



Advanced AC Motors & VFD Course Outline - 96 hours

The primary learning objective of this program is the Theory, Implementation and Practical understanding of Variable Frequency Drives and Ac Motors and how they function and interact with each other and the mechanical systems that they drive. In addition we cover methods to debug and analyze these systems when they fail using proper test equipment and methods.

Key areas the student will be exposed to:

- Allen Bradley Compact Logics PLC Controls & The Panel View Plus
- Allen Bradley 525 & 527 VFDs
- Motor Starters and Relays
- Wiring of Three phase AC Motors, VFD's & Motor Starters and Single phase AC Motors and Motor Starters.
- Tuning VFDs & PID concepts
- Motor Controls concepts –Both open and closed loop with Encoder Feedback
- Laptop/cabling - PC to PLC communications using Studio 5000
- Electrical drawing set for the Motor Control Simulator
- Student will debug using all associated test equipment including, but not limited to, DVMs, Oscilloscopes, Amp Meters, Megger and High Potential Testing.

This will be an instructor-led class building on the concepts of both our Phase 1 Industrial Electronics & Phase 2 Industrial Controls & PLC Class, which is a prerequisite to this program. The key areas covered in this program are as follows:

Class introduction, review learning objectives and describe the course to the students. Upon completion of the course the student will have a functional understand of the following areas:

1. Ac Motor theory and practical applications
2. AC Motor Rules & Formulas
3. Magnetism, Electromagnetism & Induction
4. Rotating Field in the Poly phase Motor
5. Poly phase motors



6. Synchronous Motors
7. The Alternating field in a Single Phase Motor
8. Single Phase Motors
9. Dc Motors
10. Principles of Electronic speed control
11. Variable Frequency Drives & Pulse Width Modulation
12. Harmonics & Power factor
13. Practical AC Motors Lab - The student will wire and field commission both a three phase dual voltage induction motor & AB 527 VFD application and then a single phase AC motor and motor starter application.
14. Student will review both a Networked VFD and Stand alone VFD motor control application
15. Student will review both open and closed loop positioning systems concepts using a custom designed CNCTS Dual Motor & Drive system which utilizes the AB Compact Logixs PLC and Panel View Plus for the operator interface and twin AB 527 power flex VFD and Marathon Inverter rated motors with a shaft mounted 12 bit 4095 count A Quad B encoders for positioning. This system is intended to give the student a comprehensive understanding of PID tuning concepts using our CNCTS designed state of the art industrial hardware simulation system. The simulation system will be using three inertia wheels of different mass which is intended to demonstrate the concept of the load inertia ratio and how this will affect the performance of a system. Under direction from an instructor the student will plot and graph the systems response with these changing masses and the student will understand the relationship between Position Error, Velocity Command and Current and how the associated tuning parameters effect the performance of the entire system. This tuning will all be graphically displayed using custom developed trends applications which will allow the student to do real time comparative analysis of two VFD motor controlled systems running side by side.
16. Motor controls application concepts covered - VFD closed loop device with feedback (PID application) air compressor, water pressure pumping system, Load sharing concept (EGB) conveyor and tension control. VFD open loop pumps & fan application concepts.
17. Troubleshooting failed motors and motor cables using the Insulation Tester "Megger" and High Potential tester "Hipot".
18. Use of the Proper instrumentation for AC motor diagnostics, i.e. Digital Voltmeters with low pass filtration, AC Clamp on Amp Meter with low pass filtration, Digital Oscilloscopes, both contacting and non contacting Tachometers, the insulation tester (Megger) and the high Potential tester (Hi Pot) will be covered in great detail.

****A textbook and study guide will be used for this class****