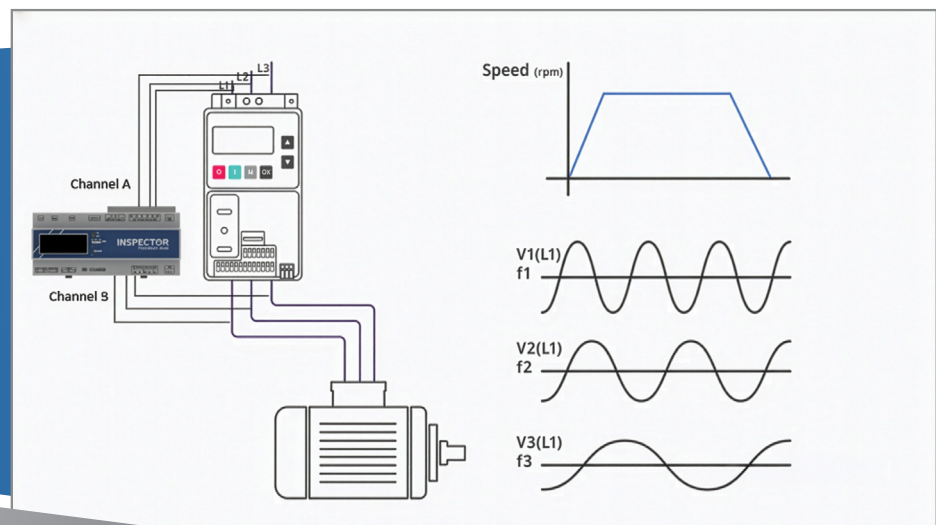
INSPECTOR™ for «VFD» Variable Frequency Drive Analysis

Drive-Aware Monitoring for Variable-Speed Systems

Variable Frequency Drives (VFDs)

Variable Frequency Drives (VFDs) are widely used to improve efficiency, control speed, and optimize industrial processes. However, VFD outputs are fundamentally different from utility power and cannot be accurately assessed using conventional power quality tools.

Using INSPECTOR™, VFD output analysis is specifically designed to monitor and characterize drive behavior directly at the motor terminals—providing accurate, meaningful insight under real operating conditions.



Challenges of Monitoring VFD Outputs

VFD outputs are characterized by:

- Continuously varying fundamental frequency
- High voltage rise rates (dv/dt)
- Rapid changes during acceleration and deceleration
- Pulse-width modulated (PWM) voltage waveforms
- Presence of common-mode voltage

Traditional instruments assume a fixed-frequency, sinusoidal supply. When applied to VFD outputs, this leads to misleading measurements and missed issues.

INSPECTOR™ applies drive-aware measurement methodologies, ensuring reliable interpretation of VFD behavior.

What INSPECTOR™ Monitors on VFD Outputs

INSPECTOR™ continuously monitors key parameters that directly reflect drive performance and electrical stress:

- VFD output frequency
- Output voltage and current
- Voltage rise rate (dv/dt)
- Carrier frequency
- Output current unbalance
- Frequency ramp rate and stability
- Output power delivered by the drive
- Common-mode voltage
- Modulation index

This provides visibility into how the drive is operating, not just what the motor is consuming.

Accurate Frequency Tracking and Dynamic Behavior

Accurate tracking of the actual VFD output frequency is fundamental to drive analysis.

Using INSPECTOR™, this enables:

- Reliable monitoring across a wide operating speed range
- Detection of abnormal ramp behavior
- Accurate measurements during acceleration and deceleration
- Correlation of electrical events with process changes

This capability is critical during commissioning, tuning, and long-term monitoring of variable-speed systems.

Visibility into Electrical Stress

VFD operation introduces electrical stress mechanisms that are not present in utility-fed motors.

INSPECTOR™ provides direct visibility into:

- dv/dt levels, highlighting excessive voltage rise rates that can degrade motor insulation
- Common-mode voltage, associated with bearing currents and insulation stress
- Output current unbalance, indicating asymmetry or abnormal drive behavior

Continuous monitoring enables early identification of reliability risks.

Drive Behavior Characterization

Beyond basic measurements, INSPECTOR™ characterizes key aspects of VFD operation:

- Carrier frequency monitoring to identify switching behavior or configuration changes
- Modulation index tracking to verify correct voltage-to-frequency behavior
- Detection of deviations from expected operating envelopes

This insight is especially valuable for commissioning, troubleshooting, and performance validation.

VFD-Specific Event Detection

INSPECTOR™ automatically detects and records events specific to VFD operation, including:

- Frequency ramping events
- Abnormal ramp rates
- dv/dt spike events
- Elevated common-mode voltage conditions
- Output current unbalance events

Each event is captured with contextual data, supporting root-cause analysis and corrective action.

Application Value Using INSPECTOR™

By using INSPECTOR™ for VFD analysis, operators gain:

- Accurate monitoring of variable-frequency outputs
- Early detection of electrical stress and abnormal behavior
- Improved drive reliability and motor protection
- Reduced troubleshooting time
- Clear insight during commissioning and operation



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