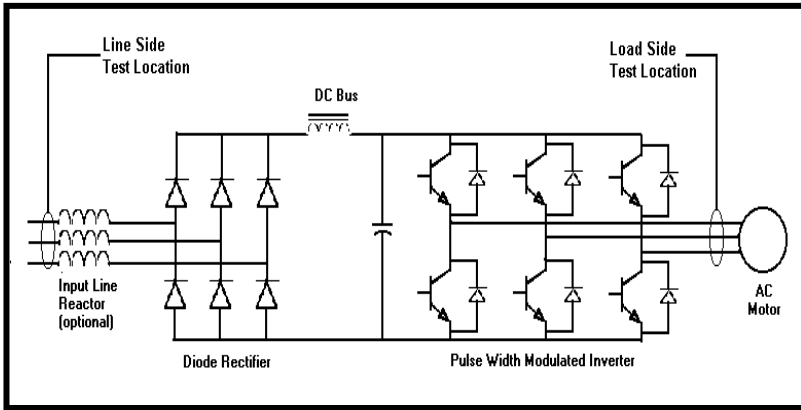


# VFD Testing and Analysis

Note 2201

## Description

Motors powered by variable frequency (VFD) or variable speed (VSD) drives require additional testing and analysis to ensure the high voltage stresses are not weakening the motors insulation system or the drive components. This application note is designed to give a quick review of the techniques in testing and analyzing drives and motors powered by drives using the MCEMAX.



## MTAP Information

MTAPs can be used on the line and load side of VFDs, but you need to be aware of the capabilities of the voltage and current sensing devices. Like most electrical components, potential transformers and current transformers all have voltage/frequency ranges that they can work in. The MTAP2 will work with VFDs from 15 to 60 Hz on the voltage circuit and 40 to 60 Hz on the current circuit using a constant Volts/Hertz.

Voltage					
	Fund RMS	Tot RMS	C.F	THD	
Voltage 1-2	371.43	478.86	1.38	7.89	
Voltage 2-3	363.15	473.97	1.35	11.22	
Voltage 1-3	371.04	479.49	1.37	9.23	
Average	368.54	477.44			
% Imbalance	1.46	0.73			HVF 0.01
%NEMA Derating	98.12	%NEMA Derating			100.00

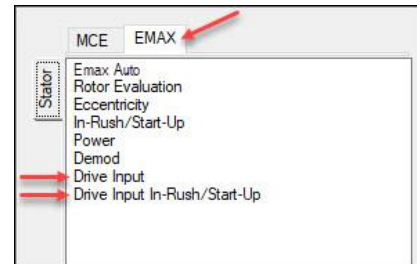
Current					
	Fund RMS	Tot RMS	C.F	THD	
Voltage 1	215.88	309.00	1.55	11.32	
Voltage 2	211.58	306.35	1.60	11.15	
Voltage 3	210.87	308.42	1.60	11.51	
Average	212.78	307.92			
% Imbalance	1.46	0.51			

Impedance					
	Real	Magnitude	Angle		
Current 1	142.90	171.64	1.75	5.36	
Current 2	148.88	175.82	1.77	3.49	
Current 3	153.04	185.15	1.75	6.00	
Average	148.27	177.54			
% Imbalance	3.62	4.29			
% FLA	62.04	74.28			

## Procedures/Instructions

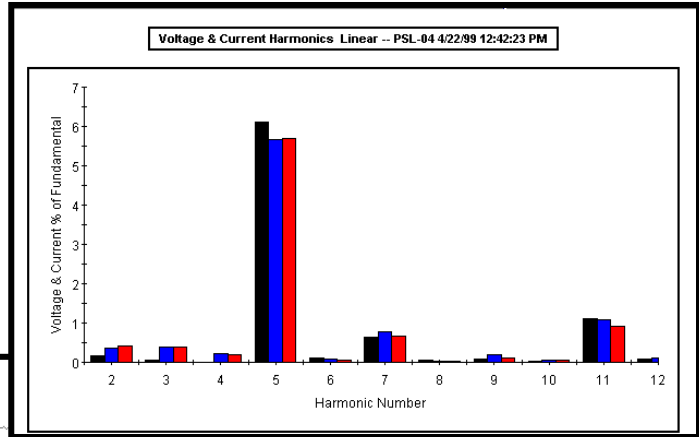
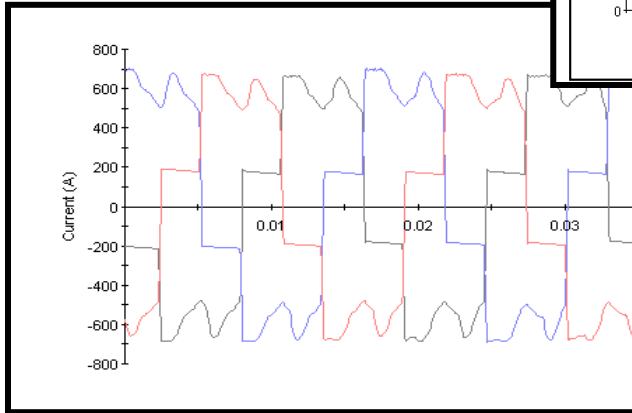
- There are two test points for each drive/motor combination: line side and load side. Drive Input and Drive Input In-Rush/Start-Up tests will be used for EMAX testing on the line side of the drive. The other tests will be used for EMAX testing of the load side of the drive.
- Disconnect the drive from the motor when performing MCE (deenergized) testing.
- Establish alarm setpoints appropriate for your drive/motor application. Consider an alarm template for drives if you have multiple like applications. Remove warning level set points, which are not applicable to drive signals. Load side ( $V_{L-L}$ ,  $V_{THD}$ , HVF,  $F_L$ ). Line side (Current THD, HVF,  $F_L$ ,  $Z_{Imbalance}$ ).
- Refer to IEEE 519 for standards on Power Quality.



## Line Side Analysis

Line Side Analysis focuses on the health of the drive components and the impact of the drive on the power system.

- Monitor the Voltage THD.
- Look for excessive harmonics of voltage on the voltage and current harmonics graph.



- Refer to IEEE 519 for power quality standards and guidelines for harmonic distortion.
- Look for erratic zero crossings of voltage and current, as seen in the figure to the left.

## Load Side Analysis

- IEEE 519 power quality standards do not apply on the load side of a drive.
- MCE testing and analysis is identical for drive motors and non-drive motors.
- As seen below the voltage and current time domain is different, but still balanced. Look for voltage or current imbalance for indications of drive or stator anomalies.
- Rotor Evaluation and Eccentricity tests have a built-in line frequency modifier so the “calculated speed” and “estimate bars” algorithms are correct for different line frequencies. Verify speed to confirm rotor defects.

