

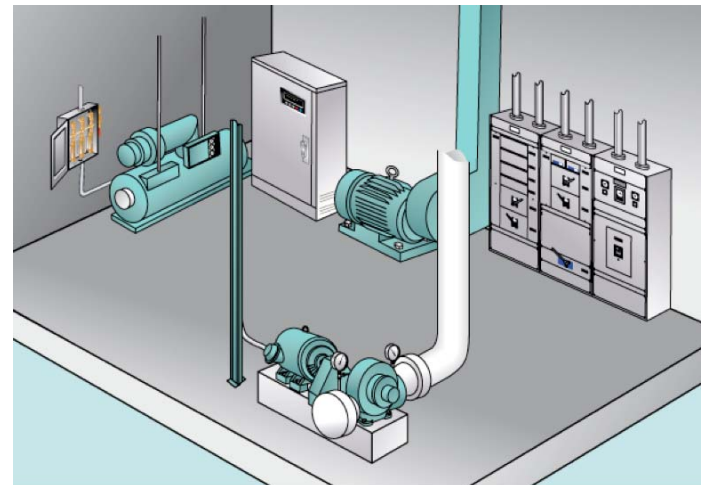
Application: VSD failure

Introduction

- A variable speed drive on a critical system, the fault indicator LED is on
- According to the VSD (variable speed drive), the error code is F4; this is: the drive has detected an “under voltage” condition and shuts down



How do you identify if the failure is in the drive, in the motor or in a distorted supply voltage?



A typical industrial electrical distribution system with non-linear loads

Diagnosing VSD failure

Using a DMM

- Check the input line voltage (figure 1)
 - A typical multimeter will display either average or rms voltage values
 - Depending on the type of distortion, the rms or peak value may not reveal if a problem exists
- Check the VSD dc bus voltage
 - The dc bus voltage is directly proportional to the peak of the input line voltage
 - Any distortion or error in peak amplitude of the line voltage can cause an over- or under-voltage error
- The drive dc bus voltage in figure 2 shows around 20 % under the nominal value of 160 V

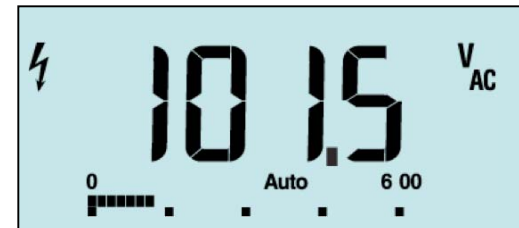


Figure 1. Measuring the line voltage at the input to a Pulse Width Modulated drive, appears to be normal

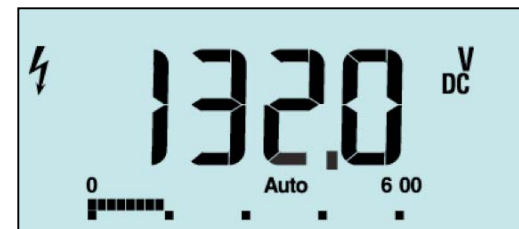


Figure 2. Checking the dc bus voltage level is less than nominal revealing a potential problem

Do you replace the drive controller and/or motor?

Diagnosing line voltage distortion.

Using an Oscilloscope

- Check the input line voltage
 - Connect the oscilloscope to Phase and the ground lead to Neutral
 - The waveform reveals sine wave peaks that are rounded, almost becoming a “flat top” (figure 3)
 - When this occurs, the ratio between “peak” versus “rms” measured values is smaller than 1.4, as it should be
 - Figure 4 shows a circuit with an ideal line voltage wave shape

The waveform distortion is caused by a non-linear load attached to the same feeder circuit, and not necessarily the VSD or motor

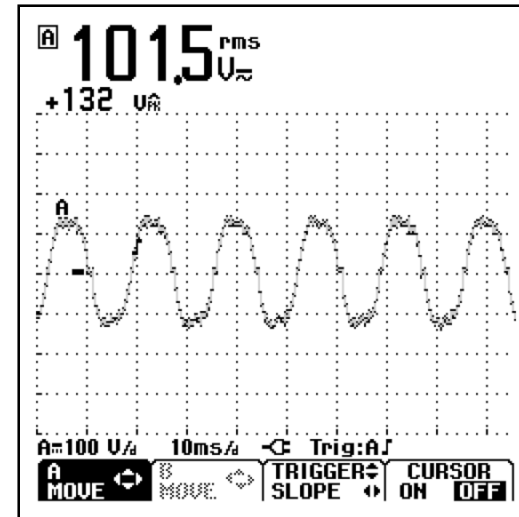


Figure 3. Oscilloscope waveform displaying flat top input line voltage

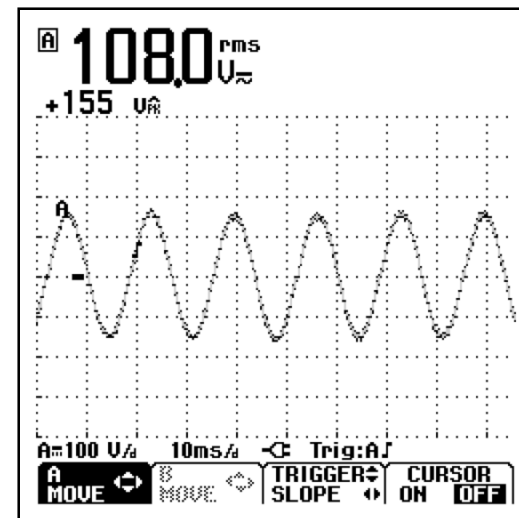


Figure 4. Ideal line voltage sine wave

Troubleshooting using an oscilloscope

Conclusion

- A DMM can display precise amplitude RMS or Peak values
- An oscilloscope will graphically show amplitude (RMS or peak) as well as any distortion, disturbance and noise that may be present on the waveform

*A picture is worth more than
a thousand words.*

The more you see—the more you can fix!

Fluke 120 Series ScopeMeter

Dual input oscilloscope and multimeter makes troubleshooting as easy as 123!

