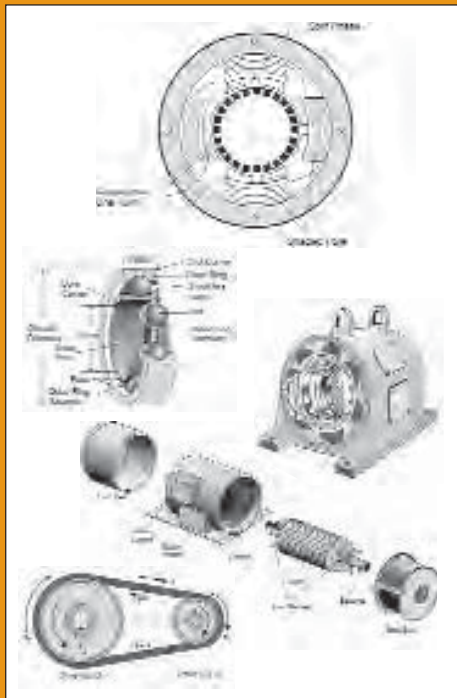


# PRACTICAL DRIVES, MOTORS AND PLCs FOR ENGINEERS AND TECHNICIANS



## YOU WILL LEARN HOW TO:

- Demonstrate a sound understanding of how motors work, specifically the induction motors
- Demonstrate a sound understanding of how AC Variable Speed Drives (VSDs) work
- Install VSDs properly
- Select the right VSD for a given application
- Troubleshoot VSDs competently
- Competently explain how flux-vector control works for drive applications
- Identify the protection and control system requirements for VSDs
- Understand architecture of PLC and its associated components and systems
- Interface VSDs with PLCs
- Understand the causes of motor burnout
- Deal effectively with VSD harmonics and EMC/EMI problems

## WHO SHOULD ATTEND:

This course is designed for personnel who want to understand and utilise variable speed drives and PLCs for energy efficient application comprising of motor driven systems. The workshop will also benefit those working in system design as well as site commissioning, maintenance and troubleshooting. Typical personnel who would benefit are:

- Plant Engineers
- Instrument and Control Engineers
- Instrument Technicians
- Process Control Engineers
- Operations Personnel
- Mechanical Engineers
- Maintenance Personnel
- Service Technicians
- Electrical Maintenance Technicians and Supervisors



## The Workshop

This interactive two day-course which gives you a fundamental understanding of all the three components of a complete drive system, the VSD, motor and the PLC. There is a good coverage as well on installation and commissioning, operation and maintenance and troubleshooting of these devices. Besides, the criteria behind selection of components of a drive system for optimum operation are also covered in detail. Typical practical applications of VSDs in process control and materials handling, such as those for pumping, ventilation, conveyers, compressors and hoists are covered as examples.

On completion of the workshop the participants would get significant insight and understanding on the working of these essential components of the drive mechanism. They would be able to better utilise the existing system or introduce the new and more efficient ones working on the discussed technologies at their work places. The accompanying manual includes simple but appropriate and highly effective technical content along with suitable examples on wide areas of topics relevant to Variable speed drives, Motors and Programmable logic controllers.

## Practical Sessions

This is a practical, hands on workshop enabling you to work through practical exercises which reinforce the concepts discussed.



## The Program

### THE BASIC CONCEPTS

- Variable Speed Drives (VSD) – their utilities in industry
- Commonly used parameters associated with drives
- VSD for speed control and energy saving
- Basics of electrical machines
- AC power system
- PLC basics
- PLC and process interaction

### MECHANICAL, HYDRAULIC AND ELECTRICAL TYPE OF VSIDS

- Types of variable speed drives
- Mechanical variable speed drive
- Hydraulic variable speed drives
- Electrical variable speed drives

### 3-PHASE AC MOTORS; THEORY, CONSTRUCTION AND MAINTENANCE

- Fundamentals of 3-phase AC motors
- Operating principles; 3-phase AC motors
- 3-phase wound rotor motors
- 3-phase synchronous motors
- 3-phase induction motors
- Induction motor equivalent circuit
- Selection of motor

### POWER ELECTRONIC CONVERTERS

- Terminology and definitions; power electronics
- Components of power electronic converters
- Power diodes
- Power thyristors
- Commutation in electronic device switching
- Power electronic rectifiers (AC/DC converters)
- Gate commutated inverters (DC/AC converters)
- Gate controlled power electronic devices

### ELECTRICAL PROTECTION OF VSD COMPONENTS

- AC converter protection circuit
- Operator information and fault diagnostics
- Protection of electric motors
- Temperature; the critical parameter to monitor
- Current sensor for thermal overload protection
- Thermal overload protection – direct temperature sensing

### VSD CONTROL SYSTEMS

- The overall control system
- Control system power supply
- The DC bus charging control system
- The PWM rectifier for AC converter
- VSD control loops
- Vector control of AC drives
- Closed-loop field oriented vector drives
- Speed feedback from motor

## DAY TWO

### ELECTROMAGNETIC COMPATIBILITY

- The electromagnetic interference
- Sources of electromagnetic interference
- Harmonics on the supply side of AC converter
- Power factor and displacement factor
- Voltages and current on the motor side of the PWM

### SELECTION OF AC CONVERTERS

- Important parameters considered for selection
- The basic selection procedure
- The loadability factor
- The characteristics of machine load
- The requirements for starting and stopping motor of VSD
- Selecting motor and converter of correct specification
- Summary of selection
- Retrofitting electronic VSD

### INSTALLATION AND COMMISSIONING OF VSD COMPONENTS

- Installation and environment requirements
- Power supply connections and earthing requirements
- Installing controls of AC drives
- Control wiring of VSD
- Commissioning of variable speed drives

### PLC ARCHITECTURE

- The processor unit
- The PLC power supply
- The PLC programming device
- The memory system
- Digital input output interaction
- Analog I/O interaction
- Digital input output modules
- Connecting analog input output systems to PLC

### BASICS OF PLC PROGRAMMING

- Introduction to PLC programming
- PLC programming steps
- PLC programming languages
- Commonly used logical instructions in PLC programming
- Timers and counters
- Program flow control instructions
- Data load/transfer instructions
- Arithmetical (math) instructions
- Working example of PLC programming; drive application

### SUMMARY, OPEN FORUM AND CLOSING